Part VII – Technical Specifications

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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 of the Hong Kong Special Administrative Region of the People's Republic of China ("Government") in relation to **one (1) Fireboat** ("Vessel") for use by the Fire Services Department ("FSD" or 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]; and

(b) Those specifications that are not labelled with [E] 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 in sufficient detail 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 All TS, 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), 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 of Part V.

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 As mentioned in the definition of "Vessel" in Clause 1.1 of Part IV, unless otherwise expressly stated, references to "the Vessel" shall mean each of the one (1) Vessel. References to "a Vessel" shall mean any such Vessel. Unless otherwise specified, all requirements specified in this Part VII shall apply to each of the one (1) Vessel to be supplied.

1.1.8 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 The Vessel shall be used by the FSD for firefighting operations in Hong Kong waters.

1.2.2 The Vessel shall be used in the event of an emergency/ rescue situation where a vessel is in distress in Hong Kong waters.

1.2.3 The Contractor acknowledges and agrees that the Government relies on the professional judgment and skill of the Contractor to ensure that the Vessel is compliant with all of the requirements of this Part VII and warrants that it will alter, modify or otherwise change aspects of the Vessel's fittings, fixtures, user interface as required by the Government in order to ensure the ultimate fitness for purpose of the Vessel before the Acceptance Certificate is issued.

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 Vessels for the Government.

1.3.2 GNC may delegate the site 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 Navigational Equipment ("ENE") technical acceptance.

1.4 Shipyard

1.4.1 The Tenderer's shipyard must have the essential shipbuilding and workshop facilities such as lifting gears, aluminium hull construction and calibration equipment, machinery installation and calibration equipment, and vessel launching or slipping facilities.

1.4.2 The Tenderer's shipyard shall have experience of designing and building craft which are capable of self-righting.

1.4.3 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 The Vessel shall be designed and constructed for a service life of not less than fifteen (15) years under reasonable maintenance.

1.5.2 It is the SOLE responsibility of the Contractor to supply Vessel which are safe, fit and suitable for the operation of the of the FSD as set out in Paragraph 1.2 above and which meet all the relevant regulations and the specifications in this Part VII, which include without limitation requirements for safety, health, environmental protection, hull form design features, structure, method and materials for construction and fitting out, stability, sub-division and operational efficiency.

1.5.3 The Vessel is required to be issued with a certificate of class (without conditions) with notations by the RO as specified in Schedule 9 of Part V. All plans, particulars and documentations which are required for the classification of the Vessel shall be approved 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.

1.5.5 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 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 five (5) working days (if the Vessel are located in Asia), and ten (10) working days (if the Vessel are located other than Asia) must be given to GNC before the representatives of GNC and other Government officers are invited to conduct a survey visit of the Vessel. The Contractor shall be fully responsible for any delay if the Contractor fails to give adequate notice as aforesaid.

1.6.4 The Contractor shall provide

(a) an Implementation Timetable, in the form set out in Annex 2 to this Part VII, setting out the major milestones and their scheduled completion dates and incorporating the Delivery Dates specified in Schedule 2;

(b) the Drawing Submissions Timetable in the form set out in Annex 3 to this Part VII; and

(c) the Main Items Inspection Timetable in the form set out in Annex 4 to this Part VII.

Each one of the above shall be submitted to GNC for approval by the respective deadlines specified in Clause 11 of the Conditions of Contract.

The Delivery Date 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 and material/equipment procurement status shall 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 site supervision and 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 of all approved drawings, sketches, correspondence, change notices, change orders, test agendas, schedules and other necessary documents where applicable.

1.6.7 After arriving at the site for a survey visit, if MD officers consider 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 an RO which are necessary in order to fulfil any obligation of the Contractor under the Contract, the Contractor is responsible to pay 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 office space for MD officers and FSD officers during their survey visits and construction progress visits to the Vessel at the shipyard where the Vessel are constructed. The office space shall include, but not be limited to, two (2) desks, six (6) chairs, one (1) telephone, one (1) conference table for 10 persons, drinking facilities, power supply 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 FSD officers 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 test, 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 be included evidence that the Vessel is safe to go to sea for the intended tests and trials specified in the Contract.

1.7.2 As in 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). 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 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 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 condition, weather condition and wind condition, 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 the 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 Hong Kong Waters.

(b) As part of the Technical Acceptance as specified in Paragraph 1.8.1 of this Part VII, 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.

(d) The vessel shaft speed shall be determined using a calibrated torque meter or equivalent to validate the actual power delivered at 90% MCR engine load. This shall be carried out and witnessed to the satisfaction of GNC officer(s). Calibration certificates for the torque meter shall be provided to the GNC for acceptance.

(e) 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.

(f) 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.

(g) The Contract Speed to be achieved by the Vessel in the Official Speed Trial shall be the minimum highest achievable speed of 25 knots as specified in Paragraph 2.5.1 of this Part VII, with the engine power at declared maximum (rated) power and the Vessel

under Official Speed Trial Conditions as stated in Annex 5 to this Part. If the Vessel fails to achieve the minimum highest achievable speed under the aforesaid conditions, the Government will deem that the Vessel has failed to pass the Official Speed Trial and therefore Technical Acceptance.

(h) The instruments used 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, which is properly calibrated (with supporting calibration documents) and installed on board the Vessel, is acceptable to GNC; or other speed measuring methods that are acceptable to GNC.

(i) All Equipment shall also be in operation during the Official Sea Trial unless explicitly exempted by MD. This Equipment shall have passed the Technical Acceptance. 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 the GNC surveyor (or the GNC representatives) during the Official Sea Trial and shall form part of the Official Sea Trial Report. A copy of the Official Sea Trial Report as required in Paragraph 1.7.6 below shall be given to GNC before Delivery Acceptance. 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, for the Vessel, shall be conducted by the Contractor 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) All three 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 shall be carried out.

(e) Anchoring Test according to RO Requirements;

(f) Noise Level Test according to the requirement stipulated in Paragraph 4.9.3 of Chapter 4 of this Part;

(g) External fire-fighting capability test according to RO requirements and the requirements of the FSD as stipulated in Chapter 5 of Part VII;

(h) Vessel Watertight Integrity test, including vessel superstructure, ventilation, hatches and any other hull openings, to be carried out according to requirements of the GNC to be agreed during the vessel project take-off meeting;

(i) Station Keeping Test

A Station Keeping Test shall be carried out to validate the capability of the system as detailed in Paragraph 8.9 of Part VII. The Station Keeping Test shall confirm the following:

(i) With both outer main propulsion propellers and the bow thruster engaged, the Vessel, must be able to hold station within one Vessel length of the Vessel's original position (fore/aft and transversely) in WMO sea state 3, BF number 4; and

(ii) The accuracy of heading shall be ±5° from original position in WMO sea state 3, BF number 4.

(iii) If during the test, it is not possible to test in the required conditions; operational calculations shall be provided proving the system capability as required for submission to the GNC.

(j) Daughter boat Launch and Recovery Test

(i) Launch tests shall be carried out to validate that the daughter boat can be launched in WMO Sea state 5.

(ii) Recovery tests shall be carried out to validate that the daughter boat can be recovered in WMO Sea state 5.

(iii) If during the test, it is not possible to test in the required conditions; operational calculations shall be provided proving the system capability as required for submission to the GNC.

(k) Daughter boat Performance and Handling Test

The Daughter Boat Test shall be carried out for different engine loading and speeds to determine the Daughter Boat capability and suitability for use as a rescue boat and workboat to support the fireboat. The Daughter Boat Test shall confirm the following:

(i) The Daughter Boat shall be tested to confirm that it is safe and fit for purpose for normal operations.

(ii) Documentary evidence to be provided that is capable operating in WMO Sea State 0-5 to the satisfaction of GNC.

(iii) The Contract Speed to be achieved by the daughter boat shall be a minimum of 30 Knots at full displacement. This shall be measured using the same instruments detailed in Paragraph 1.7.5 (g) of Part VII. The actual mean speed to be calculated following sea trial, carried out as determined in Paragraph 1.7.5 (d) of Part VII.

(l) Vessel self-righting test

The shipyard shall carry out roll-over test to verify the self-righting capability of the vessel.

(m) Other tests required by the RO, FSD and GNC.

1.8 Acceptance of the Vessel

1.8.1 Acceptance of the Vessel (including all Equipment) shall be carried out in two (2) parts:

(a) Technical Acceptance

(b) Delivery Acceptance

1.8.2 Technical Acceptance

(a) This includes all the hull construction, mechanical and electrical tests and trials as required in this part and those considered necessary by the Government, including equipment tests, anchoring tests, inclining experiment and bottom survey on the

slipway in Hong Kong, the Official Speed Trial as mentioned in Paragraph 1.7.5 of this Chapter shall be conducted in Hong Kong Waters, the Endurance Test, Manoeuvrability Test and Crash Stop Test as mentioned in the Paragraphs 1.7.6 (a), (b) and (c), the bench acceptance test and on-site commissioning test for ENE as mentioned in Chapter 10 of this Part and all other verification tests 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) and (b) 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. If the delivery of the Vessel in Ready to Use condition is 120 days later than the Delivery Date specified in Schedule 2, at the discretion of Government, the Contract may be terminated according to the applicable terms stipulated in the Contract.

(b) Certificate of class (without conditions) for the Vessel with notations as specified in Schedule 9 of Part V shall be issued by the relevant RO as specified in Schedule 9 of Part V 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 engines, on board equipment, manuals, documentation, spares, stores, and equipment for testing in respect of the entire Vessel. The Inventory List shall be approved by MD before the day of Delivery Acceptance and covers everything which the Contractor is required to deliver under the Contract. At the Delivery Acceptance of the Vessel, the approved Inventory List will be used to check that all the items have been delivered to MD in a satisfactory state. Details of each inventory item shall include item name, description, type, quantity, manufacture’s name and contact details, part reference number and/or serial number, and the items’ locations in the Vessel.

(f) The items specified in Paragraph 11.1 of Chapter 11, and all items set out in the Inventory List in the form as approved or stipulated by the Government shall be delivered to MD at the Delivery Acceptance of the Vessel. The Contractor must provide 14 days advance notice in writing for Vessel delivery when the Vessel is considered to be completed in accordance with the Contract and Ready for Use and to be delivered for the Delivery Acceptance. The Government will not accept delivery if after undergoing the tests and trials in the Technical Acceptance, the Government does not consider that the Vessel is in Ready to Use condition.

(g) On delivery, the Vessel must be in a clean, tidy and fully fitted and operational condition.

(h) 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 once the Director of Marine has issued the Acceptance Certificate.

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 Guarantee 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 Guarantee Slipping. The full scope of the Services to be provided as part of the Guarantee 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 the HKSAR by appointed agent of shipbuilder based on an operation profile and minimum life expectancy as mentioned in this Part VII.

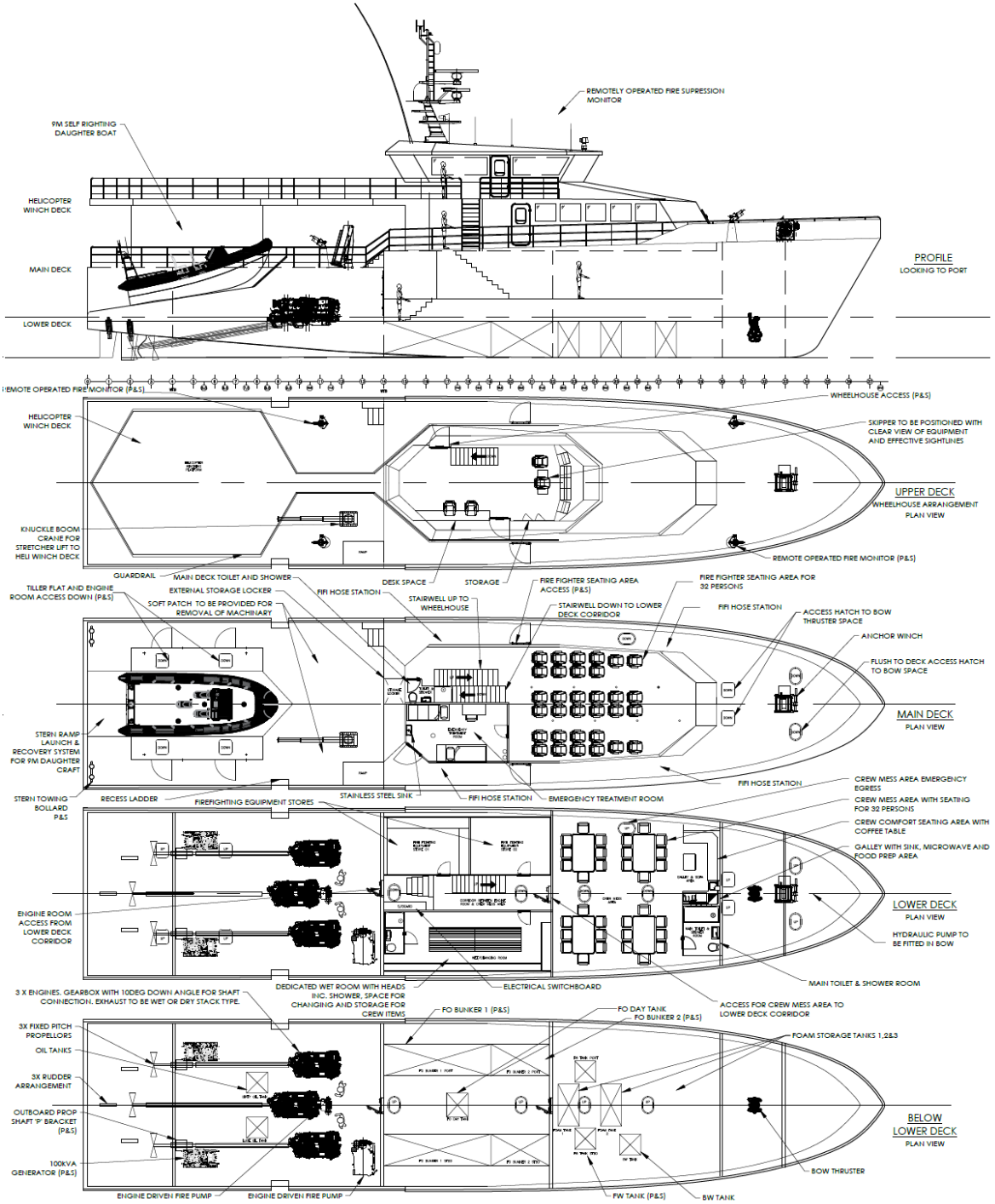
1.10.2 The above applies not only to main engines but also to all other equipment installed in the Vessel. Support and maintenance services/ must be available (i.e. serviceable) in Hong Kong in respect of all equipment installed in the Vessel and return of the whole or part of the Equipment to the original 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 RO 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 specifications for the Vessel. The significance of Essential Requirements is explained in Paragraph 1.1 of Chapter 1 above.

2.2.2 The work to be done under this Contract consists of the design, construction, outfit, testing and delivery of the Vessel for the Fire Services Department (FSD). Workmanship, functions, characteristics and performance shall be in accordance with these TS, best marine construction practices, and the regulatory standards herein specified or otherwise applicable.

2.2.3 Whilst 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 that in Paragraph 2.1 above only serves as guidance and is a reference drawing to help to explain the tender requirements.

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 the TS, together with their requirements for design and installation standards that are stipulated in this Chapter and in any other parts of the TS, 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 an RO. The Tenderer shall state in Schedule 9 of Part V which RO and its rules and regulations and class notation shall be used in the design and construction of the Vessel. [E]

2.3.2 The Vessel is required to be issued with certificate of class (without conditions) with notations as in Schedule 9 of Part V 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 these TS 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 the TS, 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 Vessels 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 (m) 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 Electro-technical 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 an RO or American Welding Society (AWS) or other applicable international standards or rules acceptable by MD.

(m) International Regulations for Preventing Collisions at Sea 1972, as amended by International Maritime Organisation (IMO) Resolution A464(XII) of the Inter-governmental Maritime Consultative Organization and Resolutions A.626(15), A.678(16), A.736(18), A.910(22), A.1004(25) and A.1085(28) of the International Maritime Organization, except Rules 39, 40 and 41.

(n) 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 (a) to (i) above are applicable, then the applicable standards specified by any of 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 (m) shall prevail over the requirements of the relevant RO as listed in sub-paragraphs (a) to (i) above.

2.4 Vessel Operating Profile and Environment

2.4.1 The Operational Hours / Range shall meet the following requirements: [E]

Number of days the Vessel will be used in a year:	Unrestricted
Number of hours cruise running in normal daily operations:	850 hours/year
Number of hours running non-stop at maximum speed:	150 hours/year
Endurance range required:	8 hours at 25 knots

2.4.2 Vessel's normal daily operating profile is:

(a) 2 hours at maximum speed of 25 knots at 90% MCR;

(b) 2 hours at cruising speed of 18 knots at 60-70% MCR;

(c) 4 hours at idle conditions.

2.4.3 Number or persons to be carried on board

(a) Carries 10 crew and 25 land crew for fire-fighting;

(b) Crew weights shall be 100kg per person (including outfit) plus 20 kg of effects when calculating weights;

(c) The Vessel shall be self-righting when the following personnel are onboard:

i, Full Load Departure including 10 crew and 25 land crew;

ii, Full Load Arrival including 10 crew and 25 land crew;

(d) Rescue Mode:

(i) The Vessel shall also be designed such that, in a matter of life-death rescue operation the Vessel shall take onboard the maximum number of persons (who will either be sitting or standing or lying on deck at any available space with or without shelter) without affecting the overall stability of the Vessel when it is stationery at sea. Hence the Vessel shall also comply with the specific stability requirements for this purpose. Passenger overcrowding as per the IMO 2000 HSC Code shall be considered when identifying the maximum number of persons onboard (POB).

2.4.4 Operational environment –

The Vessel shall be designed and manufactured to be able to operate in conditions up to Beaufort wind scale number 9 and Sea State 8 in accordance with WMO standard. See Annex 8 and below for definitions:

Beaufort wind scale number 9 and Sea State 8 – survival;
Beaufort wind scale number 7 and Sea State 6 – 11 knots;
Beaufort wind scale number 5 and Sea State 4 – 18 knots;
Beaufort wind scale number 3 and Sea State 2 – 25 knots.

2.4.5 Ambient Conditions –

All machinery, equipment and systems shall be capable of operating at their full design performance under the following environmental conditions:

External air	+ 40 ºC
Internal air	+ 20 ºC
Machinery space	As per Manufacturers recommendation and subject to MD's approval
Maximum seawater temperature	+ 30 ºC

2.4.6 The Vessel shall operate in various type of waters. The water is expected to include debris, sand and sea grasses and may be aerated.

2.5 Contract Speed

2.5.1 The Contract Speed shall be not less than 25 knots when all the propulsion engines running with the output power at 90% of Maximum Continuous Rating (MCR) under Official Speed Trial Conditions as stated in Annex 5 to this Part. [E]

2.5.2 The guaranteed speed prescribed above shall be achieved without porpoising, or other dynamic instabilities. The propellers selected shall match the engine profile.

2.5.3 Power to speed estimation for the Contract Speed at its sea trial conditions shall be provided, together with a descriptive account of the philosophy and methodology employed for such speed estimation and evaluation.

2.6 Principal Dimensions

Length Overall (LOA):	35.0 – 38.0 metres (Fenders included)	[E]
Breadth Overall:	Not less than 6 metres	[E]
Maximum Draught:	Not exceeding 3.5 metres	[E]

2.7 Material of the Vessel Structure

Hull Structure:	Marine Grade Aluminium Alloy	[E]
Main Deck:	Marine Grade Aluminium Alloy	[E]
Superstructure:	Marine Grade Aluminium Alloy	[E]

2.8 Propulsion System

2.8.1 Three fixed pitch propellers shall be driven by three marine diesel engines. Each of these marine diesel engines shall be supplied by the same manufacturer, for which shall be of the same model and with the same horse power rating. [E]

2.8.2 One (1) external fire-fighting pump driven via a power take-off (PTO) fitted to the central propulsion engine shall be provided. Both outer propulsion engines shall be used for manoeuvring of the Vessel and vessel station keeping during firefighting mode.

2.8.3 The Vessel shall be equipped with one (1) external fire-fighting pump driven by independent diesel engine. [E]

2.8.4 The Vessel shall be equipped with a bow thruster for station keeping and harbour manoeuvring. [E]

2.9 Markings and Colour Scheme

2.9.1 Markings and colour scheme for the Vessel shall be provided.

2.9.2 All labelling shall be both in Chinese and English and as per applicable rules and regulations. The FSD logo shall also be displayed on both sides of the deckhouse and at location as directed by MD.

2.9.3 The Vessel's name shall be made of cut off aluminium plate, welded to the hull and painted on both sides of the bow and the transom centre to MD and the FSD's satisfaction. Draught marks shall also be marked at both sides of bow and stern in the same manner as the Vessel's 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 built; and
(d) Maximum number of persons including the crew that the Vessel is designed to carry.

2.10.2 Tally plates in both English and Chinese characters shall be fitted for all spaces and all equipment as required by MD including but not limited to:

(a) Equipment in the console;
(b) Electrical and communication equipment;

(c) Air vents and filling pipes for the fuel oil tanks;
(d) All valves and equipment on deck;
(e) Control panels, switchboards, distribution boxes and electrical circuits; and
(f) Any other equipment and fittings 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 ballasts can only be used as agreed by GNC.

2.11.3 The Vessel shall be free of unacceptable structural noise and vibrations at all speeds.

Chapter 3 - Hull and Deckhouse

3.1 Hull and Deckhouse

3.1.1 The Vessel shall be designed and built as a monohull. The hull structure shall be constructed of marine aluminium alloy.

3.1.2 The design stress and load (wave height versus speed), maximum acceleration considered and scantling calculations including the internal structural members shall be approved by an RO. All materials and build processes for aluminium 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.

3.1.3 The hull structure design loads shall be in accordance with the Vessel operational profile and other applicable requirements. Hull construction materials shall be new and of a type which has been certified by an RO or other entities acceptable to GNC for shipbuilding purposes.

3.1.4 The Contractor shall carry out quality control throughout the construction of the Vessel by their quality control personnel.

3.1.5 Records of the structural materials used for vessel construction and up-to-date copies shall be provided to GNC before and/or during the construction stage of the Vessel.

3.1.6 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.

3.1.7 Major penetrations or access openings through bulkheads shall be avoided as far as possible. All penetrations through bulkheads 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 The Watertight 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 watertight integrity in all operational conditions including self-righting.

3.1.9 Close attention shall be paid to the fabrication and installation of machinery foundations and major equipment to ensure rigidity of the foundations and their structural continuity with adjacent structure.

3.1.10 The keel structure shall be arranged to accommodate Vessel's dry docking and lifting requirements in the Government Dockyard and relevant dockyard in Hong Kong.

3.2 Hull and Deckhouse Structural Requirements

3.2.1 Hull Structure Construction

(a) The hull of the Vessel shall have a double bottom, which shall be accessible by a person of average built. The Vessel shall be designed and manufactured to be able to handle adverse weather conditions whilst operating in shallow waters. The double bottom shall be painted and protected from see water corrosion. The construction of double bottom shall comply with Chapter 2 of High Speed Craft Code. [E]

(b) Trunks, coamings, and openings where applicable shall have radius corners as large as possible and acceptable to the RO;

(c) Fittings and openings through decks and bulkheads for pipes and cables shall be properly designed using RO approved fittings to maintain watertight integrity, reduce transmission of heat, and to minimise transfer of machinery vibration and noise to the hull structure;

(d) 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;

(e) Sharp corners shall be avoided.

3.2.2 Tightness

(a) All fittings on the weather deck and deckhouse shall be watertight and be capable of surviving an inversion;

(b) Watertightness tests coreesponding to heads of water encountered during self-righting are required for all doors and windows installed;

(c) All structures and fittings shall withstand the tests described above and any weakness such as leakage and deformation shall be made good by, and at the expense of, the Contractor;

(d) The vessel watertight integrity is paramount to the vessel's ability to self-right.

3.2.3 Fairness

The hull, decks, and deckhouse side wall shall be fair and smooth, and shall be free from objectionable buckles or uneven sight edges. Special care shall be used in aligning and fairing of surfaces which will be joined and are between stiffeners or similar structural members.

3.2.4 Decks, Platforms, Flats and Stiffness

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

(b) The main deck shall be fitted with water-tight hatches or soft patches as deemed appropriate by the GNC for removal of main engine, generators, and also fire pump power pack, without dismantle of built-in furniture or deck house structure. All hatches shall be fitted to the satisfaction of the RO and GNC;

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

3.2.5 Through-Hull Fittings

(a) Through-hull fittings shall be located in convenient locations for maintenance purposes, as required for equipment listed in these Technical Specifications. The number of through-hull fittings shall be kept to a minimum. A non-return valve shall be fitted to all through-hull and through-deck fittings. All through hull fittings shall be fitted in accordance with RO requirements to the satisfaction of the RO and GNC;

(b) All non-return and shut-off valves fabricated of metal and having suitable corrosion protection, such as cathodic protection. If such valves are made of dissimilar materials to the hull, suitable isolation shall be provided for preventing galvanic corrosion. The valves shall be of RO approved type;

(c) The hull external shell surface below the waterline where through-hull fittings are located shall be fitted with external fairings/screens to minimise drag.

3.2.6 Hull Structural Closures

(a) Access to hull compartments from the main deck shall be provided by watertight deck hatches. These shall be type approved by the RO and shall be tested for watertightness and approved by the attending surveyor;

(b) 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. These shall be tested for watertightness and approved by the RO and GNC attending surveyors;

(c) All spaces shall be provided with access from the main deck;

(d) Flush access watertight hatches to the fore peak from the main deck shall be provided;

(e) Two watertight readily accessible access points shall be provided from the main deck to the engine room;

(f) Hinged hatch covers shall be provided with means to hold them securely in the fully opened position;

(g) All access closings shall be able to be opened and closed on both sides.

3.2.7 Ventilation Openings

All ventilation openings, but not limited to engine compartment ventilation, other compartments ventilation, fuel oil tank, fresh water tank and exhaust openings, shall be: [E]

(a) located such that they are not less than 0.2m above the waterline at every angle of heel in any loading conditions; or

(b) ducted in such a way that they are not less than 0.1m above the waterline at every angle of heel in any loading conditions; or

(c) equipped with an automatic closing device that does not rely on electronic, manual or any other active control to close and subsequently open.

Each opening, for the sake of water-tight integrity for self-righting purpose, shall be designed to prevent any water ingress.

3.2.8 Deckhouse Closures

(a) The watertight doors shall comply with the requirements of the RO and shall be provided for access into and out of the deckhouse;

(b) Doors giving access to the deckhouse shall have a sill height as per RO's regulation above the finished main deck surface;

(c) Appropriate locking devices to be provided for all access doors which can be operable from both sides;

(d) Deck structural strength to be maintained in way of deck openings;

(e) All windows and doors in the deckhouse shall have clear toughened safety glass windows and shall be able to withstand the loads from a capsize/ operational environment as stipulated in Paragraph 2.4.4 of this Part. [E]

3.2.9 Hull Preservatives and Coverings

(a) Exterior surfaces of the Vessel above the boot top (boot topping being the part of the outside shell of the Vessel between the light and loaded draught, that is, that part of the hull which is exposed alternately to wind and water) shall be painted and prepared to a satin finish/appearance/texture;

(b) Antifouling paint shall be applied by the Contractor to the paint manufacturer and GNC's satisfaction;

(c) Wherever paint is used, the Contractor shall propose a suitable paint specification in conjunction with a paint manufacturer acceptable to GNC for GNC's approval;

(d) All coatings shall be applied as specified by the manufacturer including temperature and humidity at time of application, coverage/rate, wet and dry film thickness, recoat time and application equipment and rate;

(e) The Vessel shall be painted externally with a paint process which can be guaranteed for a minimum of two years' service life by the paint manufacturer. Paint shall be used on surfaces as directed by GNC;

(f) Painting Schedule shall be proposed by the Contractor in consultation with the paint suppliers/manufacturers and submitted for GNC agreement and approval;

(g) All materials used for painting of the Vessel internally and externally shall be agreed by GNC and shall not have adverse effects to the environment and the health of persons on board;

(h) Painting report for the complete Vessel on delivery and after warranty slipping shall be prepared by the paint manufacturer and submitted to GNC.

3.3 Weld Quality

3.3.1 All welding and fabrication work shall be carried out according to the rules of the RO.

3.3.2 Welding joints shall be carefully designed and constructed to conform to the latest established standards and shipbuilding practice to prevent fatigue failures.

3.3.3 Welding and edge preparations shall be carried out by the RO recognised qualified workers.

3.3.4 Only qualified welders shall perform the cutting and welding work.

3.3.5 Certification of the qualifications of each individual welder shall be submitted to GNC and the RO by the Contractor before commencing welding works.

3.3.6 Welds installed using unqualified procedures or welding performed by non-certified welders shall be subject to removal by the Contractor at its own expense.

3.4 Supervision of Fabrication and Assembly

3.4.1 The items listed below (and other items as required by GNC) shall be recorded by the Contractor and submitted to GNC before commencing fabrication:

(a) Inventory of the incoming materials, consumables components and machinery;

(b) Traceability procedures for the use of the materials, and their traceable identification codes;

(c) Lofting, cutting, fitting, welding, forming and dimensions control of all the major structural components;

(d) Welding and inspection procedures for identifying the type and extent of Non-Destructive Test (NDT) inspections for the Vessel structures. GNC may require further NDT where necessary subject to the quality of the welding. A NDT inspection plan shall be submitted to GNC for approval before inspection;

(e) All NDT reports;

(f) Welding and inspection qualification and certification of each personnel;

(g) Records of maintenance and calibration of the welding, machining, measuring and inspection equipment;

(h) Records of machining, finish surfaces, and bolting;

(i) Procedures for work quality non-conformance reporting and records of rectification of defects;

(j) The design and manufacturing drawing control procedures, including any of its revisions and updates, and records for any re-issue of drawings.

3.5 Stability and Subdivision

3.5.1 The preliminary lines plan and the preliminary calculations for intact and damaged stability information of the Vessel shall be submitted with the tender as specified in Schedule 7 of Part V. The stability information shall include the loading condition for carrying out self-righting tests, with detailed stability analysis provided. The calculations shall be carried out using a proven computer system (viz. recognised by a Government authority or Classification Society). [E]

3.5.2 The Vessel shall be Inherent Self-Righting with a positive righting lever (GZ) from 0 degrees to 180 degrees. The Vessel shall be capable of rolling back to an upright position from a heeled position anywhere in the range of roll motion. [E]

3.5.3 The port and starboard side of the buoyant volume of the hull and superstructure need not to be symmetrically equal, as long as the Vessel's self-righting capability is met when then Vessel rolls on both sides. Both port and starboard roll over scenarios shall be evaluated and presented to GNC.

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

3.6 Inclining Experiment

3.6.1 An inclining experiment shall be carried out according to guidance and requirements given in IMO Resolution MSC.267(85)-2008.

3.6.2 Not less than 14 days before conducting the inclining experiment, a "Scheme of Inclining Experiment" ("the Scheme") shall be submitted to GNC for acceptance. The inclining experiment can only be conducted after GNC has accepted the Scheme.

3.6.3 The Scheme shall include:

(a) The intended date and time, and the place of the inclining experiment;

(b) The anticipated water depth at the time of the inclining experiment;

(c) A recent photograph of the site of inclining experiment;

(d) A recent photograph of the Vessel to be inclined. That includes its external view and hull superstructures and main deck situation;

(e) The name of the RO representative and the name of the Contractor representative who will attend and be responsible for the inclining experiment;

(f) The Vessel's intended initial loading condition (with a comprehensive list of all the items on board that are not part of the ship structures, machinery, fixture and fittings, liquid (if any) including persons and inclining experiment facilities and equipment) during the inclining experiment;

(g) The proposed initial locations and the subsequent movements of the inclining weights;

(h) The calculation of the estimated heel of the Vessel before and during the inclining experiment;

(i) The proposed number, location and lengths of pendulum used; or other methods of measuring heel angles (that must be of a type acceptable to GNC);

(j) The list of data to be measured in accordance with IMO requirements; and

(k) The lightship weight and centres of gravity, the draft and trim and the metacentric heights of the Vessel after each shift of inclining weight shall be determined in accordance with IMO requirements applicable to the Vessel.

3.6.4 For the avoidance of doubt, if there is any liquid on board, the worst possible free surface effects of all liquids on board shall be considered in all calculations.

3.6.5 The preliminary Inclining Experiment Report which shall be submitted to GNC 14 working days before the Official Sea Trials 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.

3.6.6 The final Inclining Experiment Report shall be approved by the RO before submitting to GNC for further comments and acceptance.

3.6.7 The Vessel must not carry any operational limitations with respect to its stability capability within the operational requirements stipulated in the TS of Part VII.

3.6.8 In addition to the above the requirements for the conduct of and the report of the Inclining Experiment, the Stability Information Booklet shall also follow any specific requirements given in the TS of Part VII.

3.7 Stability of the Vessel and the Stability Information Booklet

3.7.1 The Vessel shall comply fully with ALL the stability criteria (Intact, and Weather Criteria) stipulated in International Code on Intact Stability, 2008, IMO Resolution MSC.267(85)-2008.

3.7.2 The Vessel shall be Inherent Self-Righting with a positive righting lever (GZ) through the range from 0 degrees to 180 degrees.

3.7.3 The stability due to wind, ship rolling, and passenger crowding shall be calculated for the operational sea and weather conditions stipulated in the TS. These calculations shall be submitted to GNC for approval.

3.7.4 All the requirements stipulated in the latest International Code on Intact Stability, 2008, regarding the Stability Information Booklet and the conduct of the inclining experiment and the Inclining Experiment Report shall be followed.

3.7.5 In this regard the format and presentation of the Stability Information Booklet, Inclining Experiment Report shall strictly follow the requirements and instructions in the latest International Code on Intact Stability, 2008, IMO Resolution MSC.267(85)-2008.

3.7.6 The Stability Information Booklet and the Inclining Experiment Report shall be approved by the RO before they are submitted to GNC for final acceptance. These documents shall only be considered as acceptable when they are accepted in writing by GNC.

3.7.7 A preliminary Stability Information Booklet based on the estimated centre of gravity (CG) positions of the Vessel shall be submitted to GNC during the design stage and within four months after the kick-off meeting, to show that the Vessel can fulfil the TS required vessel stability as well as any other stability requirements required by GNC to be considered, during the design and construction stage.

3.7.8 The Official Sea Trial shall only be carried out after the results of the inclining experiment showing that the Vessel's actual centre of gravity position is consistent with the information given in the preliminary Stability Information Booklet, and that the Vessel is safe to go on with the sea trials.

3.7.9 The final Stability Information Booklet and the Inclining Experiment Report shall be delivered to GNC at least 14 days before the Delivery Acceptance.

(a) For the avoidance of doubt, in addition to the above requirements, the Stability Information Booklet in its final version shall include (but not limited to): ship particulars, sketch of general arrangement drawing showing different compartment and tank positions, hydrostatic curves, and cross curves;

(b) Tank calibration/sounding tables, fuel oil tank, freshwater tank, etc. 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;

(c) Stability calculations for each loading condition shall include a profile drawing of the Vessel and items of deadweight, lightship, displacement, drafts, trim, VCG, GM (solid and fluid), LCG, down-flooding angle, static stability curves, etc.;

(d) Any other information as reasonably required by the RO and/or GNC; and the Inclining Experiment Report approved by the RO;

3.7.10 Both the preliminary and final Stability Information Booklet (intact and damage) shall include the following loading conditions (and any other conditions as may be required by GNC during the design and construction of the Vessel) and their stability results shall be presented in a manner and format as indicated in latest IMO Resolution MSC.267(85)-2008.

Loading Condition	Fuel (%)	Fresh Water (% of 1000 litres)	Black Water (% of 1000 litres)	Crew and Effects	Persons (Land Crew)	Payload (excluding personnel)
Lightship	0	0	0	0	0	0
Full Load Departure	98	98	10	10	25	1000
Fully Loaded Arrival	10	10	98	10	25	1000
Operational Condition	50	50	50	10	25	1000

Fire-fighting condition	50	50	50	10	25	1000

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

(b) The weight of each person is assumed to be 100kg with effects of 20 kg.

(c) The VCG of each person shall be assumed as 1,000 mm above the deck where they are likely to be located. LCG of each person shall be in their most likely position on board.

(d) The wind moments in various loading conditions due to Beaufort Wind Force Scale 9 shall also be considered in the stability calculations.

(e) The Stability Information Booklet shall be approved by the RO before submitting to MD for comments. The Contractor shall supply to MD three copies of Stability Information Booklet (as built), which must be given to MD at Delivery Acceptance.

3.7.11 Intact Stability Criteria

Stability and freeboard will be considered satisfactory if the following criteria are complied with, after taking into account of free surface effects and wind speed at Beaufort Wind Force Scale 9, for loaded conditions as specified above.

(a) The maximum righting lever (GZ) occurs at an angle of heel of not less than 25 degrees;

(b) The GZ shall be at least 200 mm an angle of heel equal to or greater than 30 degrees;

(c) The area under the GZ curve shall not be less than:

(i) 0.055 metre-radian up to an angle of heel of 30 degrees;

(ii) 0.090 metre-radian up to an angle of heel of 40 degrees or the angle at which the lower edges of any openings in the hull, deck, deckhouses, being openings which cannot be closed watertight, are immersed if that angle be less;

(iii) 0.030 metre-radian between 30 and 40 degrees or such lesser heeling angles referred to in (2) above;

(d) The initial transverse metacentric height shall not be less than 0.15 metre.

3.7.12 Damage Stability Criteria

(a) The Vessel shall comply with the latest and as amended IMO International Code of Safety for High Speed Craft, 2000 (2000 HSC Code) for monohull craft residual stability after damage with single compartment flooding when the vessel is loaded as per Paragraph 3.7.10 of this Part.

(b) Transverse bulkheads shall be arranged to maintain the stability of the Vessel when flooding (i.e. total flooding, partial flooding and progressive flooding).

(c) The residual stability of the Vessel in the above-mentioned damaged condition shall be sufficient to maintain adequate stability of the Vessel to continue to operate at sea in any one of operational modes (except the fire-fighting mode) mentioned in the TS.

3.7.13 Self-Righting Stability Criteria

(a) The Vessel shall be designed to comply with the following roll over operational requirements:

(i) The Vessel shall be able to survive and inversion/roll over through 360°.

(ii) The self-righting system of the Vessel must be integral within the design and structure of the Vessel and shall not use additional buoyancy bags or movable ballast to provide the righting moment required to recover the Vessel from inversion.

(iii) The Vessel shall be able to safely return to a safe haven/port after such event as a minimum, using the Vessel's own propulsion and steering systems.

(iv) All systems and equipment (mechanical and electronic) shall be designed and installed such that the above criteria are fulfilled. The following must be fully operational after an inversion and the Contractor shall provide a report on the expected state of all systems on the Vessel after an inversion, including the time to restart any systems which are shut down during an inversion:

1. Main Propulsion Engines;
2. Gearboxes;
3. Generator Engine;
4. Windscreen wipers;
5. VHF radio;
6. GPS system;
7. AIS system; and
8. All safety equipment aboard the Vessel.

(b) The Contractor shall provide previous experience in the design of self-righting vessels, the stability and self-righting criteria used in the design and supply details of the closing systems and mechanisms for all openings and vents which may be submerged in the event of inversion.

(c) The Contractor shall make all possible efforts to ensure that damage to any other systems or equipment on the Vessel is minimised and shall provide a report on the possible damage expected to other systems as a consequence of an inversion.

(d) Rescue Mode is as specified in Paragraph 2.8.3 of Chapter 2 of Part VII (with the maximum number of persons who can be on board the vessel). A passenger heeling moment calculation shall be carried out in accordance with 2000 IMO HSC Code;

(e) Fire-fighting Condition:

(i) Total number of people 35 (10 Crew and 25 Persons);
(ii) 1000 kg payload;
(iii) 98% foam tanks; and
(iv) For the Fire-fighting Condition, the Stability Information Booklet shall provide the stability information of the Vessel when in the above-mentioned loading and when two (2) fire-fighting monitor nozzle facing 90 degrees beam pointing to the horizontal, ejecting water at full fire pump power. This stability (and heeling) calculation shall be carried out separately for port and starboard sides. For the heel (or list) calculation the Vessel shall be assumed not in motion (i.e. in still water) and without any assistance from the propulsion engines.

(f) The final Stability Information Booklet shall be approved by the RO before submitting to GNC for comments. The Contractor shall supply to GNC three copies of Stability Information Booklet (for the as-built Vessel), which must be given to GNC;

(g) The final acceptance of the Stability Information Booklet and the Inclining Experiment Report shall rest with GNC for this Contract.

3.8 Specific Additional Requirements for Stability of the Vessel

3.8.1 In addition to the above requirements, it is also mandatory that:

At any time the Vessel shall not heel over 7 degrees AND the freeboard at amidships shall not be reduced by more than 70 % in the Fire-fighting mode of operation when any one of or both fire monitors are in full power operation at any horizontal and vertical ejection angle whether the Vessel is stationary in water or under power moving in any direction and at any forward speed below 5 knots.

3.8.2 The Contractor must provide GNC the turning stability calculation of the Vessel showing it is safe to conduct the turning test at least 14 working days before the Official Sea Trial.

3.9 Roll Over Test Requirements

Contractor shall submit a list of Procedure and Safety Precaution for Roll Over test, which shall include the following, to RO and GNC at least 14 working days in advance of the Roll Over Test:

(a) The means of recording the test;
(b) The proposed location of the test,;
(c) The pulling arrangement in details, which shall include all equipment and methodology involved in the test;
(d) The stowage of all portable items and equipment inside the Vessel;
(e) All the closing of all water-tight/ weather-tight appliances;
(f) All means of closing appliance to prevent water ingress into the hull, and the method to drain out the water in each appliance, if any;
(g) Checking the ingress of water after the test;
(h) Checking the damage of hull and outfit, if any, after the test;
(i) Checking the functionality of all equipment powered by main engines, generators and DC power supply after the test;
(j) Safety Precaution when the Roll Over test is undertaken; and
(k) The uninstalled items which are prone to be damaged after Roll Over test.

The Roll Over Test shall be conducted under loading condition as stipulated in Paragraph 3.7.10, whichever is the worse condition of self-righting stability as calculated and stipulated in Paragraph 3.7.13. Normal vessel operation shall be resumed after the Roll Over Test is conducted. Like all other tests and trials to be conducted as part of the Technical Acceptance, the Contractor is required to carry out the roll over test at its own expense (including the expense of fuel, lubrication oil, crew and other necessary expenses), in the presence of MD and FSD officers.

3.10 Down flooding Angles and Permeability

3.9.1 The opening(s) to be used to determine the down-flooding points and the angle(s) shall first be agreed by the RO and GNC before carrying out the calculations.

3.9.2 The permeability of each flooded compartment for the stability calculations shall be defined in accordance with the 2000 IMO HSC Code.

Chapter 4 - General Arrangement

4.1 General Provisions

4.1.1 The Vessel shall be designed and built as a mono-hull high speed light craft. The hull and superstructure shall be constructed of certified marine grade aluminium alloy plates and specially designed extrusions.

4.1.2 The Tenderer should note that the Guidance General Arrangement Plan given in Chapter 2 of Part VII only serves as a guide and to help to explain the tender requirements. Nevertheless, it is a contractual requirement that all furniture, equipment and facilities, fixture and fittings, including outfitting of the Vessel that are described in the TS of Part VII, together with their requirements for design and installation standards that are stipulated in this Chapter and in any other parts of the TS, are the items that must be included in the complete "As-built" Vessel delivered to the Government.

4.1.3 The Tenderer should note that the requirements given in the TS of Part VII are in addition to the RO requirements and IMO requirements and shall be met by the design and construction of the Vessel.

4.1.4 The Tenderer shall submit with the tender submission a General Arrangement Plan for Government consideration at the tendering stage.

4.1.5 During the design and construction of the Vessel, the Contractor shall again submit detailed General Arrangement Plan to GNC for approval and acceptance.

4.2 General Arrangement

4.2.1 The deckhouse shall be set in to provide a clear passageway of not less than 900mm width on each side of the weather deck, extending from bow to stern. Obstructions to this walkway shall be avoided as there can be many rescued persons using the passageway.

4.2.2 The hull shall be subdivided by transverse watertight bulkheads into separate watertight compartments. The compartment lengths shall be defined according to the IMO International Code of Safety for High Speed Craft, 2000 (2000 HSC Code).

4.2.3 The below subdivisions and accommodation compartments should be designed to be similar to the GGAP (General Arrangement Guidance Plan) which is provided for guidance only.

(a) Under Deck compartments:
- (i) Fore peak;
- (ii) Bow Thruster compartment;
- (iii) Water Tank compartment;
- (iv) Fuel tank compartment;
- (v) Engine room;
- (vi) Steering gear room.
- (vii) Forward fire pump room

(b) Under Main Deck Accommodation compartments:
- (i) Crew Mess Room/ Galley;
- (ii) Fire Fighting Equipment Stores;
- (iii) Wet Changing Room;
- (iv) Toilets/showers.

(c) Main Deck Accommodation compartments:
- (i) On the main deck, there shall be comprised of the following compartments:
  1. Fire Fighter (land crew) Seating Area;
  2. Emergency Treatment Room;
  3. Toilet/shower.

(ii) On the bridge deck accommodation, there shall be comprised of the following compartments:

1. Control Station;
2. Port and Starboard Manoeuvring/Station Keeping Wing Stations.

4.2.4 Final design for subdivision and accommodation compartments mentioned in Paragraph 4.2.3 above shall be subject to full compliance with the requirements of stability and subdivision as required by the RO. The arrangement and preliminary stability booklet shall be submitted and approved by the RO and GNC prior to commencement of vessel construction.

4.2.5 All cabins shall be designed and arranged to protect the occupants from weather and sea conditions and aim to minimise risk of injury from ship motion.

4.2.6 All controls, electrical and mechanical equipment and parts, wiring and piping, rotating parts and assemblies in cabins and compartments shall be properly placed not to cause injury.

4.2.7 Windows in cabins shall be strong and suitable for the worst intended operation conditions including capsize/inversion i.e. self-righting condition.

4.2.8 Window glass and the frame shall be made of materials which will not break into dangerous fragments when fractured/shattered.

4.2.9 Equipment fixtures and fittings on board shall be fitted properly to avoid injury to persons at all time.

4.2.10 A general emergency visual and audible alarm system shall be provided for the Vessel. The alarms shall be audible throughout the Vessel and sound pressure level shall be at least 14 dB(A) above the ambient noise levels anywhere in the Vessel and its spaces and compartments when the Vessel is in its normal operational conditions. The alarm shall continue to function after it is triggered off until it is turned off or is temporarily interrupted by a voice message on the public-address system.

4.2.11 There shall be a public-address system covering all areas and spaces of the Vessel, and where crew shall have access, including the escape routes. The system shall be such that at the initial stages of a flooding event, or at the start of a fire in a compartment, it would remain operable.

4.2.12 A clear headroom of at least 2100mm in Under Main Deck, Main Deck and Upper Deck shall be designed and built to ensure sufficient space for operation, for which the General Arrangement should be subject to the prior approval of GNC/MD and FSD.

4.2.13 Storage space to be provided for upkeeping of FS equipment, e.g. breathing apparatus, salvage pumps, fire hoses, breaking in tools, etc. If practicable, a store room for large and heavy breaking in tools, a store room for small gear and breathing apparatus.

4.2.14 The storage space for upkeeping of FS equipment shall be designed with identical mounting/securing system to prevent from falling out when the Vessel is heavily listing and/or capsize/inversion.

4.3 Deckhouse

4.3.1 As a minimum requirement, the visibility to outside from inside the control station shall be in accordance with the RO/ Flag State requirements.

4.3.2 As a minimum requirement natural light shall be provided to the main deck accommodation in accordance with the MLC requirements to the satisfaction of the RO and GNC.

4.3.3 Side mirrors / CCTV shall be provided at locations to allow the coxswain to safely manoeuvre the craft to a berth.

4.3.4 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.

4.3.5 Frames at the wheelhouse window separations shall be kept to a minimum, and they shall be of adequate structural strength and stiffness. They shall not be installed immediately in front of the coxswain position.

4.3.6 The positions of window frames shall be agreed by GNC before installation.

4.3.7 The wheelhouse front windows shall avoid reflection.

4.3.8 Throughout the Vessel, polarized and tinted windows are NOT to be fitted.

4.3.9 All window glass used throughout the Vessel shall be hardened and tempered and be of a type suitable and safe for marine use. Furthermore, the windows shall be of sufficient strength to be able to survive a capsize/ inversion.

4.3.10 At all times regardless of the weather and sea conditions at least two thirds of the wheelhouse front width in front of the coxswain shall be a clear view.

4.3.11 The following outfitting items shall be provided:

(a) Marine type wide span and large area electric wiper(s) (covering not less than 60% of the window glass pane area) with fresh water window washing systems shall be fitted to all wheelhouse front windows;

(b) Heavy-duty marine type of wipers shall be used. They shall have an interval operation and adjustment functions and be fitted with electrical fresh water window/wiper washing systems. These wipers shall be capable of operating independently of each other. The type and make of wiper must be submitted to GNC for acceptance before they are fitted;

(c) Two sets of spare wiper blades shall be provided for each window wiper installed for the Vessel. One spare unit of wiper for the coxswain front window shall also be provided;

(d) An all-round de-misting system shall be provided for all wheelhouse windows at the interior side of the windows;

(e) Retractable solar UV roller blinds shall be installed on all cabin windows throughout the Vessel;

(f) The blinds shall be capable of being retained in position either partially lowered or fully lowered, without swinging due to Vessel motions at sea.

4.4 Lighting

4.4.1 Adequate lighting intensity and lighting arrangement, as well as any necessary lighting segregation, by means of blinds or other means, shall be provided inside the cabins and wheelhouse spaces to enable the operating personnel to perform their navigation task.

4.4.2 Emergency lighting shall be provided throughout the Vessel for its operational needs.

4.4.3 Only limited (and suitably reduced) illumination of the essential gauges, instruments and controls for monitoring likely system fault situation is allowed.

4.4.4 A suitable device shall be available to enable lighting intensity and direction adjustment in different areas of the compartment.

4.5 Deck Railing, Mast and Navigational Lights

4.5.1 Unless specified as not required (or otherwise with alternative requirements) in the TS, the following items shall be provided:

(a) Open decks where accessible for persons and crew shall be fitted with strong guard railings at their perimeter for safety of persons on board except where for the convenience of crew operation (e.g. at the bow deck area);

(b) A mast with: three search lights, one set of flood lights and two flashing beacons shall be fitted on the wheelhouse top;

(c) Wheelhouse top shall be fitted with IMO required navigational lights, shapes, sound signals, and radar scanner and other electronic and navigational equipment, including the lightning arrestor, ensign hoist, signal hoists, antennas and UHF mobile transceiver etc. as required by the operation of the Vessel;

(d) The aft bridge deck shall be a designated area for helicopter winching;

(e) Safe access for the maintenance and servicing to equipment and its fittings shall be provided;

(f) All hardware for them, such as screws, hooks, hasps, hinges, handles, sliding bolts etc. shall be made of stainless steel and be with proper galvanic corrosion preventive measures at their contact points with the hull/superstructures.

4.6 Lightning Protection

4.6.1 The Vessel shall be fitted with a proven lightning protection system as per RO and IMO requirements.

4.6.2 Method and working principle of protection shall be submitted to GNC for approval before the installation.

4.7 Access, Doors, Ladders and Hatch

4.7.1 Design of all outfitting including, but not limited to, doors, hatches, ladders, ventilation heads, etc. shall be of a type approved by the RO for this type of vessel, or other entities acceptable to GNC. These shall require GNC acceptance and approval before installation. Careful consideration to be carried out to ensure watertight integrity is maintained in the event of capsize and recovery to the satisfaction of the GNC.

4.7.2 Detailed specifications of these items shall be provided to GNC by the Contractor before installation. Any item(s) not acceptable to GNC shall be removed and replaced with the one(s) acceptable to GNC.

(a) Where the use of a hatch is not practical on the weather deck, an RO approved flush type watertight manhole should be used;

(b) The design and the arrangement of the flushed type watertight manhole shall be submitted to GNC for approval;

(c) The design and arrangement of the deck hatch must be watertight and suitable for a craft designed to survive a capsize/inversion.

4.7.3 Hatches shall be capable of being operated from both sides.

4.7.4 Stairway inclination shall not be more than 50 degrees to the horizontal and shall be fitted with handrails on each side. A minimum width of 600 mm shall be provided between the handrails.

4.7.5 All exterior grab hand rails shall be 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 bad weather and sea conditions, and when all these persons are lining up together on one side of the deck in case of an emergency at sea.

4.7.6 Vertical ladders, if fitted on board, shall be constructed with tread round bars at suitable step space intervals, adequate footsteps and handholds for safety.

4.7.7 The engine room and all crew spaces shall be provided with two widely separated means of access/escape designed and manufactured in accordance with RO requirements.

4.8 Furniture and Fittings

4.8.1 Built-in furniture shall be adequately secured against ship impacts in case of ship collision or in bad weather and sea conditions. All furniture and fittings to be adequately secured to withstand the loads induced during a capsize/ inversion.

4.8.2 All seats shall be in accordance 2000 IMO HSC Code Annex 10 and shall be securely fitted to withstand the loads likely to be experienced during a capsize and operation in required sea states when all seats are occupied by sitting persons.

4.8.3 Seating and handholds shall provide support for spinal neutral alignment and postural stability for each person up to the crew limit and to prevent them from falling or being thrown on deck.

4.8.4 Upholstery such as seat cushion back rests and settees shall be self-extinguishing, e.g. urethane foam to BS 3379 or equivalent, and be of thickness not less than 100mm; and be covered with imitation leather.

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

4.8.6 Lockers shall be provided with built-in locks and keys. They shall be designed and fitted to the satisfaction of GNC officers.

4.8.7 All hardware including screws, hooks, hasps, hinges, handles, sliding bolts, etc. shall be made of brass with chrome plated finish, or in stainless steel.

4.8.8 All fittings and hardware fitted on board the Vessel (such as, coat hooks, ceiling lights, bulkhead mounted lights etc.) shall be of a high-quality chrome finish. They shall be properly fitted in accommodation space and any other spaces directed by GNC officers

4.8.9 Equipment Store Room is the space fitted with racks, shelves, and red lockers to store all manner of fire-fighting equipment such as poles, axes, tools, fittings, hoses.

4.9 Insulation and Lining

4.9.1 Boundaries and ceilings inside the wheelhouse, main deck cabin and crew space shall be properly insulated against weather, heat and temperature, with not less than 50 mm thick glass-fibre wool; and be lined with protective/decorative panel linings of hard-wearing surface.

4.9.2 All spaces subject to structural fire protection shall be insulated against fire with asbestos-free materials in accordance with IMO regulations and requirements applicable to the Vessel to the satisfaction of the RO and GNC.

4.9.3 The noise level throughout the Vessel shall be in accordance with IMO regulations and requirements applicable to the Vessel.

4.9.4 Samples of wall, ceiling panels and joints materials and method of joining shall be submitted to GNC for approval before installation.

4.9.5 The panels shall be fitted to avoid noise generation at all operational speeds. Within reasons, when the noise level is considered unacceptable to GNC officers, the Contractor shall improve the design and fitting methods of the panel/ceilings.

4.9.6 The deck or floor of wheelhouse, main deck cabin and crew space shall be covered with non-skid, wear resistant and fire-retardant vinyl PVC sheets that are acceptable to GNC officers.

4.10 Wheelhouse

4.10.1 The wheelhouse shall be designed to have all-round visibility at the steering/helm position of the console area.

4.10.2 The wheelhouse shall not be designed for use for purposes other than navigation, communications, fire-fighting, monitoring the performance of the machinery and other functions essential to the safe operation of the Vessel.

4.10.3 In addition to the RO and IMO requirements, the wheelhouse shall be properly designed for the controls and instruments for navigation, manoeuvring, communication and machinery operation to the satisfaction of GNC.

4.10.4 The steering position, console and its instrument and gauges, and control layout, coxswain seat and the navigator and commanding officer seats, and in fact the complete interior arrangement of the wheelhouse shall first be agreed by GNC before the installation and construction. For this purpose, the Contractor shall construct a mock-up of the internal arrangement in the shipyard for the GNC officers and the user department officers to approve.

4.10.5 The steering and main engines control can be carried out by joystick and steering wheel. Back up control of individual steering gear and main engine are also provided.

4.10.6 The steering and helm position shall be situated at the centreline of the Vessel and be at a forward position close to the front windows in the wheelhouse. Two (2) crew members are also to be situated in a forward position close to the front windows in the wheelhouse, directly to port and starboard of the central steering and helm position. The available overall wide-angle visibility of the coxswain is of utmost importance.

4.10.7 Controls for the coxswain and steering shall be easily reachable by a person of about 1.67 metres height in the sitting position without needing to unduly extend his/her arms, and that it would not interfere the coxswain's all-round field of view.

4.10.8 The arrangement of equipment and means for navigation, manoeuvre, control, communication and other essential instruments shall be located sufficiently close together to enable the coxswain and the assisting officer(s) to read/receive all the necessary information and be able to use the equipment and controls while they are seated.

4.10.9 There shall be six (6) x crew seats provided with damping capability in compliance with '2000 IMO HSC CODE ANNEX 10' for crew comfort and safety during vessel operation. Requirements of the seats shall be:

(a) Seats shall be of a comfortable type and designed for protection of crew while the Vessel is operating at its maximum speed;
(b) Suspension or damping type;
(c) Adjustable seat height with foot rest;
(d) Backrest angle adjustment around 12°;
(e) Fore and aft adjustment around 160 mm;
(f) 4 point safety seat belt to be provided;
(g) Adjustable armrests;
(h) Turntable/Mounting pedestal 0° - 180°.
(i) 2000 IMO HSC Code Annex 10 Compliant.

4.10.10 All instruments shall be logically grouped according to their functions. To minimise the risk of confusion, instruments shall not be rationalised by sharing functions or by inter-switching.

4.10.11 Instruments required for use by any member of the operating crew shall be plainly visible and easily read from his normal seating position.

4.10.12 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.

4.10.13 Surface finishing and interior linings of the wheelhouse shall be of a matt non-reflecting finish to facilitate night operation.

4.10.14 Pillars are not allowed to be fitted inside the wheelhouse and/or the wheelhouse steering area.

4.10.15 Subject to any other additional or alternative requirements given in TS, the following controls, displays and equipment shall be incorporated in the control console:

(a) Steering controls;
(b) Engine speed and clutch controls (if applicable);
(c) Steering angle indicators;
(d) Integrated station keeping controls (joystick);
(e) Independent Bow Thruster Control;
(f) Electronic navigation equipment and displays;
(g) Speed log;
(h) Echo sounder;
(i) Lighting control panel incorporating controls for navigation lights and alarms, search lights and flood lights;
(j) Main and auxiliary engines monitoring indicators and tachometers;
(k) Instrument and control and alarming system for major machinery containing start/stop switches;
(l) Exhaust temperature gauges;
(m) Gear box oil pressure indicators alarms that deemed to be required by the equipment manufacturers;
(n) Fire detection system and CO_2 flooding system control panel;
(o) Emergency stop switch for accommodation ventilation fans;
(p) Meter/Gauge indicating the quantity of fuel remained in the fuel tank;

(q) One colour LED monitors of CCTV for exposed deck areas and one colour LED monitors of CCTV for engine rooms;
(r) Public address system and intercom system to engine rooms;
(s) VHF radio receiver's stowage positions and power sockets;
(t) Electric horn, siren, and flashing beacon control panel;
(u) Watertight openings monitoring system; and
(v) Or any other equipment requested by GNC of MD and FSD.

4.10.16 A separate control console shall be provided in the wheelhouse for the operation of firefighting equipment. This shall be designed as described in Paragraph 5.10 of Part VII.

4.10.17 A Wheelhouse Engine control console shall be provided in the wheelhouse for the operation of machinery and electrical system. This shall be designed as described in Paragraphs 8.3.1, 8.8.2, 8.18.2, 8.18.3 of Part VII.

4.10.18 Station keeping control panel shall be provided in the wheelhouse for the operation of station keeping. This shall be designed as described in Paragraph 8.9.1 of Part VII.

4.10.19 Bow thruster control panel shall be provided in the wheelhouse for the operation of bow thruster. This shall be designed as described in Paragraph 8.8.2 of Part VII.

4.10.20 Tow manoeuvring control console are provided in both sides of the bridge wing for steering and main engine control. They should be with similar function as described in Paragraph 4.10.5 of Part VII. The position of the control console shall facilitate the safe manoeuvring of the vessel. The steering, main engine and bow thruster control shall be carried out by joystick.

4.11 Wheelhouse Outfitting

4.11.1 The following fittings and equipment shall be provided in the wheelhouse:

(a) One display board for posting plans, maps, notices, etc.
(b) One set of pigeon holes for stowage of international code flags;
(c) One set of international code flags suitable for the mast;
(d) One set of open shelves for the stowage of log books and files;
(e) One chart table with lamp and dimmer over, a drawer shall be provided under the table top for the stowage of charts;
(f) One dial type inclinometer and one thermometer for marine use;
(g) One magnetic compass with independent illuminated dimmer switch;
(h) One electric powered marine wall-mounted master clock;
(i) Two cup holders;
(j) One swing-type metal rubbish bin with cover;
(k) One wooden box with locks for the storage of binoculars, and it shall be fitted within the vicinity of the forward high seats. Two binoculars shall be provided (one for use in day time and one for use in night time); and
(l) Four coat-hooks.

4.12 Main Deck Saloon (Deckhouse)

4.12.1 Unless specified as not required (or otherwise with alternative or additional requirements) in TS, the following furniture, fittings and equipment shall be provided:

(a) Toilet(s)/ Shower room;
(b) 32 OFF fixed crash tested seating with 4 point safety seat belts in compliance with '2000 IMO HSC Code Annex 10' for crew and passengers;
(c) Large rubbish bin with cover (of a size and type to be decided by the user department);
(d) Emergency Treatment Room as described in Paragraph 4.15 of Part VII.

4.13 Crew Space

4.13.1 Unless specified as not required (or otherwise with alternative or additional requirements) in TS, the following furniture, fittings and equipment shall be provided:

(a) Toilet(s)/ Shower room;
(b) 32 OFF high-density foam mess area seating with cushion;
(c) marine clock and lockers (of a size and type to be decided by the user department);
(d) suitable means of escape (size and arrangement according to RO and IMO requirements) to the main deck shall be provided for the crew space;
(e) refrigerator (of a size and type to be decided by the user department);
(f) large rubbish bin with cover (of a size and type to be decided by the user department);
(g) Microwave oven (of a size and type to be decided by the user department);
(h) Sink, kettle and food preparation area.

4.14 Toilet

4.14.1 Toilet(s) (heads) compartments shall be fitted within the main deck saloon (deckhouse), within the crew wet room and within the crew space. Refer to the GGAP for guidance.

4.14.2 Unless specified as not required (or otherwise with alternative or additional requirements) in TS, the following furniture, fittings and equipment shall be provided:

(a) Toilet exhaust air shall be routed to outside;
(b) Sewage flushed from toilets shall be pumped into a sewage tank;
(c) Non-slip flooring shall be provided;
(d) One stainless steel wash basin with a spring loaded cold freshwater supply tap;
(e) One shower unit (and as per TS requirement);
(f) One water delivery point under basin with a plastic hose for toilet cleaning;
(g) One cabinet with mirror;
(h) One toilet paper holder;
(i) One electric exhaust fan;
(j) One ceiling light and one cabinet light;
(k) One stainless steel grip rail;
(l) One liquid soap dispenser; and
(m) Means to avoid water accumulated on the toilet floor.

4.15 Basic User Requirements for Treatment Room of Fireboat

4.15.1 The Vessel shall be designed with a treatment room to provide emergency medical care to any casualties at scene. The emergency treatment room shall be located on the main deck for access to the exterior deck for easy transfer of patients in the event of emergency.

4.15.2 An electrical level adjustable patient bed shall be supplied and installed in the treatment room. The specification and model patient bed shall be confirmed and approved by FSD in the kick off meeting.

4.15.3 A ceiling mounted surgical light with compatible pendant/suspension system conforming to IEC 60601-1 (Medical Electrical Equipment Part 1 – General Requirements for Safety) and IEC 60601-2-41 (Medical Electrical Equipment Part 2-41 – Particular Requirements for the Safety of Surgical Luminaires and Luminaires for Diagnosis), or other equivalent national or international standard, shall be provided and installed in the treatment room.

(a) The surgical light shall be of LED type and compact design for the small workplace;
(b) Pendant/compatible suspension system of the surgical light shall be fitted with a display arm to support monitor;
(c) The handle shall be removable / sterilisable;
(d) The configuration of the suspension system with the surgical light shall allow the light-head to rotate horizontally and vertically;

(e) The central illuminance shall be no less than 40,000 lux at 1 metre or dimmable to this value;
(f) The colour rendering index (Ra) shall not be less than 94;
(g) The colour temperature shall be within 4,000 K˚ to 4,500 K˚;
(h) The depth of illumination shall not be less than 1,000 mm;
(i) The light field diameter shall be within 70 mm – 160 mm; and
(j) The LED service light shall not be less than 25,000 hours of operation at greater than 80 percent of initial light output.

4.15.4 Medical oxygen supply system shall be designed, provided and installed for the Vessel in accordance with the design, installation and performance requirements of latest edition of the Health Technical Memorandum 02-01: Medical gas pipeline systems in UK or equivalent.

(a) Securing brackets for two G size oxygen cylinders (720 mm long x 180 mm diameter) shall be provided. The cylinders shall be provided by FSD;
(b) A three ways control assembly/connector completed with independent control valves and flexible pipes shall be provided;
(c) Five standard oxygen outlets shall be provided and installed;
(d) A regulator with pin index yoke and DISS outlet fittings, and main isolator coupled with glass cover shall be provided and installed;
(e) Five numbers of flowmeter with straight probe shall be provided and installed;
(f) Plastic/nylon/brass pipework connecting the oxygen outlets and cylinder to run at central level shall be provided and fixed as directed;
(g) A high-pressure flexible hose completed with threaded nut connection of approved product shall be provided and fixed as directed;
(h) Each oxygen storage cylinder shall be protected from other cylinders by a partition.
(i) All piping and their connectors shall be easily accessible for service and replacement.

4.15.5 A minimum 1,000 watts non-flammable surface 220 V A.C. wall mounted warmer shall be provided and mounted with detachable device in the treatment room. The warmer shall be equipped with adjustable thermostat and overheat safety protection.

4.15.6 A water sink of stainless steel 316 or better completed with a brass drainage pipe and a fully-fitted cover shall be provided as directed. Water tap shall be of medical use type.

4.15.7 A stainless-steel soap dispenser and a stainless-steel paper towel dispenser shall be supplied and fitted near the water sink.

4.15.8 One wooden couch of appropriate height for treatment examination with portable step shall be provided and installed in the treatment room. Top of the couch shall be padded with 100 mm thick foam and covered with heavy gauge imitation leather of colour to match with the ward. Storage space with sliding doors shall be provided under the couch.

4.15.9 A full-size white board shall be provided and fixed right over the nearside couch in the treatment room.

4.15.10 At least four wooden cupboards completed with transparent acrylic sliding doors shall be provided in the treatment room. The sliding doors shall be fitted with push lock.

4.15.11 The partition walls and doors of the treatment room shall be of a sandwich construction including fire retardant, heat and noise insulating materials to maintain a sound level not exceeding 80 dB(A) inside the room.

4.16 Forepeak

4.16.1 The forepeak space shall be watertight and located at the foremost end of the hull, with a watertight collision bulkhead. IMO requirements for collision bulkhead must be complied with.

4.17 Bow Thruster Compartment

4.17.1 The Bow Thruster Compartment shall be located under the main deck aft of the fore peak compartment.

4.17.2 A watertight hatch shall be fitted flush to the main deck to provide access to the bow thruster compartment for routine service and maintenance.

4.17.3 The compartment shall be designed and fitted out in accordance with RO requirements and to the satisfaction of the GNC.

4.17.4 The compartment shall be designed with sufficient space to house the following equipment:

(a) Bow thruster tunnel, propeller and power pack;

(b) Racking and support structure for fitting of local operating panel(s), cabling, junction boxes and any other supporting equipment; and

(c) Any other equipment required as determined by the GNC.

4.17.5 The Contractor shall design and install the compartment in accordance with IMO 2000 HSC Code with respect to required structural fire protection, fire detection and fire suppression.

4.17.6 The Contractor shall take care when designing and installing equipment in the compartment to avoid noise and vibration transfer to the crew accommodation and superstructure.

4.17.7 The flooring of this compartment shall be covered with unpainted aluminium chequer plates.

4.17.8 Aluminium chequer plates adjacent to valves, shafts, etc., shall be easily removable for easy maintenance. Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid/minimise rattling noise.

4.17.9 Ventilation to be provided for bow thruster compartment in accordance with RO requirements and to the satisfaction of the GNC. All ventilation to be provided with automatic closing devices to the satisfaction of the RO and GNC to prevent water ingress following vessel capsize.

4.17.10 The Bow Thruster Compartment shall be adequately ventilated to maintain the bow thruster compartment in similar condition as outside ambient condition and also dampness and condensation would not accumulate. The ventilation arrangement of the bow thruster compartment should take into consideration that crew would carry out operation and maintenance work regularly and also in emergency situation. Therefore arrangement shall be proposed to ensure the safety of working personnel and accepted by FSD and GNC.

4.18 Fuel Tank Space

4.18.1 The flooring of this compartment shall be covered with unpainted aluminium chequer plates.

4.18.2 Aluminium chequer plates adjacent to valves, shafts, etc., shall be easily removable for easy maintenance. Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid/minimise rattling noise.

4.18.3 Ventilation to be provided for tank space in accordance with RO requirements and to the satisfaction of the GNC. All ventilation to be provided with automatic closing devices to the satisfaction of the RO and GNC to prevent water ingress following vessel capsize.

4.19 Water Tank Space

4.19.1 The flooring of this compartment shall be covered with unpainted aluminium chequer plates.

4.19.2 Aluminium chequer plates adjacent to valves, shafts, etc., shall be easily removable for easy maintenance. Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid/minimise rattling noise.

4.19.3 Ventilation to be provided for tank space in accordance with RO requirements and to the satisfaction of the GNC. All ventilation to be provided with automatic closing devices to the satisfaction of the RO and GNC to prevent water ingress following vessel capsize.

4.20 Engine Room

4.20.1 The engine room layout shall be in accordance with IMO and the RO requirements. For the avoidance of doubt the following specific requirements shall be complied with by the Vessel.

4.20.2 Special attention shall be paid to the engine room layout for main engines and machinery maintenance and repair. The layout of engine room shall be approved by GNC.

4.20.3 The engine room compartment shall be designed for unattended engine room operation and protected by fixed CO_2 flooding system or equivalent RO approved fire suppression system.

4.20.4 The machinery associated piping system and fittings shall be installed and protected as to reduce to a minimum any danger to persons on board.

4.20.5 All surfaces with temperatures where impingement of flammable liquids may occur as a result of a system failure shall be insulated. The insulation shall be impervious to flammable liquids and vapours.

4.20.6 The floor of this compartment shall be covered with unpainted aluminium chequer plate. Aluminium chequer floor plates shall be secured by fixing with sections but shall be readily removable for access to bilges, pumps, shaft, pipe work and strainers etc. for ease of maintenance.

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

4.20.8 Removable guards for the protection of personnel and machinery shall be provided over exposed moving parts of the machinery, hot pipe work, etc.

4.20.9 All boundary bars, handrails, gratings, ladders, platforms, stanchions and vertical supports, etc. in the engine room and steering gear compartment shall be of lightweight construction.

4.20.10 Splash plates, casings, fenders, screens, etc. shall be provided for the protection of personnel and machinery.

4.21 Steering Gear Room

4.21.1 The layout of the steering gear compartment shall be arranged for easy and convenient installation, operating and access for maintenance/ repairs to the steering gear system.

4.21.2 The space shall be readily accessible from the main deck and from below deck via a watertight door.

4.21.3 Provisions shall be made for emergency steering in accordance with RO requirements to the satisfaction of GNC.

4.21.4 The floor shall be covered with unpainted aluminium chequered plate.

4.21.5 Aluminium chequered plates adjacent to valves, shafts, etc., shall be easily removable for ease of maintenance.

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

4.22 Helicopter Winching

4.22.1 The aft bridge deck shall be designated for helicopter winching of persons (not for landing or take-off) in the event of an emergency, or evacuation of seriously wounded casualties. There shall be provisions of sufficient area for safe operation, clear visibility, and good communication both for the helicopter's and the Vessel's operators. The platform shall be clear of any projections above the level of deck for the platform concerned. Suitable arrangements shall be made to minimise the risk of personnel sliding off the platform.

4.22.2 A non-slip surface shall be provided.

4.22.3 Sufficient lighting with emergency backup power shall be provided for clear indication of the platform location in darkness, raining and foggy conditions.

4.22.4 Arrangements shall be provided for drainage of the platform.

4.22.5 Firefighting equipment suitable for use on flammable liquid fires shall be provided near to the platform.

4.22.6 Railings and meshes for protection of crew shall be provided with carefully thought out sizes and spacing between rails to prevent a person lying on deck from being swept away. Correct deck markings will be informed by GNC.

4.22.7 Stretcher lift/ or crane shall be provided to transfer an injured person between main deck and aft bridge deck for helicopter winching.

4.23 Open Deck Area

4.23.1 Permanent (or properly designed detachable type if so required) fore and aft stanchions for crew and personal safe embarkation and disembarkation shall be provided around the entire perimeter of the open deck to the satisfaction of the GNC.

4.23.2 The deck floor shall be covered with suitable anti-slip marine material.

4.23.3 The deck covering material specifications, including the attachment method, shall be provided to GNC for acceptance before fitting onto the deck.

4.24 Daughter Boat

4.24.1 The Vessel shall be supplied with one Daughter Boat with Length Overall (LOA) of 7.0 – 9.5 metre, for which the material of its hull structure shall be made of marine grade aluminium alloy. The Daughter Boat shall be equipped with an inflatable self-righting bag. [E]

4.24.2 The propulsion system of the Daughter Boat shall be twin waterjets propulsion units shall be driven by two inboard marine diesel engines of at least 180kW each.

4.24.3 The Daughter Boat of the Vessel shall run at least 30 knots at loading condition set out in Paragraph 4.24.6 of this Part. [E]

4.24.4 The Daughter Boat shall be issued with a Type Approval Certificate by the RO, a declaration of conformity, or a certificate of compliance to national or international standards recognised by GNC. [E]

4.24.5 Stability Criteria

Stability criteria shall only be considered satisfactory for the loading conditions set out in Paragraph 4.24.6 if, the following criteria are complied with either:

(a) The criteria specified in ISO 12217-1 for Category C vessels, or

(b) As per stability requirements of the RO.

4.24.6 The loading condition of the Daughter Boat shall be as follows:

	Loading condition
Fuel	90%
No of Crew	4
Equipment	200 kg

4.24.7 The Vessels shall be provided with following means of lifting for docking, storage, inspection and maintenance purposes, designed for use with fixed jib cranes, telescopic cranes and truck mounted cranes:

4-Points Lifting Method

The Vessel shall be designed with strong point lifting attachments permanently fitted to the hull. Lifting slings shall also be provided. Any attachments of the lifting slings shall be constructed with marine grade stainless steel.

4.24.8 The endurance for fuel capacity for the Daughter Boat shall be 4 hours at the maximum speed capability with full fuel oil tank(s).

4.24.9 Any openings in hull and deck shall comply with the applicable RO's rules for watertight integrity if not otherwise specified by MD or the FSD.

4.24.10 The steering console shall be integrated with the engine compartment casing abaft amidships. It shall be constructed with either marine grade aluminium alloy or Composite Material. The whole console/engine compartment casing shall be designed to be lifted up or removed for the engine (s) survey.

4.24.11 Sufficient hand holds and guard rails shall be fitted on the console/engine casing. They must be non-deflective and fabricated to suit for marine environment, i.e. marine grade aluminium alloy/marine grade stainless steel (316) or other equivalent non-corroding material. Their positions, fitting arrangement, and etc. shall be made acceptable to and approved by GNC before fitting.

4.24.12 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.

4.24.13 The steering Console of the Daughter Boat.

(a) The layout of the console shall be submitted for GNC's approval before any construction work on the consoles commences. To facilitate the efficient visualisation and inspection of the design of the console, full size mock-up consoles complete with deckplate, seats, mounting systems and any other fixtures that may influence the final design of the console shall be manufactured for inspection, modification (if necessary) and confirmation by GNC of MD and the FSD.

(b) The console shall be designed to deflect wind up and over the heads of the coxswain in both the seated and standing position and to house the equipment required by the coxswain to control the Vessel.

(c) The console's design shall be optimised ergonomically so that a coxswain of an Asian stature (approximately 1.64 metres in height) can operate the controls and displays for extended periods from both the seated and standing positions without incurring unnecessary physical strain

(d) The layout of the controls and displays shall be designed to ensure that the coxswain's left-to-right viewing angle from both the seated and standing positions does not exceed 180 degrees.

(e) The controls or displays of the following equipment shall be installed in the console and located in front of the coxswain in natural positions, with the highest priority devices being located in prime positions. Control shall ideally be positioned between elbow and shoulder height. Instrument panels and display screens shall be located at or below sitting eye height. All controls and displays shall be operable when wearing normal uniform with foul weather gear and lifejacket.

(i) Helm;
(ii) Engine throttle control head;
(iii) Engine monitoring display panel;
(iv) Engine start control;
(v) Loudhailer control unit and microphone;
(vi) A magnetic compass fitted with an independent dimmer switch, installed on the top of the console in line with the coxswain's line of sight dead ahead;
(vii) Electric horn;
(viii) Siren and flashing beacon control panel;
(ix) Navigation lights, search lights and flood lights switch panel;

(x) GPS receiver;
(xi) Fuel tanks level gauge; and
(xii) One multi-function radar, automatic identification system and electronic chart display screen of at least 9 inches.
(xiii) Power sockets and portable watertight search lights c/w cable;
(xiv) Auto draining device; and
(xv) One small fire extinguisher.

4.24.14 The following Electronic Navigational Equipments shall be installed in the daughter boat:

(a) Marine Radar;
(b) Automatic Identification System (AIS) Transponder (include the Receiver and Transmitter Modules); and
(c) Electronic Chart Display and Information System (ECDIS) with DGPS.

4.24.15 Self-righting/Aerial Mounting Frame

(a) The Vessel shall be provided with a self-righting system mounted on a frame at the stern of the Vessel, which incorporates an inflatable bag with a heavy-duty coated fabric cover and a CO_2 bottle. In the event that the Vessel capsizes, this self-righting system shall be capable of being activated manually by pulling a release handle. The system shall be dimensioned so that it shall be capable of righting the Vessel in less than 25 seconds at the Light Operational Load Condition
(b) The self-righting system mounting frame shall be positioned so that the head of a crew member standing at the stern of the Vessel shall not coming into contact with the frame during passage in sea conditions up to WMO Sea State 6.
(c) The self-righting/aerial mounting frame shall be a strong and rigid structure to support the self-righting gear, lightning arrestor, navigation lights, search light, sunroof and other electronic and navigational equipment as appropriate.
(d) The self-righting/aerial mounting frame shall be provided with all necessary fittings including but not limited to brackets for all navigation lights and lightning arrestor
(e) All hardware such as screws, hooks, hasps, hinges, handles and sliding bolts shall be made of stainless steel or corrosion resistant material with galvanic protection between contacts with aluminium hull or corrosion resistant material.
(f) The self-righting/aerial mounting frame shall not cover or be attached to the console and shall not obstruct operations at the coxswain or commander positions.
(g) The design of the self-righting system and the mounting frame shall be discussed at the kick-off meeting, and shall be submitted to the RO or other entities acceptable by GNC for approval.

4.24.16 Four dampened seats each with a drop-down seat cushion shall be provided immediately aft of the console. These seats shall be designed with progressive damping. The seats shall be fitted with adjustable shock absorbers for light/heavy personnel, a four point harness, a headrest, pistol grips and a dropdown seat base. A high, adjustable footrest attached to the primary console shall also be provided in front of each seat. All dampened seats above shall have progressive damping travel, height adjustment, fore and aft adjustment.

4.24.17 An External Fire-fighting System (EFFS) shall be designed solely for marine fire-fighting operation. The EFFS shall meet the following requirement:

(a) One electric-priming diesel fire pump rated flow of at least 800L/min at discharge pressure of not less than five (5) bars shall be mounted securely on deck connecting with steel suction pipe from bottom sea chest.
(b) One fire-fighting monitor shall be fitted at the bow of the Vessel capable of achieving (i) vertical travel and (ii) not less than 240° horizontal movement.
(c) A "Y" shape dividing head shall be fitted to provide connection between the outlet of fire pump and two delivery hoses. The delivery hoses shall be provided to connect the dividing head with (i) fire-fighting monitor and (ii) portable branch.
(d) The EFFS, including the fire pump outlet, "Y" shape dividing head, delivery hose and fire-fighting monitor, shall be fitted with light alloy instantaneous 70 mm male

and female coupling at each end. The specification of couplings shall be complying with British Standard BS 336.

(e) Fire main pipes shall be constructed with marine grade stainless steel (316).

4.24.18 The daughter boat shall incorporate a survivor recovery door or diving door sliding on tracks into the cut out opening and locking position. The sealing of the insert door shall be such that water should not ingress from the gaps whilst sailing. The design shall be appropriate for its function and discussed at the kick-off meeting.

4.24.19 A stern ramp for daughter boat deployment and recovery shall be designed into the aft body of the Vessel shaped in a "V" to suit the proposed Daughter Boat. The ramp shall allow seamless launch of the daughter boat with minimal mechanical assistance providing a safe and controlled deployment.

4.24.20 When the daughter boat is "recovered" a stern door shall enclose the daughter boat inside the stern of the parent vessel. The door shall be hydraulically driven and hinged. The stern door shall rotate outboard and below the waterline, with stays, to aid in deployment and recovery of the daughter boat. It should be possible to launch and recover the daughter boat. The stern door shall be locked in place remotely.

4.24.21 Access to the daughter boat shall be provided from the main deck of the parent vessel.

4.24.22 Daughter Boat tie-down points shall be provided.

4.24.23 Daughter Boat to be sea trialled in accordance with sea trial specification as defined for the Vessel in Paragraph 1.7.6 (k) of Part VII.

4.25 Stern Ramp Launch and Recovery System for Daughter Boat

4.25.1 The stern ramp launch and recovery system shall be designed and manufactured in accordance with RO requirements. The design shall be able to stand and operate for sea state 5 and to be a proven one which has been used on board existing vessel.

4.25.2 The design of stern ramp system shall be remotely controlled from the wheelhouse and local panel allow the Daughter Boat to be launched and recovered by the coxswain of the Daughter Boat.

4.25.3 The stern ramp shall include the followings:

(a) A stern door;

(b) A hydraulic system operated with submerged slipway cradle system, or powered wheel drive system, or other hydraulically mechanical system accepted by GNC to be integrated into stern door;

(c) A hydraulic power pack for system operation; and

(d) Daughter Boat securing system.

4.25.4 The stern door shall be operated with hydraulic cylinders with mechanical securing means and equipped with limit switch to avoid excessive movement of the stern ramp during operation.

4.25.5 The control console of the stern ramp shall be located inside the wheelhouse of the mother vessel. A backup control console (local panel) shall be located on the main deck in a position with good visibility of the stern ramp. The control console shall be enclosed in a watertight cabinet.

4.25.6 The hydraulic power unit, consists of:

(a) A hydraulic pump;

(b) An electric motor;

(c) An emergency means for stern ramp operation;

(d) Local operation control.

4.25.7 The stern ramp shall be formed of a series of angled brackets of light steel design. Each bracket is angled to suit the shape of the Daughter Boat hull and to be properly protected from physical metallic contact with vessel structure during the operation.

4.25.8 Automatic securing means to ensure quick and effective securing of the Daughter Boat in locking position for safe embarkation and disembarkation of the personnels on board the Daughter Boat.

4.25.9 Alternative means shall be provided for recovery of Daughter Boat in case of failure of hydraulic power system.

4.25.10 Alternative means shall be provided closing of stern door in case of failure of hydraulic power system.

4.25.11 Arrangement shall be provided to

(a) Operate automatically the recovery system when the Daughter Boat comes into the position for recovery;

(b) Stop the daughter and hold it in position.

4.26 Anchor and Windlass

4.26.1 One high-holding power type, hot dipped galvanised, anchor complying with the RO and the IMO requirements shall be provided. An equipment numeral calculation shall be provided by the shipyard to the RO and GNC for acceptance.

4.26.2 An anchor with its associated swivel, shackles, stowage cable or cable and warp and means of recovery shall be provided.

4.26.3 The Vessel shall be provided with adequate and safe means for releasing the anchor and its cable and warp.

4.26.4 A safe means of release shall be provided even when the anchor cable or warp is under load.

4.26.5 Adequate means and arrangements shall be provided to secure the anchor under all operational conditions.

4.26.6 An electric/hydraulic windlass with its associated gypsy and warping drum, cable stopper, hawse pipe, bollards and fairleads shall be of a size, type, height and power suitable for an easy run of the matching anchor chain and/or cables.

4.26.7 The windlass shall be capable of lifting one anchor with sufficient length of chain or cable, at a speed acceptable to the RO and in accordance with IMO requirements. The unit shall be fitted with an emergency manual operating mechanism.

4.26.8 Control of the windlass shall be near the windlass through a starter control unit enclosed in a watertight cabinet.

4.26.9 Emergency stop button for windlass shall be provided in the wheelhouse at the coxswain station position.

4.26.10 A canvas/tarpaulin protection cover for the windlass shall be provided.

4.26.11 The Vessel hull shall be protected against the anchor and chain/cable damaging the hull structure during operation.

4.26.12 Fairleads, bitts and mooring ropes shall be provided and fitted at the appropriated position for the safe mooring operation.

4.26.13 Two stainless steel boat hooks with staves (length to be decided by the user department) and stowage arrangement shall be provided.

4.26.14 An additional spare anchor shall be provided which can be deployed using a simple mechanical capstan. This shall be stored above the main deck in an easily accessible area. The spare anchor shall be sized in accordance with the approved equipment numeral calculation.

4.27 Fenders

4.27.1 Fender material shall be Polyurethane type.

4.27.2 Pushing Head Fender

(a) The fender shall be designed to absorb stresses which are exerted on to the Vessel;

(b) Top and bottom edges of the fender shall be chamfered back at 45 degree to half diameter (of round section fenders).

4.27.3 Side and Stern Fenders

(a) Fixed hollow D shape Polyurethane fenders of at least 250mm diameter (of a size acceptable to GNC) shall be fitted continuously along the ship sides and stern at the main deck level to the satisfaction of the GNC;

(b) The hull structures shall be suitably strengthened for the fendering arrangement;

(c) The size and number of rubber tyre (or equivalent as proposed by the contractor) fenders specified by FSD shall be provided on each side of the Vessel at the weather deck level, with stainless steel securing devices. The arrangement shall submit to GNC's approval prior to installation.

4.27.4 The number and size of portable air-filled fenders specified by FSD shall be provided.

4.28 Cathodic Protection and Painting

4.28.1 Underwater cathodic protection (self-sacrificing anodes) suitable for a minimum of one-year life shall be fitted at hull bottom.

4.28.2 Good quality epoxy paints shall be used throughout the Vessel and applied in accordance with the manufacturer's specifications.

4.28.3 Volatile Organic Compounds (VOC) content limits of the paints shall comply with the Controls and Requirements of the VOC Regulation (VOC content limits for regulating paints used on vessels and pleasure craft) of the Regulation of Hong Kong Air Pollution Control Ordinance.

4.28.4 A suitable Tributyltin (TBT) free fouling-release/anti-fouling paint shall be applied on the exterior of the hull below the waterline which is suitable for two years protection against marine growth.

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

4.28.6 All paint work shall carry a one-year guarantee provided by the Contractor against defects in material and workmanship.

4.28.7 Painting schedule proposed by the Contractor in consultation with the paint suppliers/manufacturers shall be submitted for GNC approval before painting.

4.28.8 TBT free certificate of the paint materials applied to the Vessel, issued by the paint manufacturer, shall be submitted to GNC before the Delivery Acceptance.

4.28.9 A painting report shall be submitted to GNC upon the completion of painting work for the Vessel, and it shall be submitted to GNC before the Delivery Acceptance.

4.28.10 The Contractor shall provide GNC 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 that it is in accordance with the manufacturer's requirements for surface preparation, metal surfaces temperature and atmospheric conditions, paint thickness and method of application.

4.28.11 The colour of the paints shall refer to this Part (Markings and Colour Scheme).

4.28.12 The Contractor after contract award shall proposal a list of the paint to be used for the hull, deck, superstructures structural materials (including and fouling, paint) with detailed specifications of the paint. Thickness of each coating shall be specified. Property compatibility of different paint layers must be maintained.

4.29 Forward Fire Pump room

4.29.1 The forward fire pump room layout shall be in accordance with IMO and the RO requirements. For the avoidance of doubt the following specific requirements shall be complied with by the Vessel.

4.29.2 The forward fire pump room shall be housed with independent diesel engine drive, flexible coupling and reduction gear, fire pump and associated piping arrangement.

4.29.3 The attachment and mounting of diesel engine drive, flexible coupling and clutch reduction gear, fire pump, fuel tank and associated piping arrangement shall all be able to withstand and not cause damage to hull and personnel of the Vessel in case of capsize.

4.29.4 Special attention shall be paid to the engine room layout for main engines and machinery maintenance and repair. The layout of engine room shall be approved by GNC.

4.29.5 The location of the fire pump shall ensure sufficient suction head of sea water for fire pump operation and the diesel engine running. The possibility for air trapped in the fire pump and the diesel engine sea water piping system shall be avoided.

4.29.6 The engine room compartment shall be designed for unattended engine room operation and protected by fixed CO_2 flooding system or approved fire suppression system in accordance with RO requirement. Local operation panel for diesel engine is also to be provided.

4.29.7 The forward fire pump room shall be adequately ventilated to maintain the pump room in similar condition as outside ambient condition and also dampness and condensation would not accumulate. The ventilation arrangement of the forward fire pump room shall take into consideration that crew would carry out operation and maintenance work regularly and also in emergency situation. Therefore arrangement shall be proposed to ensure the safety of working personnel and accepted by FSD and GNC.

4.29.8 The machinery associated piping system and fittings shall be installed and protected as to reduce to a minimum any danger to persons on board.

4.29.9 All surfaces with temperatures where impingement of flammable liquids may occur as a result of a system failure shall be insulated. The insulation shall be impervious to flammable liquids and vapours.

4.29.10 Hatch cover, bracket, guide railing shall be provided for easy removal of diesel engine, fire pump, coupling, gearbox for routine maintenance and overhaul.

4.29.11 The floor of this compartment shall be covered with unpainted aluminium chequer plate. Aluminium chequer floor plates shall be secured by fixing with sections but shall be readily removable for access to bilges, pumps, shaft, pipe work and strainers etc. for ease of maintenance.

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

4.29.13 Removable guards for the protection of personnel and machinery shall be provided over exposed moving parts of the machinery, hot pipe work, etc.

4.29.14 All boundary bars, handrails, gratings, ladders, platforms, stanchions and vertical supports, etc. in the engine room and steering gear compartment shall be of lightweight construction.

4.29.15 Splash plates, casings, fenders, screens, etc. shall be provided for the protection of personnel and machinery.

4.30 Towing Facility

4.30.1 Towing pits shall be provided at the port and starboard sides of stern area.

4.31 Sound Reception System

4.31.1 Sound reception system, as described in Paragraph 13.14, Chapter 13 of HSC code 2000, shall be provided on board.

4.31.2 The position of the receiver shall be decided by FSD to facilitate the sound to be heard and direction determined.

Chapter 5 - External Fire-Fighting System

5.1 General Requirements

5.1.1 The design and installation of the external fire-fighting system (EFFS) shall follow the RO requirements.

5.1.2 The EFFS shall be designed for fighting marine fire including oil fire at sea.

5.1.3 The Contractor is required to submit the design of the EFFS in details for approval of FSD and GNC prior to installation.

5.1.4 The Contractor shall demonstrate at Technical Acceptance to the satisfaction of FSD and GNC that the design of the fire-fighting system, arrangements and equipment are suitable for containing and smothering oil fire at sea.

5.1.5 The performance/function tests of EFFS for the water/foam monitors shall be part of the Technical Acceptance as per Paragraph 1.7.2 of this Part.

5.1.6 The External Fire Fighting System (EFFS) shall meet the following requirements: [E]

(a) Two (2) external fire pumps (each having at least 12,000 litre/minute) shall be fitted to the Vessel. One (1) pump shall be driven by an independent diesel driven power pack. One (1) pump shall be driven via a power take off (PTO) fitted to the centre propulsion engine.

(b) Four (4) remote foam/water fire monitors shall be fitted onboard the Vessel, each having a minimum capacity of 12,000 litre/minute. Two (2) remote monitors shall be fitted on the forward deck. One (1) port and one (1) starboard shall be fitted to the satisfaction of the GNC of MD and FSD. Two other (2) remote monitors shall be fitted on the aft deck. One (1) port and One (1) starboard shall be fitted to the satisfaction of the GNC of MD and FSD.

(c) Four 100 mm diameter fire outlets, and four 70mm diameter fire outlets shall be provided at each side of the Vessel (i.e. total eight outlets) at locations to be decided by the FSD. The specification of outlets and coupling shall be complying with British Standard BS 336.

(d) Stainless steel 316L shall be used for the fire main pipes.

(e) Water-throw of 110m minimum ejection from each remote monitor shall be provided.

(f) Two (2) foam tanks, each of not less than 3000 litres total capacity shall be fitted onboard the Vessel. Each foam tanks shall be fitted with a foam capacity indicator and proportioner. Each foam tanks shall be remotely controlled by an operating system which shall be situated in the wheelhouse.

(g) A sight-glass shall be fitted to the foam concentrate tanks to indicate the liquid level in each tank.

5.2 Pumps and Piping for Fire Fighting and Water Spray

5.2.1 Pumps and piping systems used for fire-fighting foam/water monitors shall be for fire-fighting purpose (including the operating fire hose stations) as well as for the Vessel self-protecting water spray purposes during fire-fighting.

5.2.2 Each pump shall be provided with its own dedicated, independent sea water suction.

5.2.3 The pipe lines from the fire pumps to the foam/water monitors and the pipe lines from the foam concentrate tanks leading to the proportioner shall be suitably designed to avoid large amount of water and foam concentrate being stored within the system.

5.2.4 The response time of the system shall be as short as technically practical without affecting safety and causing damage to the system:

(a) Time required for ejecting water at foam/water monitors (starting from the fire pumps in stop and valves in shut position) shall not be more than 120 seconds. This shall be discussed at and decided by the FSD at the kick-off meeting based on the system proposed by the Contractor in its tender submission;

(b) The maximum time from actuating the valves of the piping system prior to starting the fire pump to the water filling up the pipe to the monitor shall not be more than 120 seconds. This shall be discussed at and decided by the FSD at the kick-off meeting, based on the system proposed by the Contractor in its tender submission;

(c) The time required to have foam solution at the foam/water monitors (after the fire pumps start) shall not be more than 120 seconds. This shall be discussed at and decided by the FSD at the kick-off meeting based on the system proposed by the Contractor in its tender submission.

5.3 Fire Pumps

5.3.1 For external firefighting duties, the Vessel shall be provided with two (2) centrifugal type fire pumps and these fire pumps shall have equal capacity. The fire pumps may also be used for water supply to the water spray system and/or to the fire hose stations thus minimising the total number of pumps required. In such cases there shall be sufficient water supply for all services to be performed simultaneously.

5.3.2 The two fire pumps are located in different compartments and the piping arrangement allow of each fire pump to be inter-connected together to ensure either one of them is capable to fulfill the requirements as stated in Paragraph 5.1 above.

5.3.3 The isolation valve for inter-connection shall be power driven remotely controlled.

5.3.4 The arrangement for the inter-connection shall be designed and arranged to avoid system leakage, water hammer, air entrapped or whatever affecting the performance of the system.

5.3.5 The pumps shall have piping arrangements to prevent overheating at low pump delivery rates.

5.3.6 The fire pumps shall be of centrifugal type with impeller(s) made of stainless steel suitable for sea water service.

5.3.7 Suction and discharge pressure gauges, safety valves or devices if required, tachometer, and any other gauges and fittings required by the pump manufacturer shall be provided.

5.3.8 The minimum water pumping capacity of each pump shall be 12,000 litres per minute at a discharge pressure of 10 to 15 bar according to RO requirements. The system shall be designed and manufactured to the satisfaction of the GNC of MD and FSD.

5.3.9 The pumps shall be positioned in the hull as low as possible and where possible be below the Vessel design waterline to ensure positive suction head.

5.3.10 Both fire pumps shall be arranged so they can provide to all fire outlets and so is there is a pump failure the system can remain operable. The fire distribution system shall be able to be isolated by a motor driven cross-over valve in the event of a failure of any one pump.

5.3.11 The materials of the pumps shall be galvanically, physically and chemically compatible with the hull and any material they are associated with. This shall be confirmed during the vessel kick-off meeting to the satisfaction of the GNC of MD and FSD.

5.3.12 The pumps and their connecting pipes shall be hydrostatically tested according to the RO's rules, and further tested to the requirements of the GNC of MD and FSD.

5.4 Piping System

5.4.1 The piping systems shall be protected from overpressure.

5.4.2 All piping shall be suitably protected from corrosion and freezing and be capable of being thoroughly drained.

5.4.3 Where pipes supplying water to the monitors are passing through the propulsion machinery spaces, they shall be led through the engine room casings all the way to the monitors. If this requirement is not achievable the complete design shall be thoroughly discussed with GNC of MD and the FSD before installation. This piping system must be acceptable to FSD and GNC in addition to the applicable agreed RO requirements.

5.4.4 Piping passing through deck or bulkhead shall be via penetration arrangement approved by RO and GNC. The arrangement shall not impair the water-tight and fire insulation integrity of the bulkhead and deck. Also the arrangement shall avoid any galvanic corrosion arise.

5.4.5 Isolation valves shall be fitted to separate the fire main system from the water monitors and the water sprays systems.

5.4.6 Pressure regulation means shall be used such that the fire main system can operate independently and/or simultaneously with the fire monitors and/or water spray system.

5.4.7 All pipes, flanges, valves etc. in the piping system shall be made of a suitable grade of copper nickel or stainless steel 316L or equivalent material, as agreed by GNC, and thickness and to avoid corrosion happening within expected ship lifespan.

5.4.8 Adequate piping support arrangement shall be decided by GNC of MD and FSD in addition to the RO requirements.

5.4.9 Where flanges are used to join piping or to facilitate removal of valves for service, a support shall be provided near the joint in accordance with RO requirements or to the satisfaction of the GNC.

5.4.10 Galvanic corrosion on piping support arrangement and pipe joint including flange arrangement shall be avoided.

5.4.11 Bracing shall be provided to resist the nozzle reaction of discharge devices.

5.4.12 Provision shall be made for the expansion or contraction of piping and for stresses in the piping due to temperature changes or flexing of the hull, in accordance with the RO requirements.

5.4.13 Drains shall be provided to drain all portions of the discharge and distribution piping.

5.4.14 A small drain line (by a valve) that bypasses each pump check valve shall be provided to permit drainage of the discharge piping.

5.4.15 Fire pump discharge piping shall be designed for a working pressure not less than the maximum cut off pressure of the pump(s) fitted.

5.4.16 Piping systems 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. This shall be proven to the satisfaction of the RO, GNC of MD and FSD.

5.4.17 Piping systems arrangement shall be submitted for RO, GNC of MD and FSD approval.

5.5 Water Suction and Discharge

5.5.1 Suction pipe lines shall be designed to avoid cavitation.

5.5.2 Fire pump suction velocity shall be in accordance with the manufacturers designed limit and verified by the RO, GNC of MD and FSD.

5.5.3 The discharge velocity at the foam/water monitors shall be in accordance with the manufacturers designed limit and verified by the RO, GNC of MD and FSD.

5.5.4 Means and/or facilities shall be provided for the gradual filling of the pipe up to the monitor level with water before the full capacity of pump is allowed to be engaged.

5.5.5 The suction arrangement for each pump shall include at least one dedicated sea chest with screened inlet, a valve at the sea chest outlet, and a valve vent to atmosphere.

5.5.6 Where looped sea chest outlet piping is needed and provided, a valve shall be provided at or near the suction inlet of each pump.

5.5.7 The open area of the screen shall be at least two times the cross-sectional area of the suction pipe.

5.5.8 The intakes to all fire pumps shall be fitted with a means of clearing while the Vessel is afloat.

5.6 Sea Chests and Valves

5.6.1 Sea chests for external fire-fighting shall not be used for any other purposes.

5.6.2 Sea water inlets for fire-fighting and sea chests shall be arranged as low as practical to avoid clogging due to debris or oil intake from sea. The locations and arrangements shall be submitted to the RO for approval. All inlets shall be installed to the satisfaction of the GNC.

5.6.3 The location of sea water inlets for firefighting and sea chests shall be such that water suction shall not be impeded by ship motions.

5.6.4 The design of the sea water inlets shall ensure an even and sufficient supply of water quantity to the pumps.

5.6.5 All motor driven valves shall be capable of being operated manually.

5.6.6 Strainer Plates: All sea water inlets at sea chests shall be fitted with strainer plates at the Vessel's shell. The strainer plates shall have a clear area of at least twice that of the sea valves. The edges of strainer plate slots or holes shall be rounded to prevent cavitation. Compressed air or other effective means shall be provided for clearing off the strainer plates.

5.6.7 Valve: Each sea water inlet for fire-fighting shall be equipped with an RO approved shut off valve. The leading edge of inlet pipe shall be rounded to avoid the formation of cavitation.

5.7 Operation of Pump and Valves

5.7.1 The firefighting pump, the sea water shut off valve and the sea water discharge valve shall all be operable from the same locations.

5.7.2 Starting of the fire pump when the shut off valve is closed must be prevented by providing an interlock system together with audible and visual alarms at the wheelhouse.

5.7.3 All fire pump suction valve, discharge valves and the concerned control valves shall be RO approved motor driven type. The discharge valve shall be with non-return arrangement.

5.7.4 All motor driven valves shall be capable of being manual operated.

5.7.5 On/Off control and indication for all valve positions shall be provided on the guidance schematic diagram control panel on the External Fire-Fighting Control Panel (EFCP).

5.7.6 The External Fire-Fighting Control Panel (EFCP) drawing shall be approved by the RO and it must also be acceptable to GNC of MD and FSD before the installation of the fire-fighting system.

5.8 Hose Stations

5.8.1 Eight hose stations (four at port and four at starboard) shall be located on the main deck and be located on each side of the Vessel.

5.8.2 One 70 mm diameter hydrant outlets at each station of bronze or gunmetal construction with valves at base shall be fitted.

5.8.3 One 100mm diameter hydrant outlets at each station of bronze or gunmetal construction with valves at base shall be fitted.

5.8.4 Each hydrant / outlet shall have female instantaneous coupling conforming to BS 336 standard.

5.8.5 At least half of the total number of hose connections shall be operated simultaneously with a pressure capable of producing a water jet throw of at least 12m.

5.9 Fixed Water Spray System

5.9.1 For the Fire-fighting Mode operation, a permanently installed water-spray system shall be provided to protect all exposed decks and external vertical areas of the hull, superstructure and deckhouse, including water monitor foundations and equipment associated with the water monitors. All the water-spray system piping, valves and nozzles shall be suitably protected from damage during fire-fighting operations.

5.9.2 During the water-spray operations, all round visibility from the navigating bridge and from the monitor's remote-control station shall be maintained.

5.9.3 Each fire pump shall have sufficient capacity to provide pressure and volume for both the foam/water monitors and the water-spray systems.

5.9.4 Spray system pumping capacity shall be sufficient to ensure an adequate supply of pressure and water volume for operation of the water-spray system.

5.9.5 The water-spray system shall be well protected from corrosion. Suitable drainage arrangements shall be arranged on deck.

5.9.6 Extra deck scuppers and freeing ports (in addition to the Vessel's normally designed scupper and drainage system) shall be provided to provide efficient drainage of water from deck when the water-spray system is in operation.

5.10 External Fire-Fighting Control Panel (EFCP)

5.10.1 Remote control of the external fire-fighting system shall be centralised on an "External Fire-Fighting Control Console" located in the wheelhouse. The system shall be powered by 24 Volt DC.

5.10.2 The EFCP shall include the following:

(a) A miniature diagram of the whole fire-fighting system (from sea suction chest to fire monitor on deck with valve position indicator lamps for all the major valves including suction and discharge valves of all fire pumps, cross-over valve, isolating valves for fire monitors and outlets on deck, inlet valves for the pump inductors, foam tank outlet valve, all foam supply valves etc);

(b) Remote start stop of PTO fire pump, including clutch in or out operation;

(c) Remote start stop of diesel engine driven fire pump, including clutch in or out operation;

(d) Remote controls for each water/foam monitor;

(e) Fire main pressure gauges (one gauge for each of the two zones) minimum diameter 100 mm;

(f) Remote start-stop engine drive;

(g) AC electric current;

(h) Fault indicating alarms;

(i) Protective devices such as overspeed and others as recommended by the manufacturer.

(j) Foam line pressure/vacuum compound gauge;

(k) Foam tank content repeater;

(l) Lamp test button;

(m) Alarm mute push button; and

(n) Dimmer switch for control panel.

5.11 Foam Monitor System

5.11.1 The foam/water monitors shall be capable of a throw range of 110 m, with all foam/water monitors in simultaneous operation at maximum foam output. The foam concentration tanks shall have a minimum capacity for 30 minutes foam production at an assumed admixture of 1 percent.

5.11.2 The foam/water monitor system shall be of a fixed installation design with separate foam concentration tanks, foam mixing units and pipelines to the foam/water monitors. The water supply shall be pumped from independent sea water chests. Means to reduce supply water pressure shall be provided to assure correct water pressure for maximum foam generation.

5.11.3 Three (3) fixed remote foam/water monitors shall be controlled remotely at the EFCP located in the wheelhouse.

5.11.4 The foam discharging system shall be designed for discharging foam solution (mixture of 1% Alcohol Resistant AFFF Concentrate (foam liquid) and 99% sea water via the external fire-fighting system within one minute after starting of fire pump.

5.11.5 Foam concentrate shall be supplied by the Contractor for testing and for the topping up all foam concentrate tanks to the operating level as part of the requirements of Technical Acceptance.

5.11.6 A fresh water flushing capability for the foam discharge piping shall be provided.

5.11.7 The Vessel shall be capable of supplying the power required by the foam-proportioning system in addition to the requirements of the other power-dependent systems installed on the Vessel.

5.11.8 The materials and system components used in the construction of the foam concentrate storage and proportioning and delivery system shall be compatible with the concentrate as specified by the foam manufacturer.

5.11.9 The foam-proportioning system shall be designed to operate with the AR-AFFF type foam concentrate.

5.12 Foam Concentrate Tank

5.12.1 Two (2) foam tanks of not less than 3000 litres each, to be fitted with foam capacity indicators and proportioners, to be remotely controlled by the GNC of MD and FSD approved operating system.

5.12.2 Each concentrate tank shall be provided with a protected fill opening that is designed to facilitate the operator's filling the tank from 20 litres foam concentrate containers. A fill opening with an area of at least 2,320 mm² shall be provided. The opening shall be protected by a removable cover and screen. The cover shall be attached to the tank by mechanical means to prevent air from entering or escaping during normal service.

5.12.3 Each foam concentrate tank shall incorporate an expansion compartment or dome located so that foam concentrate enters this compartment only after the entire main tank compartment is completely filled. The volume of the expansion compartment shall be not less than 2 percent of the total foam concentrate tank volume. A pressure/vacuum vent shall be provided to adjust automatically for changes in pressure when filling or withdrawing foam concentrate from the tank. The pressure/vacuum vent shall not permit outside air to enter the tank freely except during operation or for normal changes in volume due to changes in temperature.

5.12.4 Each foam concentrate tank shall be designed and constructed to facilitate cleaning the inside of the tank. A removable top allowing access to the tank or a removable personnel access hatch with a minimum inside diameter of 510 mm shall be provided.

5.12.5 Each foam concentrate tank shall have a sufficient number of swash partitions so that the maximum dimension of any space in the tank, either transverse or longitudinal, shall not exceed 1,220 mm and shall be not less than 584 mm. The swash partitions shall have vents and openings at the top and bottom to permit movement of air and foam concentrate between compartments to meet the maximum flow requirements of the foam-proportioning system.

5.12.6 Each foam concentrate tank shall be provided with an outlet connection which shall be located near the bottom of the tank and shall permit discharge of at least 95 percent of the tank's capacity. The discharge shall be protected by an anti-swirl baffle in systems where the foam concentrate delivery rate exceeds 20 litres per minute.

5.12.7 Each foam concentrate tank inlet connection shall terminate within 51 mm of the tank bottom to prevent aerating the foam concentrate.

5.12.8 A drain valve shall be provided near the bottom (lowest possible point) of each foam concentrate tank.

5.12.9 Each foam tank shall be substantially constructed and hydraulically tested to 2.45 metre water head above the top of tank crown or to the top of overflow, whichever is the greater. It shall be provided with stainless-steel fittings leading to the main deck.

5.13 Foam-Making Circuit

5.13.1 A strainer defined by the foam concentrate manufacturer shall be installed on the intake side of the foam concentrate pump so that any foam concentrate entering the foam system passes through the strainer. This shall be designed and installed to the satisfaction of the GNC of MD and FSD.

5.13.2 A gauging device for determining remaining foam concentrate volume in the tank or a foam level indicator of an approved type with toughened glass and protection shall be provided. This shall be designed and installed to the satisfaction of the GNC of MD and FSD.

5.14 Foam/Water Monitor

5.14.1 Three (3) Foam/Water monitors shall be located so as to allow for an unobstructed range of operation. Means shall be provided to prevent monitor jets from impinging on Vessel structures and equipment.

5.14.2 Monitor foundations and structural supports shall be designed for all modes of operation, with attention given to loadings at maximum output and water jet reactions. Calculations demonstrating adequacy of the design, including water jet reaction specified by the monitors' manufacturer, shall be submitted to the RO and the GNC before installation for consideration.

5.14.3 The remote monitors shall be remote-control from wheelhouse. The monitor remote-control station shall have adequate overall operational visibility, including that of the water trajectory elevation, means of communication and protection from heat and water spray.

5.14.4 Control systems shall be suitably protected from external damage. Electrical control systems shall be provided with overload and short circuit protection. Hydraulic or pneumatic monitor control systems shall be duplicated. Shut-off and control equipment shall be clearly marked.

Foam/Water monitors shall be brass and stainless-steel construction suitable for operation at a maximum pressure of 10-15 bar and with following characteristics:

	Remote Monitors Remote on Wheelhouse Roof, Two (2) x Remote of Main Deck, One (1) on port side and One (1) on starboard side Forward.
Application	Alcohol Resistant AFFF Concentrate
Minimum Flow Rate	12,000 L/min at 10 Bar
Minimum Throw Range	> 110 metres at 10 Bar
Vertical Movement	-20˚ to +70 ˚
Rotation Angle	270 ˚ Continuous

5.14.5 A gate valve, pressure gauge and pedestal pipe base of suitable height shall be provided for each monitor.

5.14.6 The Contractor shall demonstrate the following to the satisfaction of Government at the Technical Acceptance:

(a) Operating pressure of the foam proportioning system; and

(b) Flow rate of foam solution discharge available at each individual outlet equipped with a foam proportioning device.

5.14.7 All gauges, flow-meters, and indicators shall be located so they are readily visible. All gauges or flow-meters shall be mounted in a manner to protect the gauge from physical damage and from excessive vibration.

5.15 Nameplates and Instruction Plates

5.15.1 All labels and marking shall be in both English and in Traditional Chinese and be of a type permanent in nature, shall be capable of withstanding the effects of extreme weather and temperature, and shall be attached in a manner that requires mechanical means to remove.

5.15.2 A nameplate shall be provided for each control, gauge, and indicator that is clearly marked with the identification and function of that device.

5.15.3 An instruction plate shall be provided for the foam proportioning system that includes, as a minimum, a piping schematic of the system and basic operation instructions.

5.15.4 Foam concentrate trade names shall not be substituted for foam solution percentage ratios on instruction plates.

5.15.5 A label that reads "Foam Tank Fill" shall be provided at each foam tank fill opening and shall indicate the type and proportioning percentage of concentrate.

Chapter 6 – Fire Safety Equipment

6.1 General Provisions

6.1.1 The Engine room compartment shall be enclosed by fire-resisting divisions complying with the requirements of the International Code for Application of Fire Test Procedures (FTP Code), as defined in Chapter II-2 of SOLAS.

6.1.2 Fire-resisting bulkheads and decks shall be constructed to resist exposure to the fire as per 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 for the period as stated in Chapter II-2 of SOLAS.

6.1.3 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.

6.1.4 The arrangement of pipes, ducts, electrical cables etc., penetrating the engine room's 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.

6.1.5 All furniture shall be constructed entirely of approved non-combustible or fire-restricting materials, except that a combustible veneer with a calorific value not exceeding 45 MJ/m2 may be used on the exposed surface of such articles.

6.1.6 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.

6.1.7 All deck finish materials shall comply with the FTP Code.

6.1.8 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.

6.1.9 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.

6.1.10 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.

6.2 Fire Detection System

6.2.1 An approved automatic fire detection system shall be provided in the Vessel at appropriate locations in accordance with RO Requirements. The fire detection system shall comply with the rules of an RO or International Standard acceptable to GNC.

6.2.2 The fire detection panel shall be installed in the wheelhouse.

6.2.3 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 in the wheelhouse control station.

6.2.4 Fire detectors shall be installed in all compartments of the Vessel. Detection system using only thermal detectors shall not be permitted unless in spaces of restricted height and where their use is especially appropriate.

6.3 Fixed Fire-Extinguishing System for Unattended Engine Room

6.3.1 Engine room fire extinguishing systems shall be a fixed CO_2 flooding system or equivalent RO approved fire suppression system complying with RO regulations for engine room protection. Activation of the CO_2 system or equivalent shall cause an audible and visual warning alarm in the wheelhouse and the engine room. The system shall be approved by an RO.

6.3.2 The CO_2 bottles for the system should be stowed at the aft of the vessel.

6.3.3 The CO_2 bottles shall be properly protected from weather.

6.3.4 Engine room ventilation systems shall be fitted with RO approved automatic actuating fire dampers. They should close automatically prior to release of the CO_2 flooding systems or manually from controls at the control station.

6.4 Portable Fire Extinguishers

6.4.1 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.

6.4.2 Fire extinguishers shall be type-approved by an RO or other international standards acceptable to GNC. Certificates shall be submitted to GNC before Delivery Acceptance.

6.4.3 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.

6.5 Sprinkler System

6.5.1 If required according to RO Requirements, a sprinkler system shall be designed and fitted in accordance with fixed sprinkler system requirements as stated in the IMO 2000 HSC Code for Cargo Craft.

6.6 Fire Pumps

6.6.1 The shipboard systems shall follow the RO requirements. Unless specified as not required (or otherwise with alternative requirements) in the TS, the following requirements shall be met:

(a) At least two independently driven pumps shall be arranged. The arrangement of the pumps shall be such that in the event of a fire in any one compartment, all the fire pumps will not be put out of action;

(b) Isolating valves to separate the section of the fire main within the machinery space containing the main fire pump or pumps from the rest of the fire main shall be fitted and easily accessible in a tenable position outside the machinery space. The fire main shall be so arranged that when the isolating valves are shut all the hydrants on the Vessel, except those in the machinery space referred to above, can be supplied with water by a fire pump not located in this machinery space through pipes which do not enter this space. The spindles of manually operated valves shall be easily accessible, and all valves shall be clearly marked;

(c) Hydrants shall be so arranged that any location on the Vessel can be reached by the waterjets from two fire hoses from two different hydrants, one of the jets being from a single length of hose;

(d) Each fire hose shall be provided with a nozzle of an approved dual-purpose type (i.e. spray/jet type) incorporating a shutoff.

6.7 Fire Control Plan

6.7.1 The fire control plan shall be permanently exhibited for the guidance of the ship's crew at main deck cabin, using graphical symbols in accordance with IMO Resolution A.654(16) as amended.

6.7.2 The fire control plan must be approved by the RO and the GNC before Vessel acceptance.

6.7.3 The plan shall show the following (but not limited to, as required by GNC):

(a) Date of the preparation of the plan;
(b) The wheelhouse and the control console/station;
(c) Areas and compartments of the Vessel enclosed by fire-resisting divisions;
(d) Particulars and locations of the fire alarms;
(e) Fire detection systems and the location and type of fire detectors;
(f) Location and type of the fixed and portable fire-extinguishing appliances;
(g) Means of access to the various compartments and decks;
(h) Ventilating system and their shut-off, and damper particulars (including particulars of the master fan controls, the positions of dampers and identification numbers of the ventilating fans serving each section of the Vessel);
(i) Position of all means of control referred to in quick closing valve for fuel tanks, engine room ventilation and fans; and
(j) The text of such plan shall be in the languages of English and Chinese.

6.8 Additional Protection

6.8.1 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 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.

6.8.2 The additional protection shall be turned on and off when required.

Chapter 7 – Lifesaving appliances (LSA) and arrangements

7.1 General Provisions

7.1.1 In addition to the following requirements, LSA shall follow IMO international regulations and requirements as well as the RO Requirements and any additional and/or specific requirements given in the TS.

7.1.2 The wheelhouse shall be provided with a self-igniting light and a self-activating smoke signal. The positioning and securing arrangements of the self-activating smoke signal shall be such that it cannot be released or activated solely by the accelerations produced by collisions or groundings.

7.1.3 At least one lifebuoy shall be provided adjacent to each exit from the main deck cabin and emergency exit from crew space.

7.1.4 Lifebuoys shall be fitted with buoyant lines of at least 30 metres in length.

7.1.5 All lifebuoys shall be fitted with self-igniting lights.

7.1.6 All lifejackets shall be fitted with a light, which complies with the requirements of the LSA Code.

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

7.1.8 In addition to the other lifejacket requirements in the LSA Code, the name of the Vessel shall be painted on each side of the lifejackets on board. The size of the ship name shall be decided by GNC, and the paint quality shall be of a type that would not cause damage to the lifejacket surface material.

7.1.9 Lifebuoys shall be painted with Vessel's name.

7.1.10 All lifebuoys, lifejackets and life-rafts shall comply with Hong Kong local vessel requirements in terms of their number of supply and the quality standard (including size of children are expected to be carried on board). Details of these supplies shall be submitted to GNC for approval.

7.1.11 Additional and any specific requirements for the operational requirements of the Vessel given in the TS shall be met.

7.1.12 2 x reversible inflatable life-rafts with each capacity of not less than 50 persons shall be provided on two sides of the Vessel.

7.1.13 Total of two (2) sets of survivor recovery system used as scrambling net/boarding ladder/stretcher shall be provided.

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Chapter 8 – Machinery and systems

8.1 General Requirements

8.1.1 The Tenderer should note that the Vessel is for use in Hong Kong and it is required that the main engines, gearboxes, electric generator sets, and any other machinery offered by the Tenderer are those at present commonly used by ships operating in Hong Kong Waters, and that they have good support for spare parts and after sale services locally in Hong Kong.

8.1.2 All vessel equipment required to ensure the Vessel can return to safe harbour shall be designed and installed to be able to remain functional following a capsize/ inversion. This shall be proven to the satisfaction of the GNC during the tendering stage.

8.1.3 The Vessel shall be equipped and fitted with all machineries described, each complying with the specifications set out in this Chapter for such machinery. The Spare Parts to be provided shall be of the same model as supplied for the Vessel and shall equally comply with all specifications set out in this Chapter.

8.1.4 The engine room shall be an unmanned machinery space (UMS), designed for unmanned operation. Under normal operation, all controls are directed from the wheelhouse where the control consoles shall be fitted with a full set of monitoring instrumentation and alarm indications. However, essential local manual controls shall also be provided for the main propulsion engines and steering gear for emergency operation.

8.1.5 Two accesses with reasonable separation shall be provided for the engine room. The design of the engine room layout shall be approved by an RO and agreed by GNC. The machinery associated piping systems and fittings relating to the main engines and electric generator sets shall be of a design and construction adequate for the service for which they are intended and shall be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design shall have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.

8.1.6 Easy access and ample headroom around all machinery shall be provided for local operation, routine checking and 'in-situ' maintenance. Well-planned removal routes shall be provided for the major items such as the main propulsion engines, gearboxes, diesel engine including gearbox for fire pump and the generator set, etc.

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

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

8.1.9 Provision shall be made to facilitate cleaning, inspection and maintenance of main engines, electric generator sets, fire pumps etc. and their associated piping and equipment.

8.1.10 Lifting brackets for moving heavy equipment shall be mounted underneath the deck head of the engine room, the engine room entrance and other appropriate locations. The lifting capacity shall be marked on every of these lifting brackets after a load test.

8.1.11 If necessary, guide rail with associated arrangement shall be provided to facilitate the shifting of heavy equipment e.g. centre main engine, diesel engine including gearbox for fire pump into position for removal and lifting for routine overhaul and maintenance.

8.1.12 The main engines shall be interfaced with the vessel position keeping system. The contractor needs to ensure the arrangement and design of the main engines are all suitable for that purpose e.g. proper interfacing features. And the proposed system, arrangement and design shall be submitted for RO and GNC approval.

8.1.13 All emergency stops shall be fitted with protective guards to prevent inadvertent use.

8.2 Main Propulsion Engines

8.2.1 The Vessel shall be equipped with three electrically started, marine diesel engines of adequate power for the Contract Speed. The three engines are identical with model and power rating. The rating of the engines shall be determined for the Vessel with annual operation of 3000 hours. The diesel engines shall meet IMO Tier II emission requirements. [E]

8.2.2 The main propulsion engines and associated systems shall be capable of operating with self-righting capability features. The self-righting capability features are stipulated in Paragraph 8.2.3. The engines shall be able to operate continuously, without increased risk of damage, whilst inverted or that the control system will automatically reduce the engine speed to idle in the event of an inversion. [E]

8.2.3 Self-righting capability features and additional features shall include shock load requirements, prevention of oil and oil-mist entering combustion system, inclination requirements, additional software and sensor for engine performance as stipulated in Paragraphs 8.2.4 to 8.2.9 of this Part.

8.2.4 Shock load requirements –

Engine must withstand shock loads of 3g vertical, 2g longitudinal and lateral. The engine mounting and damper elements must be able to support the engine weight during roll-over. Engine exhaust compensator design to compensate for increased movement of engine.

8.2.5 Prevention of oil and oil-mist entering combustion system –

Oil and oil-mist are not allowed to enter the cylinder through the air inlets. Crankcase ventilation is designed to prevent oil entering the cylinder through air inlet. Special oil pan design with greater depth for extreme inclinations. Secured oil dipstick prevents popping out due to transient high pressure.

8.2.6 Inclination requirements –

Engine must be capable to operate without restrictions under inclination angles up to 40° in the longitudinal direction and 30°in transversal direction. High incline angle is detected by sensor and automatic engine speed reduction at high incline angles.

8.2.7 Additional software and sensor for engine performance –

High incline angles are detected by sensor and an automatic engine speed reduction is initiated. Additional software for engine performance, idling, clutch in and out, shutdown, crankcase valve control, protecting the engine from uncontrolled combustion. Safety measure to protect the engine when there is a pressure increase in the crankcase due to the closing of the crankcase breather valve.

8.2.8 The exhaust system shall be so designed that no seawater will flow back into the engine during capsize, which is detailed in Paragraph 3.2.7 of this part, or the exhaust piping system is designed to retain seawater during rollover and the exhaust gas is led to overboard through other outlet during capsize.

8.2.9 All relevant vents, breathers and any other part of the main propulsion engine which may leak in the case of an inversion must be modified such that any leakage is minimised and no system shall lose any amount of fluid or ingest any amount of air which would impair the operation of the engines after an inversion.

8.2.10 Type-approved certificates and EIAPP certificates shall be issued by an RO or other entities acceptable by GNC shall be provided.

(a) General

(i) The main engines (M/E) shall be marine diesel engines of proprietary make, electric started by 24 Volt-DC, and to have integral fresh water/sea water heat exchangers, fresh water pump, sea water pump, LO pump, fuel lift pump (if necessary), FO filters, LO filters, engine-mounted instrumentation panel with essential gauges and protective devices, and any other ancillary equipment and fittings as recommended by the engine manufacturer for the efficient operation of the engines;

(ii) Flexible mounting shall be used for containing the noise levels in accommodation spaces not to exceed 80 dB(A);

(iii) Engine-mounted charging alternator, capacity of not less than 60 amperes, with built-in voltage regulator shall be provided on each M/E for charging their respective starting batteries;

(iv) The design of main engine and control system shall be approved by RO;

(v) For the single inner engine, the forward end of the main engine shall be connected to an external firefighting pump via a clutch and flexible coupling arrangement;

(vi) To avoid overloading the centre main engine, an interlocking device, which is subject to GNC approval, shall be provided to constrain gearbox clutch-in when the M/E driven fire pump is engaged;

(vii) To facilitate LO renewal, a suitable hand pump connected to the LO sump shall be provided for each diesel engine so that LO can be drained from the lowest point of the engine LO sump;

(viii) The main engines shall drive the propellers through reduction gears; and

(ix) The main engine's exhausts and silencers shall be protected according to the requirements of RO to avoid the hot surface danger to the personnel and minimise the heat transfer into the machinery space. All components of exhaust system shall be mounted or suspended by the hangers which will not transmit heat, noise or vibration to the Vessel's structure. Additionally, the exhausts must be arranged to prevent back flooding of water into the engine turbo outlet in the event of a capsize/inversion. The concerned arrangement shall be agreed by the GNC of MD and FSD prior to fitting. Note the "capsize" exhaust system must not reduce the performance of the exhaust system in conventional operation.

(b) Engine Performance

(i) The Tenderer is required to submit the estimated speed-power requirements and characteristic curves of the propulsion system for the Vessel to support its claim for the achievable 25 knots Contract Speed at 90% MCR;

(ii) Manufacturer's full power ship trial certificate for a continuous running test at full load for four hours for each main engine must be submitted to GNC before the acceptable trials;

(iii) Overspeed shutdown shall be provided to shut down the engine(s) from a fully loaded condition in the event of an engine overspeed and overspeed alarm shall be triggered to alert the operator before actual shutdown;

(iv) In the event and engine overspeed there shall be an audible and visual alarm at the wheelhouse; and

(v) Pre-lubrication LO pump shall be provided and the Main engines shall always be in a standby mode and being pre-lubricated.

8.3 Main Engine Control

8.3.1 The design and installation shall follow the RO and IMO requirements (where applicable also complying to IMO HSC requirements).

(a) For the avoidance of doubt the following requirements shall also be met:
   (i) Instrumentation and control systems for the main and auxiliary machineries shall be designed for unmanned machinery space operation;
   (ii) The Wheelhouse Engine Control Console (W/H E.C.C.) in the wheelhouse shall be designed to allow for one-man engineering operation. The W/H E.C.C shall centralise all the instrumentation and control devices for the remote operation of the main and major machinery on board. In addition, there shall also be Local Operating Panel (LOP) for each engine. The wheelhouse remote control (W/H E.C.C) and LOP shall be interlinked;
   (iii) Comprehensive instrumentation and control devices for the main propulsion engines, and for the fire pump clutch operation, shall be provided at the W/H E.C.C. for remote operation. There shall also be simplified systems installed at the LOP. for emergency engine room controls in the event of the failure of the remote-control system in the wheelhouse;
   (iv) All LOP controls shall be operative in the Vessel's "deadship" condition, i.e. when there is no AC electrical power supply for the whole Vessel;
   (v) The LOP for each engine shall be situated close to each engine to provide the essential gauges locally to facilitate easy maintenance as well as for convenient engine-side control;
   (vi) The monitoring probes and sensors fitted to the main and auxiliary machineries shall be of a type-approved by RO;
   (vii) These units shall be the signal sources for the W/H E.C.C. and LOP gauges and communication panels. If LCD is used for this system, it shall be so arranged that light signal emitted is easily seen by the operator;
   (viii) All rescue and berthing controls shall be controlled from inside the wheelhouse.

(b) General Requirements for the Control System
   (i) The W/H E.C.C. shall be arranged at the forward end of the wheelhouse at the steering position.
   (ii) The LOP(s) shall be arranged at a suitable location(s) in the engine room.
   (iii) Emergency communication between the wheelhouse and the engine room shall be arranged.
   (iv) The remote-control systems at the W/H E.C.C. shall be electronically operated.
   (v) The remote-control system shall be a standard control package supplied by the manufacturers of the main engine and the gear box. Technical information of the remote-control system shall be submitted to GNC for acceptance and approval before installation. The remote-control system shall be type-approved by the RO.
   (vi) Wheelhouse Engine Control Console (W/H E.C.C.)
   (vii) The controls and instrumentation of the main engines shall be designed for one-person operation in the wheelhouse, they shall be ergonomically laid out and grouped around the steering position in the W/H E.C.C.
   (viii) The following instrumentation and control devices shall be provided at the W/H E.C.C.:
      1. Start/stop keys or push buttons to be fitted with guard cover and running / stop indication lamp for each of the three main engines;
      2. RPM control device for each of the three main engines;
      3. Clutch control and on/off indication devices for each of the clutches used in the propulsion and M/E driven fire pump system;
      4. Rudder angle indicator;
      5. Engine tachometers with running hour meter;
      6. Sea water cooling pressure;

7. Coolant water temperature and pressure;
8. Engine lubricating oil temperature and pressure gauges;
9. High cooling water temperature alarm and de-rate function;
10. Engine low lubricating oil pressure alarm and trip;
11. Gearbox lubricating oil low pressure gauge;
12. Gearbox lubricating oil low pressure alarm and trip;
13. Engine exhaust gas pyrometer;
14. Fresh water tank content gauge;
15. Fuel oil tanks content gauge;
16. Overspeed alarm and trip;
17. Main engine expansion tank low level alarm;
18. Battery charging control lamps;
19. DC power on light;
20. Central illumination dimmer for all light in the control console;
21. Lamp test;
22. Alarm test and reset; and
23. Any other instrumentation recommended by the engine maker and GNC.

8.3.2 Local Operating Panel (LOP)

Simplified instrumentation and control system at the LOP shall include the following:

(a) Main engines and gearbox system emergency control system, control functions including:
(b) Main engine start/stop push button;
(c) Main engine RPM control and indication;
(d) Gearbox control and indication;
(e) Any other controls necessary for the effective control of the propulsion and positioning system;
(f) Shaft tachometers;
(g) Sea water temperature and pressure gauges;
(h) Fuel supply pressure gauges after fuel filters;
(i) Engine LO pressure gauges for main engines, generator engines, and gearbox system;
(j) Engine cooling water temperature gauges for main engines, generator engines and gearbox system.

8.4 Electrical Generator Engines (Gensets)

8.4.1 Two electrically started, engines integral with alternating current alternators, of self-excited, brushless and ventilated type, shall be installed in the engine room. [E]

8.4.2 The capacity of these generating sets shall be such that either one of the two generating sets shall be able to supply all electricity necessary to ensure that normal operational conditions of propulsion and safety can be achieved. An automatic changeover switch shall be fitted.

8.4.3 Each electric generating set at its continuous service rating, shall have sufficient capacity for:

(a) Supplying all full operational electrical load of the whole Vessel including air conditioning running at full capacity plus not less than a 15% reserve margin, and;
(b) Permitting the starting of the largest motor without causing any motor to stall or any other device to fail due to excessive voltage drop of the system when the electric

generating sets is supplying full operational electrical load including air conditioning running at full capacity of the whole Vessel;

(c) Generators shall be capable of being withstanding the loads experienced during a capsize i.e. self-righting condition.

8.4.4 Electrical load analysis and calculations shall be approved by an RO before submission to GNC.

8.4.5 The genset exhaust(s) shall be arranged with a water lock/lift-silencer with a view to reducing its noise levels. This shall be configured with a hose running from the genset and a wet hose outlet:

(a) Exhaust pipe outlets shall be at a minimum of 300 mm vertical distance above loaded waterline and can be arranged via gooseneck type expansion bellow to the exhaust outlet fitted to shell above waterline for discharge. The arrangement should consider the vessel's requirement to survive capsize/inversion;

(b) The exhaust systems shall be designed appropriately to comply with the genset and exhaust manufacturers' requirements. The generator set exhaust system shall be arranged to provide reasonable access to engine room machinery;

(c) Class approved expansion bellows (for example the gooseneck type in both dry and wet side) shall be used;

(d) All exhaust components shall be mounted or suspended using spring-type hangers which will not transmit heat, noise or vibration to the Vessel's structure;

(e) Shock load requirements - Engine must withstand shock loads of 3g vertical, 2g longitudinal and lateral. The engine mounting and damper elements must be able to support the engine weight during roll-over. Engine exhaust compensator design to compensate for increased movement of engine.

(f) If the generators have an automatic cut off in case of excess heel then they must be capable of restarting manually within 15 seconds after the Vessel returns to upright. In this situation, it can be assumed that the generators are at full operating temperature.

(g) All relevant vents, breathers and any other part of the generators which may leak in the case of an inversion must be modified such that any leakage is minimised and no system shall lose any amount of fluid or ingest any amount of air which would impair the operation of the generators after an inversion

(h) Lagging / Noise control requirements: Flexible sound reduction wrap for exhaust piping works to be based on the manufacturer's working manual or any other applicable industrial standards.

8.4.6 The design and installation of the generator sets, switchboard and the associated wiring shall follow the RO and IMO requirements. For the avoidance of doubt the following requirements shall also be met:

(a) Each generator set shall be provided with a certificate issued by one of the recognised Classification Societies set out in the interpretation of "Recognised Organisations" under Clause 1.1 of Part IV – Conditions of Contract;

(b) The rating of each diesel engine shall be capable of developing for a short period (15 minutes) a power of not less than 110% of the alternator's continuous service rating;

(c) The Vessel's main electrical supply shall be generated and distributed at 380-415V, 50 Hertz, 3 phase system. Transformed supply of 220-240Vshall be used for lighting and electrical equipment of relevant voltage. A low voltage 24V DC supply shall be provided for the relevant equipment/apparatus;

(d) The Vessel shall fulfil the following requirements for the continuous service rated (CSR) power of diesel generators on board:

(i) To supply full operational electrical load (including air-conditioning and EFFS) of the Vessel plus 15% reserve power; and

(ii) To permit the starting of the largest motor without causing interruption to other loading of the Vessel.

(e) The resilient-mounted generator set designed for marine application shall be of a proprietary make. The arrangement of the electrical and piping systems shall enable the quick dismantling and easy replacement of the unit;

(f) Shore supply voltage on the Vessel is 380V for the essential electric apparatus when the Vessel stations in Hong Kong. Distribution of 380V three phase power supply to the electric equipment from the distribution board shall be arranged through circuit breakers.

8.5 Electrical Generator Engine Control

8.5.1 The controls and instrumentation of the generator engines shall be designed for one-person 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, low lubricating oil pressure trip etc. as recommended by the engine builder;
(i) A standard manufacturer' local control panel to be fitted in the engine room.
(j) Instrumentation and alarm panel for auxiliary machinery;
(k) The control panel shall contain the following devices:
    (i) Start / stop push buttons to be fitted with guard cover and running / stop indication lamp for each of the two generator engines;
    (ii) Voltmeter, Wattmeter for each generator;
    (iii) Sea water temperature and pressure gauge;
    (iv) Auxiliary engines expansion tan low-level alarm (audio and visual);
    (v) Auxiliary engine starting battery charging ammeter;
    (vi) DC power on light;
    (vii) Any other instrumentation devices required for the safe operation of the Vessel;
    (viii) Lamp test switch;
    (ix) Alarm reset, and alarm acknowledged push buttons;
    (x) Dimmer control;

8.5.2 A local operation panel shall be provided for emergency operations and service and maintenance of generator sets. The LOP(s) shall be situated in the engine room.

8.6 Instrumentation and Control

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

8.6.2 One fire detector panel and one engine room fire suppression panel shall be installed near the control station.

8.6.3 Additional controls and monitoring devices shall also be provided locally near that machinery or equipment.

8.6.4 All the instruments such as temperature sensors, pressure sensors, level gauges etc. shall have obtained type approval certificates by the recognised Classification Societies set out in the Interpretation of "Recognised Organisations" under Clause 1.1 of Part V – Conditions of Contract or the manufacturer's certificate complying with the national standards of the place of manufacture of the relevant instrument. The Contractor shall provide copies of the type

approval certificates or the manufacturer's certificate to GNC on or before the Delivery Acceptance.

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

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

8.7 Reduction Gearboxes

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

(a) Gear oil heat exchangers shall be piped to the engine cooling circuits as specified by the manufacturer. Gearbox oil coolers shall be sized to accommodate the heat generated by the clutches at less than full engagement;

(b) Reduction gear shall be sized to provide both low and high-speed performance;

(c) To operate at the loitering speed of maximum 5 knots, repeated cycling of the clutches in and out of gear is not permitted in station keeping or any other case to obtain low speed operation. The Vessel shall be fitted with a gearbox configured with a trolling clutch to permit low-speed operation.

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

8.7.3 Sufficient engine side space for maintenance and repair shall be required. Design of installation arrangement shall be confirmed either using vertical offset or horizontal offset gearbox.

8.8 Bow Thruster

8.8.1 A transverse bow thruster shall be fitted in the bow thruster compartment and driven by hydraulic power. The bow thruster shall be capable to keep the Vessel in stationary position when two main fire monitors are working horizontally at 45 degrees at the same side plus 15% reserve power for wind and current.

8.8.2 Bow Thruster control shall be fitted in the wheelhouse control console incorporating with the following minimum protection and instrumentation:

(a) hydraulic system pressure low alarm

(b) Hydraulic oil supply tank level low alarm;

(c) Hydraulic oil temp high alarm;

(d) Power supply to the control system between the remote control station and hydraulic actuator failure;

(e) Electrical driving motor overload alarm; and

(f) Indicator showing direction of thrust.

8.8.3 A Vessel polar plot performance analysis shall be carried out to determine the kW power requirement of the bow thruster. This shall be submitted to the GNC for review by the Contractor.

8.8.4 The bow thruster shall be fitted within an aluminium tube, which shall be integrated into the ships structure.

8.8.5 The tube shall be extruded or rolled and welded from class approved material and welded to the satisfaction of the RO and GNC. NDT shall be carried out on the bow thruster tube before and after installation into the hull.

8.8.6 The bow thruster shall be fitted within a designated space aft of the collision bulkhead, forward of the crew accommodation. The position of the bow thruster should be positioned as forward as practicable. It should be located below the waterline with sufficient depth for the prevention of air sucked into the tunnel. And the minimum diameter of propeller should not be less than 500mm.

8.8.7 The bow thruster shall be fitted as low as possible within the hull to maximise its operational efficiency.

8.8.8 The bow thruster hydraulic actuator shall be situated directly above the bow thruster tunnel. It shall be easily accessed for service and maintenance.

8.8.9 The system would be interfaced with the vessel position keeping system. The Contractor needs to ensure the proposed system, component, arrangement and design are all suitable for that purpose e.g. proper interfacing features. The Contractor's proposed system, component, arrangement and design shall be submitted to RO and GNC for prior approval.

8.8.10 The bow thruster shall be capable of producing 12-16 kN thrust.

8.9 Station Keeping

8.9.1 A compact electronic station keeping control and monitoring system shall be installed aboard the Vessel. A control panel shall be fitted at the wheelhouse steering positon.

8.9.2 The system shall be designed to automatically hold the Vessel in a predetermined position by controlling the speed (RPM) of the Vessel propellers and Bow thruster. Further, it shall automatically adjust the Vessel rudder to assist the Vessel holding station.

8.9.3 It shall be possible to control the system manually using a joystick control head, or by selecting the position (longitude and latitude) and required heading, via a navigation display/control panel located at the Wheelhouse Control Station.

8.9.4 The station keeping system shall be designed and installed to receive input data from the DGPS, Gyro Compass and Wind Speed/Direction Finder.

8.9.5 The system shall have a built-in electrical power monitor to ensure that the nominal limits are not being exceeded. The limit in power shall be managed to ensure effects on position and heading are minimized.

8.10 Fixed Pitch Propellers and Propulsion Controls

8.10.1 The design and installation shall follow the RO and IMO requirements (where applicable also complying to IMO HSC requirements).

8.10.2 For the avoidance of doubt, the following requirements shall also be met:

(a) The propulsion system shall be installed in accordance with the engine maker's instructions and RO requirements.

(b) The Vessel shall also be provided with the following items:

(i) The design of the propulsion system and the control system shall be of a design approved by RO

(ii) The RO's design and construction inspection certificates of the drive shafts, propellers, supporting brackets and other associated propulsion equipment shall be provided to GNC before the Acceptance Delivery;

(iii) The propulsion system shall be installed in accordance with manufacturer's instructions as well as to the RO's regulations and requirements.

8.10.3 Torsional vibration calculations approved by the RO for the shafting system shall be provided to GNC before the Acceptance Delivery.

8.11 Steering Gear System

8.11.1 The steering gear system shall be a triple rudder arrangement and shall comply with RO Requirements.

8.11.2 Electro-hydraulic steering gear with three independent power units, each running unit capable of providing the maximum torque operating on triple rudders.

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

8.11.4 The rudder(s) shall be controlled by a steering wheel and joystick in the control station of the wheelhouse. The Coxswain shall be able to use steering helm wheel or joystick at the same time. The steering wheel shall be of a non-skid type of appropriate size acceptable to GNC. The power electro-hydraulic pump shall be capable of being started and stopped both in wheelhouse and in the steering gear room.

8.11.5 Individual illuminated rudder angle indicators with dimmer switch, running and overload alarm shall be provided at the Wheelhouse Control station, the Wheelhouse Engine Remote Control Console and the Steering Gear Room.

8.11.6 An emergency steering system shall be provided in accordance with RO Requirements.

8.11.7 A change-over electric switch shall be provided at the Wheelhouse Control station for switching the steering control between electric mode and manual mode.

8.12 Rudders and Rudder Stocks

8.12.1 The rudders shall be designed, manufactured and installed to meet RO Requirements.

8.12.2 Local rudder angle indicators shall be fitted in the Steering Room local to each rudder. The port and starboard degree markings in intervals not greater than one (1) degree shall be permanently marked and distinguished by red (port) and green (starboard) in English and Traditional Chinese.

8.12.3 Extremes of rudder travel shall be provided with mechanical stoppers to the satisfaction of the RO and GNC.

8.12.4 The rudder stock and rudder blade shall be of 316L stainless steel and shall be designed, manufactured and installed to meet RO Requirements.

8.12.5 Upper bearings shall be provided with a greasing unit.

8.12.6 Lower bearings of rudder stock shall be water-lubricated.

8.13 Machinery Space Ventilation

8.13.1 Arrangements shall provide sufficient air to the engine and machinery and shall give adequate protection against damage, as distinct from deterioration, due to ingress of foreign matter.

8.13.2 The ventilation openings shall be connected to louvres of efficient design to automatically prevent ingress of water during extreme weather conditions and in the event of a capsize/inversion. All vents shall be provided with water-tight covers, fire dampers and coamings of adequate height in accordance with RO requirements.

8.13.3 The engine room compartment and forward fire pump room shall be adequately ventilated to ensure that when machinery therein is operating at full power in all weather conditions, an adequate air supply is maintained to the compartment for the safety of personnel and the operation of the machinery.

8.13.4 All spaces containing machinery shall be provided with forced ventilation for combustion and ventilation air to meet the requirements of the prime movers and other heat sources. The ventilation design shall be such to avoid any hot spot or “dead air” area.

8.13.5 The steering gear room, bow thruster space and tank spaces shall be adequately ventilated for ensuring that the safe operation of the Vessel.

For guidance, the ventilation air to the compartment as stated should:

(a) limit the temperature rise in a machinery space in accordance with manufacturer requirements;

(b) as the prime movers draw combustion air from within the compartment, the total ventilation air be based on ISO 7547 “Standard for Shipbuilding - Air-conditioning and ventilation of accommodation spaces” as a minimum but shall not be less than that required for combustion plus 50%.

8.13.6 Automatic shut-off device(s) shall be provided according to RO Requirements prior to CO_2 system activation.

8.14 Air-Conditioning System

8.14.1 The Contractor shall propose specific equipment for approval by GNC prior to purchasing.

8.14.2 The temperature of the compartments shall be maintained at 21°C for 60% relative humidity when the external ambient air temperature is 33°C at 85% relative humidity with full complement and persons 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.

8.14.3 The design of the cooling air capacity shall be evenly distributed. An individual control shall be provided in each compartment.

8.14.4 The air-conditioning system shall be water cooled centralized one with duplicate units. The capacity of either unit, shall be sufficient to maintain the specified condition as mentioned in 8.14.2, i.e. 100 % reserved redundancy.

8.14.5 The location of air-handling units shall be easily accessible and not create obstructions to the removal of any hatch covers or direct maintenance of any major machinery and equipment.

8.14.6 The refrigerant shall be CFC and HCFC free.

8.14.7 Emergency stop switches of the air conditioning system in addition to the normal power 'on' and 'off' switches shall be installed in the wheelhouse control station.

8.14.8 Sufficient fresh air induced to the air-conditioned area shall be based on ISO 7547 "Standard for Shipbuilding - Air-conditioning and ventilation of accommodation spaces" and shall be not less than 25 m3/hour per person to keep the CO_2 level low enough for health reasons.

8.14.9 Mould and bacteria resistant replaceable filters shall be fitted at air inlets.

8.14.10 The air-conditioning system shall be designed, as recommended by the manufacturer, with due regards to air moisture at sea environment, to avoid undue condensation formation on any metallic surfaces in compartment cabin.

8.14.11 Sufficient ventilation shall be provided in case of air-conditioning breakdown.

8.15 Piping System

8.15.1 Piping connections and joints shall be constructed and designed in accordance with the rules and regulations of an RO.

8.15.2 Pipe bends shall be kept to a minimum and have sufficient radius to facilitate smoothness of flow.

8.15.3 Piping material of substantial thickness shall be of copper nickel or stainless steel 316L or equivalent material and agreed by GNC.

8.15.4 The arrangement of all piping connection, bulkhead penetration, hangar support with dis-similar materials involved, shall prevent any galvanic corrosion arise and submitted to RO and GNC for approval.

8.15.5 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.

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

8.15.7 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.

8.15.8 So far as practicable, pipelines, including exhaust pipes from engines, shall not to be routed near 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.

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

8.15.10 Machinery and piping designation and marking.

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

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

Fire Main:	Red
Sea Water:	Dark green
Fuel Oil:	Dark brown
Lube Oil:	Striped black/yellow
Fresh Water:	Blue
Hydraulic Oil:	Orange

8.16 Fuel Oil System and Fuel Oil Tank

8.16.1 As Government vessels are committed to utilise sustainable / renewable fuel blends, all engines and electric generators on the Vessel shall be able to use ASTM D975-08a B5 blends diesel fuel (5% biodiesel, 95% diesel labelled B5) and approved by the engine makers.

8.16.2 The fuel oil of the engines and generators shall be supplied from one or more fuel oil tanks. Endurance for fuel capacity is designed for 3 days x 8 hours at 25 Knots with full fuel oil tank(s). The Contractor is free to design the number and location of the fuel oil tanks to fulfil the specification requirements.

8.16.3 Quick closing valves controlled from above the main deck shall be fitted to the fuel oil tanks outlets.

8.16.4 Boost pumps (if required) shall be arranged to lift fuel to the engines through coalescing filters (Racor or equivalent).

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

8.16.6 The tanks shall be hydrostatically tested as required by an approved standard. Test to be witnessed by RO and GNC. Connections shall be proven tight.

8.16.7 An electric motor-driven pump shall be provided for transferring fuel between tanks.

8.16.8 The Contractor shall provide the initial fills of fuel oil, lube oil, coolant, and hydraulic fluids using fluids and additives prescribed by engine manufacturer. The Contractor shall provide a summary listing of all fluids and quantities used.

8.16.9 All materials used in fuel systems shall be resistant to deterioration by its designated fuel and to other liquids or compounds with which it may come into contact under normal operating conditions, e.g. grease, lubricating oil, bilge solvents and sea water.

8.16.10 The filling pipe shall be of metallic construction and a permanent fixture led from the deck and secured to the tank by an approved connection. A screwed cap and name plate inscribed 'Fuel Oil' shall be provided at the filling point. Flexible hoses are not permitted as filling pipes.

8.16.11 An easily removable coarse strainer shall be built into the filling line.

8.16.12 Two duplex filters shall be fitted in the oil fuel supply lines to the main and auxiliary engines, and the arrangements shall be such that any filter can be cleaned without interrupting the supply of filtered fuel oil to the engines.

8.16.13 Flexible pipes of approved type shall be used as short joining lengths to the engine where necessary in accordance with RO requirements.

8.16.14 Water separators shall be fitted to the fuel supply line.

8.16.15 Fuel Oil Tanks

(a) Fuel oil tanks shall be arranged to allow Vessel operation at acceptable trim in all conditions of loading and with consideration for the requirements for good static and running trim. The Vessel shall be built with independent fuel tanks to service the Vessel's main propulsion engines and ship service electric generators. The tanks shall be interconnected to permit fuel transfer between the tanks;

(b) The fuel oil tanks shall be fitted and installed in the tank space, actual location to be designed and approved by an RO and accepted by GNC;

(c) The tank thickness shall sustain the loads due to the mass of the full tank with due consideration given to accelerated forces due to the Vessel's movements at all speeds at sea, without damaging the tank and ship structure;

(d) Internal surfaces of the fuel oil tank shall be left unpainted and shall be cleaned thoroughly to the satisfaction of GNC;

(e) Provisions to the fuel oil tank:

(i) A tank content gauge and low-level and high-level alarm shall be fitted on the wheelhouse control station. A level gauge in litres shall be provided for each tank;
(ii) Rigid fuel suction pipes near the tank bottom shall be provided;
(iii) An inspection hole, air vent with flame trap on deck and discharge valve with remote operated quick closing device shall be provided. Fuel tank inspection hatch shall be sized to allow proper inspection of the entire tank interior. The inspection hatch shall have gasket cover secured by stainless steel bolts and self-locking nuts;
(iv) Suitable provision such as drip trap shall be made for collecting the oil discharge;
(v) Baffles shall be provided, the total open area provided in the baffles shall be not greater than 30% of the tank cross section in the plane of the baffle;
(vi) Baffle openings shall be designed so that they do not prevent the fuel flow across the bottom or trap vapour across the top of the tank;
(vii) The fuel oil tank shall be tested by a head of water equal to the maximum to which the tank may be subjected to, but not less than 2.5 metres above the top of the tank. The static test pressure shall be applied for 24 hours without pressure drop. After the test, the test fuel tank shall not show any leakage;
(viii) Sounding pipes with chained cap shall be provided;
(ix) Tank drain shall be provided; and
(x) The compartment or space containing the fuel oil tank shall be fitted with two ventilating pipes of arrangement acceptable to GNC.

8.17 Fresh Water System

8.17.1 One (1) or two (2) fresh water tank(s) with a total capacity of not less than 1000 litres shall be arranged in the Vessel to supply fresh water to the main deck, underdeck and crew space;

8.17.2 The fresh water tank(s) shall be installed in the compartment space as designed by Contractor according to RO requirements.

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

8.17.4 The fresh water tank shall be flushed clean before installation and delivery of Vessel.

8.17.5 The fresh water tank shall be designed to be 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 fresh water tank shall be fitted with the following:

(a) Inspection / cleaning access cover;

(b) Filling / sounding pipe; and

(c) Air pipe.

8.17.6 The tank (or tanks – to be used for the benefit of weight distribution) shall be of aluminium alloy construction. These can either be integral with the aluminium hull or as separate tanks.

8.17.7 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.

8.17.8 The fresh water tank(s) shall not be directly adjacent to any other tanks carrying liquid of any kind.

8.17.9 The fresh water tank shall be tested without leakage by a head of water equal to the maximum to which the tank may be subject, but not less than 2.5 m above the top of the tank. The static test pressure shall be applied for 5 minutes without pressure drop. This shall be witnessed by RO and GNC.

8.17.10 A fresh water test shall be carried to validate the pH. Additionally, a legionella test shall be carried out on the tank and its associated piping.

8.17.11 A capacity indicator calibrated in litres shall be provided.

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

8.17.13 Certificate of piping material shall be submitted before the delivery of the Vessel. The welding joints of the domestic fresh water piping's shall be free from lead. The domestic fresh water from the fresh water tank shall be free from any substance harmful to health and shall comply with the Government requirements for domestic water.

8.17.14 Cold fresh water taps completed with PVC braided / reinforced transparent hoses shall be fitted on the main deck aft, crew space and wheelhouse top to provide a rinse off facility for cleansing purpose.

8.18 Bilge System

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

8.18.2 A bilge audible and visual alarm panel shall be fitted in the wheelhouse for indication of high-water level in all subdivision compartment spaces.

8.18.3 Bilge alarms (audio and visual) – two for each engine compartment, one for each fuel tank compartment, and one for each watertight compartment.

8.18.4 When the Vessel is afloat and unmanned, the bilge audible, and visual alarm system shall continue to function as detailed in Paragraph 6.8.1 and 6.8.2 of this Part VII.

8.18.5 A bilge water holding tank of capacity according to the requirements of RO shall be provided in the engine room.

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

8.19 Seawater System

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

8.19.2 Sea chests provided for the main and auxiliary machineries shall be installed near their respective seawater pump suctions but with adequate distance between each other to avoid water flow disturbance.

8.19.3 A suitable strainer with isolation valves and air vent shall be fitted to each seawater system. Due consideration shall also be given for quick and easy access to the seawater strainers.

8.20 Sanitary, Grey and Black Water System

8.20.1 As a minimum one (1) grey/black water holding tank of 1000L shall be installed in the water tank compartment.

8.20.2 A sanitary/sea water pump shall be installed to supply sea water for sanitary service. Pressurised seawater shall be distributed to the toilets.

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

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

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

8.21 Hydraulic/Electrical System

8.21.1 The following hydraulic/ electrical equipment, to RO requirements, shall be supplied together with the associated power package unit;

(a) 1 x Marine Knuckle Boom Crane with safety working load (SWL) 1 tonnes at maximum 3 m outreach to meet the requirements of the GNC;

(b) Bow Thruster(s) capable of producing 12-16kN and be sufficient to manoeuvre the Vessel in normal operating conditions. The Bow Thruster(s) shall be fitted as far forward and as low as possible to maximise the effectiveness of the performance;

(c) 1 x Anchor Winch with guiding on function and emergency deployment, to RO requirements based on the Equipment Numeral of the vessel;

(d) 1 x Launch and Recovery System (LARS) as detailed in Paragraph 4.26 of Part VII, for the safe and efficient launch and recovery of the daughter boat.

8.21.2 Sea water cooled oil cooler shall be fitted to meet the cooling requirements of the system as per the recommendation of the manufacturer.

8.21.3 Each individual hydraulic equipment circuit shall be controlled via a load sensing valve, from an electrical control and monitoring panel. Each valve shall control the flow and pressure for each item circuit, as well as the load sensing feedback, allowing for flow sharing.

8.21.4 The control panel shall incorporate monitoring of low oil level, high oil temperature, and indicate which circuit is live. It shall be designed and installed in accordance with RO requirements.

8.21.5 Safety alarm and cut–out shall be installed and tested as per recommendation of the manufacturer.

Chapter 9 - Electrical System

9.1 General Requirements

9.1.1 All the electrical equipment and installation shall meet the RO Requirements.

9.1.2 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, with considerations of self-righting capability and water resistance taken into account.

9.1.3 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.

9.1.4 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.

9.1.5 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.

9.1.6 All Equipment installed shall be provided with manuals for operation and maintenance.

9.1.7 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 Traditional Chinese, or with universally recognised labels.

9.2 Electricity Distribution Network

9.2.1 The main electrical AC power supply shall be provided by two electric generators. The electric generators shall have unrestricted continuous rating and be located in the engine compartment. Each generator alone shall be able to supply the Vessel’s required electrical power.

9.2.2 Each electric generator shall be sized based on a 15% growth margin above the predicted maximum load condition. The Vessel’s electrical load calculation shall include summer and winter, static and transient, loads on AC, DC, shore power, and ship service systems. The Vessel’s electrical load calculation shall be approved by an RO and accepted by GNC.

9.2.3 The electric generator shall maintain an output voltage within ±5 percent over the entire load range and frequency within ±1.5 Hz.

9.2.4 The electric generator starting circuit shall be 24 VDC. Starting and normal shutdown controls shall be mounted on the electric 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).

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

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

9.2.7 Power distribution panels / electrical distribution boards shall be positioned in the deckhouse.

9.2.8 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.

9.2.9 Twenty percent (minimum of three) spare circuit breakers shall be provided in each distribution panel, both AC and DC. The Vessel's Electronic Navigational Equipment shall be supplied from an independent distribution panel, which shall in turn be supplied from a single breaker in the main DC panel.

9.2.10 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.

9.2.11 All three/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.

9.2.12 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 deckhouse. A special arrangement is required for the navigation lights supplied from this prime panel.

9.3 Main Switchboard

9.3.1 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.

9.3.2 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 compartment. Connections and components on panel-boards shall be in locations protected from the expected conditions in conformity with IEC 60529:

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

(b) IP 55 as a minimum, if exposed to splashing water;

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

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

9.3.4 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 compartment and shall contain the following:

(a) Sector for electric generators 220V AC;
(b) Sector for 24V and 12V DC; and
(c) Sector for shore power.

9.3.5 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.

9.3.6 Megger test and other relevant tests shall be carried out and witnessed by GNC. The results for these tests shall be submitted to GNC before Delivery Acceptance.

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

9.3.8 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.

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

(a) Electric generator Sector shall provide 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" and "Breaker Closed"; and
(v) All necessary fittings and any other protective devices.

(b) 220V Single Phase Sector shall provide 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 lighting services, fans, motors, etc.; and
(iii) Any other necessary fittings and protective devices.

(c) 24V and 12V DC Feeders Sector:
(i) Transformer / rectifier of adequate capacity for converting AC power to DC 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 DC 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 DC 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.

9.4 DC Power Source

9.4.1 Batteries for Main Engines and Electric Generator Starting

(a) Two independent banks of 24V batteries shall be provided for starting of each of the two main engines and the electric generators.

(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 the electric generator from cold, without recharging.

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

(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 two sets of 24V batteries charged directly from engine driven alternators, electric generator 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.

(h) All battery boxes shall be provided with adequate ventilation in accordance with RO requirements. Due care and attention shall be considered with respect to capsize/inversion.

9.4.2 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 DC power supply.

(b) In event of main electrical AC power failure, 24V DC batteries shall act as an emergency supply for all communication equipment, navigation and emergency lighting, steering, 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 compartment above deck. The compartment shall be well ventilated and prevent ingress of water.

9.4.3 24V DC 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) Electric locks;
(g) CCTV;
(h) Public address;
(i) One hand-held searchlight and one fixed searchlight;
(j) Siren; and
(k) Any other navigational and electronic equipment (if applicable).

9.4.4 The batteries as required in Paragraphs 9.4.1 and 9.4.2 shall be subject 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.

9.4.5 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.

9.4.6 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 eight hours (100% at ten 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 shall be available via the main propulsion engines and the 220V AC generator. Battery chargers shall not be mounted directly over batteries.
(e) Battery selector/isolator switches shall be provided between battery chargers and the battery banks they serve.
(f) Provisions shall be made to allow either main engine to be started by the other engine's starting batteries.

9.4.7 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 deckhouse.

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

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

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

9.4.11 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.

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

9.5 Shore Power Supply and Connection

9.5.1 The electrical system shall include the provision for shore power supply (380 VAC, 50 Hz) designed to an approved standard.

9.5.2 The shore power system shall be interlocked to prevent the Vessel's electric 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.

9.5.3 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

9.5.4 The watertight connection box shall be designed with a quick release receptacle.

9.5.5 Not less than 1.5 x length of vessel shore connection power cable of adequate rating with quick release watertight plug shall be provided.

9.5.6 The 1.5 x length of vessel shore connection power cable terminating at compatible connections to mate with existing facilities, to be identified by GNC. Suitable stowage on board shall be provided for the cable.

9.6 Circuit Breaker

9.6.1 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.

9.6.2 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.

9.7 Motor and Control Gear

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

9.7.2 Motors installed in the engine compartment 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.

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

9.8 Cable, Wiring and Fuse

9.8.1 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.

9.8.2 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.

9.8.3 Cables shall have minimum dimensions in accordance with IEC regulations or other equivalent international standard acceptance to GNC, 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.

9.8.4 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.

9.8.5 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.

9.8.6 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.

9.8.7 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.

9.8.8 Wiring shall be run along perforated metal trays and shall be secured in such positions as to allow easy maintenance.

9.8.9 Wiring shall not be installed below the engine compartment floor plates.

9.8.10 Cables and wiring inside accommodation areas shall run behind linings which shall have removable panels for inspection and maintenance.

9.8.11 Where electric cables have to be fitted on the decorative surface of bulkheads, they shall be enclosed in conduits.

9.8.12 RO approved watertight cable glands shall be provided in way of watertight bulkhead or deck penetrations.

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

9.8.14 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.

9.8.15 Cables and the wiring terminals of different AC and DC 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.

9.8.16 Tally plates showing the cable size and the number of cores shall be provided for each of the main power cables.

9.8.17 All fuses shall be of cartridge type and rated adequately for the protected circuits.

9.8.18 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.

9.9 Lighting Fixtures

9.9.1 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.

9.9.2 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.

9.9.3 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.

9.9.4 All lighting in the deckhouse control panel shall be fitted with a dimmer control at night. Emergency lighting of 24V DC supply shall be provided for all compartments, emergency embarkation stations and open decks as per RO Requirements.

9.9.5 Emergency exit routes shall be identified and illuminated as required by RO Requirements.

9.9.6 Lighting shall be provided in deckhouse above the desks and working areas.

9.9.7 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 there from will not be obstructed by fixed pipes, ducts, bins, berths, etc.

9.9.8 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.

9.9.9 All sockets, terminal blocks, and switch and receptacle interiors shall be made of non-flammable phenolic material.

9.10 Navigation Light

9.10.1 All navigation and signal lights to be provided shall be in compliance with the International Regulations for Preventing Collisions at Sea 1972, as amended by International Maritime Organisation (IMO) Resolution A464(XII) of the Inter-governmental Maritime Consultative Organization and Resolutions A.626(15), A.678(16), A.736(18), A.910(22), A.1004(25) and A.1085(28) of the International Maritime Organization, except Rules 39, 40 and 41. Type Approved Certificate in respect of each model of the navigation and signal lights issued by an RO shall be provided on or before the Delivery Acceptance at the latest.

9.10.2 The lighting shall be controlled from a control and alarm signal panel in the deckhouse. 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.

9.10.3 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 DC power source.

9.10.4 The following navigation 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) Three Black balls;
(i) One Black diamond;
(j) One Whistle;
(k) One Bell; and
(l) Any other navigation lights as required.

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

9.11 Searchlight

9.11.1 A mast, three search lights, one set of flood lights and two flashing beacons shall be fitted on the wheelhouse deck.

9.11.2 Search lights are proprietary made 220V AC 600W (details of the capacity must be discussed in the Kick-Off Meeting).

9.11.3 The primary 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.

9.11.4 Tarpaulin covers shall be provided for the searchlights.

9.11.5 One 24V DC LED portable search lights (with luminosity equivalent to not less than 150 W conventional type) with 30 metres water proof cable reels and plugs shall be provided in the deckhouse.

9.12 Floodlights

9.12.1 One set of 6 x 2000W marine use weathertight floodlights mounted on a telescopic mast with remote control and indication inside the wheelhouse for rotation (360 degree), titling (down-seeing capability) and elevation shall be provided for illumination of the sea during rescue operation. The mast shall be operated by hydraulic pump and its extended height is about 7 metres from wheelhouse deck. All maker's standard fittings and accessories shall be provided.

9.13 Power Receptacles / Sockets

9.13.1 Power receptacles/sockets installed in locations subject to rain, spray or splashing shall have a minimum protection of IP 55, in accordance with IEC 60529 when not in use, e.g. protected by a cover with an effective weatherproof seal.

9.13.2 A system of 380/220V AC and 24V DC socket outlets shall be provided in all the internal compartments, fore and aft ends of the Vessel on the main deck and in the deckhouse of the Vessel.

9.13.3 Socket outlets for 220V AC and 24V DC are needed in the wheelhouse.

9.13.4 Sockets shall be provided in the deckhouse for personal computers, charger for portable VHF, charger for digital camera, charger for mobile phone, desk lamp, spare etc.

9.13.5 The crew space requires 220V AC power sockets for the portable apparatus and the domestic equipment, etc.

9.13.6 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 DC socket outlets shall be supplied with fused plugs.

9.13.7 Sockets for different voltage systems shall be clearly labelled and with different pin sizes so that one system cannot plug into the other.

9.13.8 Power sockets on the weather deck, in the engine compartment 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.

9.13.9 The layout of all sockets shall be approved by the GNC in advance.

Chapter 10 - Electronic Navigational Equipment

10.1 Description of Electronic Navigational Equipment (ENE) System

10.1.1 The Contractor shall 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 ENE items to be fitted on board the Vessel for FSD:

(a) Loudhailer/Siren and Public Address System with USB Player
(b) Magnetic Compass and Fluxgate Compass
(c) Gyro Compass System
(d) Marine Radar
(e) Multi-beam sonar
(f) Electronic Chart Display and Information System (ECDIS) with DGPS
(g) International Maritime Mobile (IMM) VHF Radio with Global Maritime Distress Safety System (GMDSS)
(h) Automatic Identification System (AIS) Transponder (include the Receiver and Transmitter Modules)
(i) CCTV Systems
(j) Wind Speed / Direction Indicator
(k) Electronic Marine AM/FM Radio Broadcast Receiver
(l) Marine Band Hand-held Waterproof Radio Transceiver
(m) Thermal Night Vision System
(n) Voyage Data Recorder
(o) Third Generation Mobilising System and Digital Trunk Mobile Radio System
(p) Wired Intercom System
(q) Visual Augmentation System

10.1.2 The Contractor shall provide all labour, materials, transportation, installation calibration, testing and commissioning, Warranty Services in Warranty Period and test equipment etc. which are necessary to complete the work required in this chapter.

10.1.3 An integrated system is preferred, so that information and also the display monitors of different systems, such as ECDIS, radar system, AIS receiver, can be shared in order to utilise the limited space available in coxswain operation area and to provide users a better displaying interface.

10.1.4 All Equipment offered shall be designed for marine applications and shall allow effective operation under most arduous condition i.e. poor weather, strong winds and heavy rains, severe vibration, etc. Exposed components shall be weather-proof and adequate protection against splash and water shall be provided for all electronic equipment fitted on board.

10.1.5 All components of the Equipment exposed to the weather shall be sea water resistance. Internal components shall be fully enclosed (IP65) with heavy duty seals and sufficient heat dissipation mechanism (e.g. ventilation, conduction, etc.) to protect the Equipment.

10.1.6 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. All radar and radio equipment shall be of a type approved by the Office of the Communications Authority of Hong Kong.

10.1.7 All sitting, installation and cabling in respect of compass, VHF, radar, etc. shall comply with the relevant rules and regulations of Hong Kong.

10.1.8 All ENE and electrical appliances shall have Hong Kong warranty and their on-site maintenance shall be locally available.

10.1.9 When the generation / use of calendars are employed for logging of reports, activation of 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.

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

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

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

10.2 Loudhailer / Siren and Public Address System with USB player

10.2.1 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.

10.2.2 Loudhailer/Siren

(a) The system shall comprise a master control unit in the wheelhouse and two weather proof horn type loudspeakers, in conformance to IPX5 or better, located at forward and aftward 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) The master control unit, 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 output power of the amplifier shall be no less than 30 watts and shall have the following characteristics:

(i) Hail sensitivity Not greater than 30 mV for 30 watts output at 1 kHz

(ii) Hail distortion Not greater than 10% at 30 watts output at 1 kHz

(g) The horn type loudspeaker shall be weatherproof reflex type, 8 ohms impedance with power rating not less than 30 watts (actual rating shall match with the amplifier).

(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.

(i) An electric fog horn shall be installed.

10.2.3 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 the control panel. 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 the master control unit of the loudhailer/siren system, control panel and both the position and quantity of speakers of the public address system shall be finalised in the detailed design stage.

10.3 Magnetic Compass and Fluxgate Compass

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

10.3.2 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.

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

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

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

10.3.6 Performance Requirements of fluxgate compass:

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

10.4 Gyro Compass System

10.4.1 The gyro compass system shall be typed approved in accordance with the IMO high speed craft code.

10.4.2 The gyro compass system shall consist of a gyro compass, an operator unit and a distributor unit.

10.4.3 The system shall allow integration of additional sensors such as magnetic compass, satellite compass and external rate-of-turn gyro.

10.4.4 The system shall equip with automatic speed and latitude error correction.

10.4.5 The system shall be able to connect to other navigation equipment on board, including but not limited to, radar, ECDIS and GPS etc, through NMEA ports

10.4.6 Performance Requirements of gyro compass system:

(a)	Reference	:	Either magnetic north or true north.
(b)	Accuracy	:	$\pm 0.1^0$ typical or better
(c)	Resolution	:	0.1^0 or better
(d)	Deviation Compensation	:	Automatic.
(e)	Operating Temperatures	:	-10℃ to 55℃
(f)	Waterproofing	:	IPX5 or better
(g)	Output port	:	NMEA and RS232C

10.5 Marine Radar

10.5.1 The Contractor shall supply two radars, one is X-band and one is S-band. Both radars shall have an independent transceiver, a scanner and a colour display unit which satisfy the following requirement.

10.5.2 General Requirements for X-Band and S-Band Radar

(a) The equipment shall be a relative motion high performance radar suitable for vessels and comprises a transceiver, an antenna and a colour display unit, suitable for bright daylight and night viewing.

(b) The radar shall have interface to accept navigation data such as latitude/longitude position of the Vessel given by the GPS receiver.

(c) The radar shall be able to track high speed small crafts easily.

(d) The radar shall also be able to detect tiny targets such as small buoys or wooden stakes.

(e) The radar shall be using solid state technology or equivalent technology such that the warm up time from power on to operation is less than 1 minute or better.

(f) The Contractor shall ensure that the type and the number of provisions of the radar are appropriate to the class of the Vessel.

(g) The radar shall be equipped with a collision avoidance function that is an Automatic Radar Plotting Aid – ARPA or other equivalent function capable of tracking at least 20 targets.

(h) The collision avoidance function shall be able to display the “no go areas” directly on radar screen. This function shall support the navigator finding a save way and avoiding situations of possible collision. This function shall also analyse the movement of the plotted objects and determine in which areas the danger causes by a possible crash is exceptional high. These areas are displayed as a hatched field. If the navigator avoids these so-called “no go areas”, it navigates most probably on a safe route. This function shall show true zones (in relation to other true objects e.g. chart underlay, buoys, true marks, traffic separation zones, navigation lines).

(i) 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.

(j) The radar scanner unit shall be installed well clear of obstruction 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.

(k) Complete interface kit shall be provided to interface the radar for the gyro compass, fluxgate compass, GPS/DGPS/DGNSS, 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/DGNSS receiver.

(l) 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.

(m) 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.

(n) The radar shall have standard NMEA 0183 or NMEA 2000 interface ports, capable of accepting navigational data from a wide selection of GPS/DGPS/DGNSS 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 NMEA 2000 is acceptable.

(o) The power of the equipment shall be supplied from the DC 24V system of the Vessel.

(p) 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.

(q) 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.

(r) The display unit shall be a high resolution Thin-Film Transistor (TFT) colour display, combining brilliant display quality and compact design with a long life time.

(s) 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 and illumination

(x) Selection of background colour and target colour

(xi) Tuning

(xii) Heading marker ON/OFF

(t) The marine radar system shall comply with latest International Maritime Organization (IMO) regulations and requirements on IMO Res. A.823(19), MSC 64 (67) Annex 4, MSC.192(79) and A.820 (19)-High Speed Craft Code.

10.5.3 Performance Requirements

(a) The marine radar shall perform at least or better than the following requirements in this paragraph.

(b) Display Unit

(i)	Display	:	TFT colour LCD
(ii)	Screen Size	:	19 inch or larger
(iii)	Resolution	:	1280 x 1024 pixels or better
(iv)	Range	:	0.125 nm – 96 nm
(v)	EBLs (Electron Beam Lithography)	:	2
(vi)	VRMs (Voltage Regulator Module)	:	2
(vii)	Parallel Index Lines	:	2
(viii)	Display Presentations	:	RM (R), RM (T), TM
(ix)	Display Heading Modes	:	H Up, N Up, C Up, R Up
(x)	Gyro Input	:	NMEA, Fast NMEA
(xi)	Log Input	:	NMEA, pulse

(c) X-band Transceiver

(i)	Peak Power (kW, typ.)	:	25
(ii)	Radar Max Range	:	72nm or better

(iii)	Receiver Noise (dB)	:	6.0 or better
(iv)	Pulse Width (μsec)	:	Short: 0.08 or better Med 1: 0.3 or better Med 2: 0.6 or better Long: 1.2 or better

(d) S-band Transceiver

(i)	Peak Power (kW, typ.)	:	30
(ii)	Radar Max Range	:	96nm or better
(iii)	Receiver Noise (dB)	:	5.0 or better
(iv)	Pulse Width (μsec)	:	Short: 0.06 or better Med 1: 0.25 or better Med 2: 0.5 or better Long: 1.0 or better

(e) Antenna for X-band Radar

(i)	Operating Frequency	:	X–band
(ii)	RF Power	:	25 kW
(iii)	Scanner Size	:	6 feet
(iv)	Horizontal Beam Width	:	1.2 deg or less
(v)	Vertical Beam Width	:	25 deg or less
(vii)	Polarisation	:	horizontal
(viii)	Rotation Rate (RPM)	:	24 – 48 or better (It shall be adjustable according to the selected range scale or pulse length for optimum detection)
(ix)	Wind Load	:	100 kts

(f) Antenna for S-band Radar

(i)	Operating Frequency	:	S–band
(ii)	RF Power	:	30 kW
(iii)	Scanner Size	:	12 feet
(iv)	Horizontal Beam Width	:	1.9 deg or less
(v)	Vertical Beam Width	:	26 deg or less
(vi)	Gain (dB)	:	28 dB or better
(vii)	Polarisation	:	horizontal
(viii)	Rotation Rate (rpm)	:	24 – 48 or better (It shall be adjustable according to the selected range scale or pulse length for optimum detection)
(ix)	Wind Load	:	100 kts

(g) 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.

(h) ARPA (Automatic Radar Plotting Aid) Requirement

(i)	Target Acquisition	: 70 targets or better
(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 Adjustable warning limit – warming for CPA to a desired adjustable limit

(i) 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.

(j) The following standard interfaces shall be provided:

(i) USB interface for external units or updating by USB stick

(ii) CAN Bus (Controller Area Network)

(iii) Video Graphics Array (VGA) video output to add remote display or connect Voyage Data Recorder (VDR)

(iv) Alarm output via National Marine Electronics Association (NMEA)

(v) Connection to gyro or Global Positioning System (GPS), via NMEA, or Fast NMEA

(vi) SENC (System Electronic Navigation Chart) data input from Synapsis ECDIS (Electronic Chart Display Information System)

(k) The following system integration function shall be provided:

(i) AIS (Automatic Identification System) display of AIS targets, additional information to provide a better overview of traffic situation

(ii) ECDIS / GPS Display route coming from ECDIS / GPS

(iii) ARCP-Panel (Autopilot Remote Control Panel) Autopilot operation directly from radar workplace

(iv) SENC-Data (System Electronic Navigation Chart-Data) Input of selected chart symbols from ECDIS

10.6 Multi-beam Sonar

10.6.1 The equipment shall consist of a transducer, a processor unit and an interconnection display unit which is recessed mounted at the steering console and capable of providing readout of sea depth in feet, fathoms and meters.

10.6.2 The transducer shall be installed at the hull of the boat.

10.6.3 The interconnection display unit shall comprise of a flush-mounted LCD colour display of a type suitable for use on an open deck vessel. The display unit shall provide a clear and clutter free picture in all weather conditions and be suitable for viewing in direct sunlight without the need for a viewing hood or the like.

10.6.4 The interconnection display unit shall be interconnected with the Radar, ECDIS and other navigational equipment.

10.6.5 The measuring depth shall be from 3 metres to 200 metres or equivalent in fathom or feet with at least 3 selectable ranges to indicate shallow, mid and deep ranges. The unit of measurement shall be selected at the front panel of the equipment.

10.6.6 The equipment shall display the cross section of the sea column echo in at least 120 degrees port and starboard.

10.6.7 Shallow water audible alarms shall be provided. Setting of the alarm depth shall be at the front panel of the equipment.

10.6.8 The peak to peak transmitting pulse power of the transducer shall not be less than 100 watts and the nominal operating frequency shall be around 160 kHz.

10.6.9 The power of the equipment shall be supplied from the 12 or 24 V DC system of the Vessel.

10.7 Electronic Chart Display and Information System (ECDIS) with Differential Global Positioning System

10.7.1 General Requirements

(a) One set of ECDIS must provide the following functions:

(i) Navigational calculation

(ii) Chart updating

(iii) Piloting

(iv) Voyage monitoring

(b) The ECDIS shall be installed with DGPS receiver and echo sounder. It shall consist of a multi-touch screen monitor, a remote GPS antenna and differential beacon receiver, an echo sounder and a processor unit with controller.

(c) The ECDIS shall be able to show the radar, AIS, depth of water by echo sounder and ENC information. Different display options shall be allowed, including but not limited to the following combinations:

(v) Electronic Chart only

(vi) Electronic Chart + Radar A

(vii) Electronic Chart + Radar B

(viii) Electronic Chart + AIS

(d) The information received by the Global DGPS receiver shall be input to the marine radar and display on the marine radar and the multi-touch screen monitor of ECDIS. 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.

(e) One multi-touch screen monitor of size not less than 600mm (24 inches) diagonal high resolution colour LCD for the Vessel. The multi-touch screen monitor must fulfill the following features:

(i) Multi-touch screen

(ii) 1000 nits Brightness

(iii) 610mm active viewing area or better

(iv) HDMI, DVI and Composite inputs

(v) On-class menu keys

(vi) Can be operated as radar, chart plotter, depth sounder, alarms etc.

(f) The ECDIS 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.

(g) The ECDIS shall be equipped with navigational sea charts in details covering the entire Hong Kong Waters.

(h) The information received by the AIS shall be able to display on the multi-touch screen monitor of ECDIS.

(i) Complete interface kit shall be provided to interface with the colour chart plotter for the navigation equipment on board, including but not limited to, the radar, echo sounder, AIS, GPS/DGPS/DGNSS and multi-beam sonar. The colour chart plotter shall accept and display information given by the radar, echo sounder, AIS, GPS/DGPS/DGNSS receiver and multi-beam sonar.

(j) The processor unit of the ECDIS shall accept and display information given by the ENE equipment: Radars, VHF, AIS transponder, DGPS and three control consoles. The processor unit shall have high-performance quard-core processor for rapid, responsive operation of the multiple touch screen monitor.

(k) The ECDIS should provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment. [D]

(l) The ECDIS shall be 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 e.g. S-57 digital charts, SevenCs directENC charts, SevenCs Bathmetic ENCs, ARCS charts, VMAP/DNC charts, AML charts, BSB charts, WMS charts and Geo TIFF.

(m) The chart information to be used in ECDIS should be the latest edition, can be corrected by official updates (S-57 digital charts, SevenCs directENC charts, SevenCs Bathmetic ENCs) by the Marine Department Hong Kong Hydrographic Offices of MD with records of update shown on the ECDIS.

(n) The 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]

(o) The ECDIS should be capable of displaying both English and Chinese characters of the ENC. [D]

(p) The EDCIS should store 12 hours history voyage record and can be reproduced on the EDCIS. [D]

(q) The Contractor shall provide software updates to ensure the ECDIS is at its latest version.

10.7.2 Performance requirements

(a) Navigational Features

Total Waypoint	:	2000 or more
Routes	:	50 route plans or more
Alarms	:	including but not limited to, proximity alert, cross-track error, and arrival /anchor watch

(b) Electrical and Physical

Power Source	:	12 - 24V DC (external)
Display (Screen Type)	:	24 inch or greater diagonal high resolution coluor display, resolution 1280 x 1024 pixels or better

(c) Environmental

Operating Temperature	:	-10 ^{o}C to +50 ^{o}C

Storage Temperature	:	-20 ºC to +60 ºC

(d) GPS Receiver

GPS Receiver Type	:	Equipped with 8 channel parallel receiver or better
Frequency Range (GPS)	:	1575.42±1MHz (C/A code), L1
Sensitivity (GPS)	:	-130 dBm or better
Dynamic Range (GPS)	:	25 dB or better
Warm start fix time	:	less than 30 seconds
Cold start fix time	:	less than 3 minutes
Position Accuracy	:	no greater than 15m
Tracking Velocity	:	999 kt

(e) Differential Beacon Receiver

Frequency range	:	283.5-325 kHz
Frequency Step	:	500 Hz
Position Accuracy	:	no greater than 5m

(f) Data Display

Lat/Lon	:	N or S plus 7 digits
	:	E or W plus 8 digits
Antenna Height	:	4 digits, 1m resolution
Speed and Course	:	0.1 Kt or 0.1 Km/h resolution
	:	3 digit 1-degree resolution
Cross Track Error	:	Graphic or direction indication
Bearing	:	3 digits, 1-degree resolution
Range	:	4 digits, 0.01-nm resolution
CDI	:	Active perspective view, selectable scale (0.1, 0.3 or 0.5 nm)
Time	:	Selectable as GMT or local mode
Mapping	:	Resident world map in memory (reversible video)
Language for system	:	(i) English operation and display (ii) Bilingual (English and Chinese) is preferred [D]

(g) Electronic Charts Requirement – Livechart or equivalent

(i) Fully legal, vectorised and layered digital charts compiled according to International Hydrographic Organization (IHO) standards, such as S52, S57 and DX90, shall be required.

(ii) The charts shall accurately reproduce all the colours and details of the standard on paper charts referenced by the Hydrographic Office of MD and shall be identified by their original numbers.

(iii) The charts showing Hong Kong and nearby water shall be required.

(iv) Full chart update service shall be provided by the Contractor.Details of such service shall be submitted to the Government for approval.

10.8 International Maritime Mobile (IMM) VHF Radio with GMDSS

10.8.1 The Contractor shall supply two sets of International Maritime Mobile (IMM) VHF radio with GMDSS.

10.8.2 General Requirements

(a) The IMM VHF radio shall be a type approved by the Office of the Communications Authority of Hong Kong (OFCA).

(b) The radio shall be fully compatible with Global Maritime Distress Safety System (GMDSS) with a class A Digital Selective Calling (DSC) transceiver fully compatible with the International Maritime Organization (IMO) GMDSS carriage requirements.

(c) The radio shall be equipped with all the international maritime VHF channels completed with fist microphone with press-to-talk switch or telephone handset, mic/handset hanger, mounting bracket and loud speaker.

(d) 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.

(e) 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)

(f) The operating temperature of the radio shall be -5℃ to +55℃ or better. The water ingress protection for the radio shall be IPX7 or better.

(g) The radio shall be equipped with a lithium battery of lifetime at least five years.

(h) The radio shall be completed with antenna and integrated microphone, loudspeaker, control knobs/keys, display screen, re-chargeable battery etc., necessary for a stand-alone portable radio. The radio shall be equipped with a 220 V AC battery charger (for battery charging on shore) and one extra set of spare re-chargeable battery.

(i) The Contractor shall also supply a DC battery charger (one for the Vessel extra to the 220 V AC battery charger) which can be readily and directly connected to a DC power outlet at the Vessel such that the portable radio can be charged on the Vessel if necessary. Normally the DC 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 radio shall be supplied with a belt clip and a shoulder carrying case.

(k) 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.

10.8.3 Performance Requirements

(a) Transmitter Characteristics

Spurious and Harmonics	:	-70 dB or better emissions
RF Output Power	:	25 W / 1 W (High / Low)

(b) Receiver Characteristics

Sensitivity	:	Less than 1 uV for 20 dB SINAD or equivalent
Adjacent Channel Selectivity	:	60 dB or better

Spurious Image Rejection	:	65 dB or better
Intermodulation	:	65 dB or better
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 marine type aerial with at least 3 dBi gain, vertically polarised, omni-directional and suitable for mounting on the Vessel.

(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.

10.9 Automatic Identification System (AIS)

10.9.1 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 vessels nearby.

(d) The AIS supplied shall be completely compatible with all systems using NMEA standard and be able to interface with radar, ECDIS, gyro compass, and external GPS, etc.

(e) Edition of user message on navigation and 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) Not less than 14" AIS LCD colour graphic display unit

(ii) AIS transponder unit

(iii) VHF antenna

(iv) GPS antenna

(v) Installation / operation handbook

10.9.2 Performance Requirements

(a) The AIS shall comply with the following specifications:

(i) General

Power Consumption	:	50W peak / 10W average (Main Unit)
Power supply	:	12V DC + 10%
Default Frequencies	:	AIS1 (CH 87B) : 161.975 MHz AIS2 (CH 88B) : 162.025 MHz DSC (CH70) : 156.525 MHz
Frequency range	:	156.025 ~ 162.025 MHz
Transponder size/weight (+ 2%)	:	221 x 165 x 95 mm, 1.5 kg
MKD Display	:	5.6”(or larger) Colour TFT LCD
MKD size/weight (+ 2%)	:	255 x 162 x 75 mm, 0.9 kg
GPS size/weight (+ 2%)	:	90 x ∅ 65 mm (+140 mm mounting bar), 0.2 kg

(ii) AIS Transmitter

Power output	:	12.5W or 1.0W (41 dBm ±1.5 dB or 30 dBm ±1.5 dB)
Antenna impedance	:	50 ohms (SO-239)
Channel spacing	:	25 kHz

(iii) AIS Receiver

Sensitivity	:	(PER) < 20% at -107 dBm
Modulation	:	GMSK
Data rate	:	9600 bits/s
Frequency stability	:	< ±1 ppm
Co-Channel	:	10 dB
Adjacent Channel	:	70 dB
IMD	:	65 dB
Blocking	:	84 dB

(iv) DSC Receivers

Sensitivity	:	BER <10-4 at 107 dBm
Modulation	:	FSK (1300 Hz / 2100 Hz)

(v) Serial inputs/outputs

SENS1/2/3/4	:	IEC61162-1/2 (input only)
LONG/AUX/PILOT/RTCM	:	IEC61162-1/2 (input and output)
Display	:	RS422 non-isolated

(vi) GPS Antenna and Receiver

Antenna	:	PATCH ANTENNA / TNC (RG-58U)
Receiver Type	:	16 channel, L1 frequency, C/A code
Acuracy	:	Acquisition -140 dBm / Tracking -150 dBm

(vii) Environment

Operation temperature	:	-15℃ to +55℃
Storage temperature	:	-25℃ to +75℃
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.

10.10 CCTV Systems

10.10.1 General Requirements

(a) The Contractor shall provide two sets of CCTV system, one set for the decontamination area and sick room and one set for general overview of the Vessel.

(b) The Contractor shall finalise the locations of the cameras with FSD during the design stage.

(c) Unless otherwise stated, all cameras shall be high-resolution, water-proof, vandal-resistant type, ICR day and night dome pan tilt zoom camera. They shall be marine type and shall be suitable for operation in rough sea environment.

(d) All cameras shall have image stabilisation function to accommodate the rough sea conditions.

(e) All cameras shall be able to cover diagonal view by wide angle lens or standard lens according to the actual condition.

(f) All camera signals should route through a DVR or NVR for recording. [D]

(g) The DVR or NVR shall have sufficient disk space for archive of 31 days video image for all cameras at 3 mega-pixel resolution; real-time HD image at 25 frames per second for viewing shall be provided.

(h) LCD monitor, screen with not less than 19 inches diagonal measurement, shall be provided for display of video image.

(i) After installation of the system, the Contractor shall provide free on site operational training on the Vessel to ensure proper operation of the system until MD's satisfaction.

(j) An Uninterruptible Power System (UPS) shall be designed, supplied and installed to sustain the operation of all the equipment of CCTV system for a minimum of 60 minutes.

10.10.2 CCTV for Emergency Treatment Room

The CCTV system shall consist of cameras at least in the following areas:

(a) At least four cameras in the decontamination area and sick room.

(b) The Contractor shall ensure that at least 95% of each area listed above shall be properly covered. The Contractor shall propose the number of camera required if the above is deemed not sufficient.

(c) The control and monitoring of the CCTV for decontamination area and sick room shall be located at the command and control centre in the Vessel. The Contractor shall finalise the locations with FSD during the design stage.

(d) At least four monitors shall be provided for the CCTV for decontamination area and sick room.

10.10.3 CCTV for general purpose

(a) The CCTV system shall consist of cameras at least in the following areas:

(i) at least two cameras on port side

(ii) at least two cameras on starboard side

(iii) at least one camera for aft-side of the vessel

(iv) at least one camera for helicopter winching

(v) at least one camera for Daughter Boat launching

(vi) at least one camera for forward side of the vessel

(vii) at least two camera in each engine room

The Contractor shall ensure that at least 95% of each area listed above shall be properly covered. The Contractor shall propose the number of camera required if the above is deemed not sufficient.

(b) The camera above the wheelhouse functions as a "voyage video recorder", which shall be a fixed camera with a wide field of view of at least 120^{o} and with IR LEDs which allow operation at poorly illuminated conditions. The camera shall be so installed that it covers the area in front of the Vessel.

(c) The control and monitoring of the CCTV for general purpose shall be located in the wheelhouse. The Contractor shall finalise the locations with FSD during the design stage.

10.11 Wind Speed and Direction Indicator

10.11.1 A marine type wind speed and direction indicator of proprietary make shall be provided and the wind speed data shall be shown in the ECDIS.

10.11.2 The indicator shall interface to the ECDIS.

10.11.3 The indicator shall provide on board with data display being installed inside the wheelhouse.

10.11.4 The indicator shall be mast mounted at unobstructed position.

10.12 Electronic Marine AM/FM Radio Broadcast Receiver

10.12.1 General Requirements

(a) The equipment shall consist of a marine type AM/FM radio broadcast receiver of proprietary make, a DVD player and two speakers located at the wheelhouse.

(b) The equipment shall be weather proof and IPX5 water resistant.

(c) Language of the user interface shall be in English.

(d) The interface of the equipment shall be user friendly and there shall be buttons/control for audio playback and AM/FM radio tuning.

(e) The positions of the AM/FM radio equipment shall be finalised in the detailed design stage.

10.13 Marine Band Hand-held Waterproof Radio Transceiver

10.13.1 General Requirements

(a) The Contractor shall provide 4 sets of GMDSS VHF waterproof Marine band handheld transceivers.

(b) Each portable maritime VHF transceiver shall be of proprietary make and completed with two sets of rechargeable batteries, batteries charger, helical antenna with V.S.W.R. not exceeding 1.5:1 and carrying case (with shoulder strap or belt clip).

(c) The operation period of each fully charged battery shall not be less than 8 hours per charge (10% transmit, 10% receive, 80% stand-by). The charger shall be designed for 220V AC input power supply and equipped with a BS 1363 type 13A power plug.

(d) The portable transceiver shall be at least able to transmit and receive on all the 55 International Maritime VHF channels, together with the private maritime VHF single frequency channels 96 (157.925 MHz) and/or 99 (157.975 MHz).

(e) The transceiver shall be of robust, splash-proof, light weight design and made with shock proof material suitable for hand held radio communication both on the Vessel and ashore.

(f) The transceiver shall be fully solid state and of software programmable carrier frequency type. Add-on crystal for carrier frequency will not be acceptable.

(g) The unit shall be a type approved model accepted by OFCA for maritime frequency band application.

10.13.2 Performance requirements

(a) The transceiver shall at least incorporate with the following controls / switches / facilities:

(i) power on / off button
(ii) volume control
(iii) high / low transmitting power switch
(iv) press to talk switch
(v) built-in microphone and loudspeaker
(vi) channel selector and operating channel display
(vii) sockets for external microphone, press to talk switch and loudspeaker

(b) The transceiver shall at least comply with the following technical specifications :

General

Operating Centre Frequency Range	:	International Maritime VHF Band
No. of Operating Channel	:	99 (Programmable)
Operating Mode	:	Simplex or Two Frequency Simplex
Channel Spacing	:	25 kHz
Frequency Stability	:	+/- 8 ppm between 0 and 50°C
Housing IP Category	:	IP 57

Transmitter

RF Transmitting Power	:	2 Watts at High Power Mode 0.25 Watts at Low Power Mode
Adjacent Channel Power	:	Below -65 dBC
Spurious and Harmonic Emission	:	Below 25 W
FM Hum and Noise	:	40 dB or better

Receiver

Receiver Sensitivity	:	0.3 dB V or better for 12 dB SINAD
Receiver adjacent channel selectivity	:	70 dB or better
Intermodulation Response Rejection	:	70 dB or better
Blocking/Desensitisation Level	:	90 dB□V or better
Spurious Response	:	70 dB or better
Spurious Emission	:	Below 20 nW
Total Harmonic Distortion	:	Less than 10 %
Signal/Noise Ratio	:	40 dB or better

10.14 Thermal Night Vision System

10.14.1 General Requirements

(a) Each set of thermal imaging camera system shall include :

(i) thermal night vision camera;

(ii) touch screen multi-function display (MFD);

(iii) joystick control unit for touch screen MFD display;

(iv) external GPS antenna for touch screen MFD display; and

(v) Hong Kong water charts for touch screen MFD display.

(b) It shall be long-range thermal night vision with a colour zoom camera and gyro-stabilization.

(c) The active gyro-stabilization shall provide steady imagery, even in rough seas.

(d) The thermal night vision camera shall come with a colour television camera with 10X optical zoom which shall provide continuous zoom and shall match the thermal night vision camera's e-zoom for easy operation when switching between cameras.

(e) Colour on-screen symbols shall be provided for detailed 3D colour on-screen symbols giving users instant access to system status, position and configuration.

10.14.2 Technical Requirements

(a) Thermal Night Vision Camera:

Thermal Imaging

Sensor Type	:	640 X 480 Vanadium Oxide (VOx) Microbolometer
Field of View (FOV)	:	18 º X 14 º (NTSC)
Focal Length	:	35mm
e-zoom	:	2x and 4x
Frame Refresh Rate	:	< 9Hz or better

Colour Daylight Imaging Camera

Detector Type	:	Colour CCD
Field of View (FOV)	:	58 º (h) X 43 º (v) with 10x optical zoom slaved to thermal night vision camera or better
Lines of Resolution	:	530 or better
Minimum Illumination	:	1.4 Lux or better

System

Stabilisation	:	2-Axis Gyro-Stabilization
Pan/Tilt Coverage	:	360 º Continuous Pan +/- 90º Tilt
Video Output	:	NTSC or PAL
Accessories	:	BNC with BNC-to-RCA adapter included for video out
Power Requirements	:	compatible with the Vessels'power supply
Colour Mode	:	5 different Colour Mode : Greyscale, Red (night mode), GlowBow, Rainbow and Fusion (Note : each also has a polarity inversion ; greyscale <=> WhiteHot and BlackHot)
Camera Modes	:	Pause, Reverse (Rearview)

Environmental

Operating Temperature Range	:	-25 °C to +55 °C (per IEC 60945)
Automatic Window Defrost	:	Standard
Sand/Dust	:	Mil-Std-810E
Water Ingress	:	IPX6 or better
Shock	:	15g vertical, 9g horizontal or better
Vibration	:	IEC 60945; MIL-STD-810E
Lightning Protection	:	IEC 60945
Salt Mist	:	IEC 60945
Wind	:	100 knots (115.2 mph)
EMI	:	IEC 60945

Range Performance

Detect Man (1.8m x 0.5m)	:	up to 4,000 ft. (1.2km)
Detect Small Vessel (4m x 1.5m)	:	up to 2.4 miles (3.9km)

Touch screen MFD shall:

(i) control directly the thermal night vision camera

(ii) be touch screen and non-touch screen with keypad buttons control selectable

(iii) have built in WiFi to take full control and monitoring of the thermal night vision camera / touch screen MFD from smartphone or tablet via free-of-charge mobile apps

(iv) have built in GPS / chartplotter features

(v) be easy to customise the touch screen MFD with full or split screen, windows of charting, GPS, thermal night vision camera and colour daylight imaging camera

(vi) Display : 17 inches TFT backlit, at least 1280 X 800 pixels, LCD multi-function color display unit

(1) Viewing Angles	:	80° left/right and 80° 60° top/bottom
(2) Networking Capability	:	Yes
(3) Waterproofing	:	IPX6
(4) Mounting Methods	:	Surface mount. Trunnion mount with bracket
(5) Cartography	:	Hong Kong Water Chart Datum
(6) Wireless Connectivity	:	WiFi 802.11b/g;
(7) Bluetooth	:	AVRCP 2.1+EDR power class 1.5
(8) GPS	:	Built-in 50 channels; WAAS, EGNOS and MSAS. Automatic signal acquisition and almanac update; Operating frequency: 1575.42MHz; Geodetic Datum: WGS-84, Active Jamming Reduction; Ceramic Chip antenna; Accuracy: without SBAS < 15m 95% of the time. With WAAS/EGNOS <5m 95% of the time.

(b) Joystick Control Unit for Touch Screen MFD Display:

(i) Dedicated thermal camera controller, featuring 3 axis puck control, function keys and an LCD

(ii) Compatible with the thermal night vision camera and touch screen MFD

(iii) To provide the controls to operate and configure the camera

(c) External GPS Antenna for Touch Screen MFD Display:

(i) To provide information to the thermal imaging camera system

(ii) Compatible with the thermal imaging camera system

(d) Hong Kong Water Charts for Touch Screen MFD:

(i) To provide digital chart data of Hong Kong Water information to the thermal imaging camera system

(ii) Compatible with the thermal imaging camera system

10.14.3 Functional Requirements

(a) In surveillance mode the thermal night vision camera (the Camera) shall pan left and right continuously. The Camera shall continue to pan until surveillance mode is disabled, or the JCU (Joystick Control Unit) is used to move the Camera. When this occurs the Camera does not automatically resume surveillance mode and the mode must be enabled again if required.

(b) The Camera shall include a mechanical stabilisation feature. The mechanical stabilisation feature shall improve image stability by compensating for vessel motion and keeping the Camera aimed at the point of interest. Mechanical stabilisation shall have two aspects: horizontal (azimuth) and vertical (elevation).

(c) Point mode function shall be provided to turn off the horizontal (pan) stabilisation while retaining the vertical (tilt) stabilisation. This can be helpful when users use the Camera as an aide to navigation and keep the camera pointing in the same position relative to the Vessel as it turns.

(d) A user shall be able to reverse the polarity of the video image to change the appearance of objects on-screen. The reverse video option (video polarity) shall switch the thermal image from white-hot (or red-hot if the colour mode setting is active) to black-hot.

(e) The Camera shall have a home position which is a preset position. The home position usually defines a useful reference point. A user shall be able to return the Camera to the home position at any time.

(f) The Camera shall have a rear view mode function to flip the video image horizontally, providing a “mirror image”. This is useful when the Camera is rear-facing and a user is viewing the image on a forward–facing monitor.

(g) When user touches the touch screen MFD (cue) and the Camera shall automatically move to the cursor position (slew) so that it shall allow the user to keep chart objects like buoys or obstructions in constant view.

(h) The Camera shall have a target tracking function so that the Camera shall automatically keep “cued” targets in view at all times.

(i) The Camera and the touch screen MFD Display shall auto slew to dangerous MARPA and AIS targets, keeping dangerous targets in the Camera’s sight during limited visibility situations.

10.15 Voyage Data Recorder (VDR)

10.15.1 General Requirements

(a) The voyage data recorder shall collect data from all interfaced sensors on the Vessel, storing it in an external Data Recording Unit (DRU).

(b) The DRU shall be tamperproof and be able to withstand the extreme impact, pressure, shock and heat, which may happen during incident.

(c) The voyage data recorder shall comply with the IMO performance standards for VDR.

10.15.2 Performance Requirements

(a) The VDR shall satisfy the following minimum performance requirement:

(i) Data Collecting Unit (DCU)

Recording period	:	720 hours or better
Interface	:	Ethernet, serial input, digital and analog input

(ii) Data Recording Unit

Recording period (for fixed and float-free DRU)	:	48 hours or better
Protection	:	IP56 or better

(iii) Remote Alarm Panel

Display	:	4.3 inches colour LCD or better

10.16 Third Generation Mobilising System (TGMS) and Digital Trunk Radio System (DTRS)

10.16.1 The Contractor shall provide cable trunking, conduit and wiring and to install the equipment listed in the corresponding locations to the satisfaction of MD officer and EMSD officers.

10.16.2 Unless otherwise specified, the equipment set out in this Paragraph 10.16 shall be supplied by FSD. The Contractor shall liaise with FSD for the equipment during construction stage.

10.16.3 Technical Requirements of TGMS and DTRS are detailed below:

(a) Equipment in WheelHouse

Category	Item	Equipment	Working Voltage (V)	Working Current (Amp)	Standby Current (Amp)	Size (mm) Depth x width x height	Weight (kg)	Quantity
TGMS	1	TGMS Mobile Data Terminal (MDT)	12	3	0.7	52 x 236 x 285	2.2	1
	2	TGMS Wireless Keyboard (WKB) with charging bed	12	2.0 (when charging)	0.1	174.8 x 325.7 x 27.5	3	1
	3	TGMS OBE Box containing AVLS OBU, TMR and DC-DC converter	12	5	1	450 x 360 x 300	12.5	1
	4	Dedicated RS232 GPS Data output Port (Data format shall be						1

		NMEA 0183 or NMEA 2000). Serial port baud rate :9600 bit/Sec, 8 bit data, No Parity and 1 stop bit.						
						Total weight (Approx.):	17.7 kg	

Category	Item	Equipment	Working Voltage (V)	Working Current (Amp)	Standby Current (Amp)	Size (mm) Depth x width x height	Weight (kg)	Quantity	Remarks
DTRS Radio	1	Radio Terminal	12	2.2	0.5	169 x 170 x 45	1.07	1	Power shall be directly fed from the attached radio terminal unit.
		Enhanced Control Head	N/A	N/A	N/A	31 x 188 x 60	0.23	1	
DTRS	2	Portable Repeater (PR)	N/A	N/A	N/A	341 x 244 x 430	15	1	Not Applicable
Marine Radio	3	Marine Radio	12	3	1	250 x 190 x 65	1.6	1	Not Applicable
						Total weight (Approx.):	17.9kg		

Category	Item	Equipment	Working Voltage (V)	Working Current (Amp)	Standby Current (Amp)	Size (mm) Depth x width x height	Weight (kg)	Quantity	Remarks
DTRS	1	TETRA Mobile Radio	12	2.2	0.5	250 x 188 x 60	1.3	1	Not Applicable
						Total weight (Approx.):	1.3kg		

(b) Equipment on roof or pole of vessel

Equipment	Category	Size (mm)	Weight (kg)	Quantity	Remarks
Antenna	**TGMS**				Different antennas shall be separated with each other at least 300 mm. The weight of the antennae are estimated for reference only.
	WDN	Approx. 30 dia., 760 height	0.8	2 set	
			0.8		
	DTRS				
	DTRS	Approx. 30 dia., 660 height	0.5	1 set	
		Total weight (Approx.):	2.1 kg		

10.16.4 Physical Installation

(a) Mobile Data Terminal (MDT)

(i) An intelligent remote data terminal enabling FSD staff to send and receive data, provide dispatch information, process and display location on map, etc.

(ii) The MDT shall be installed in the cabinet of the Vessel for the crew to operate safely and conveniently.

(iii) The MDT shall be attached onto a pre-fabricated metal mounting bracket as shown in the diagram below. The Contractor shall provide a mounting platform or area for the metal bracket to fix on.

(b) Wireless Keyboard (WKB) with Charging Bed

While not in use, the keyboard shall rest on the Keyboard Charging Bed (KCB) for recharging the battery inside the keyboard. The WKB with KCB shall be mounted near the MDT.

(c) TGMS On Board Equipment Metallic Box

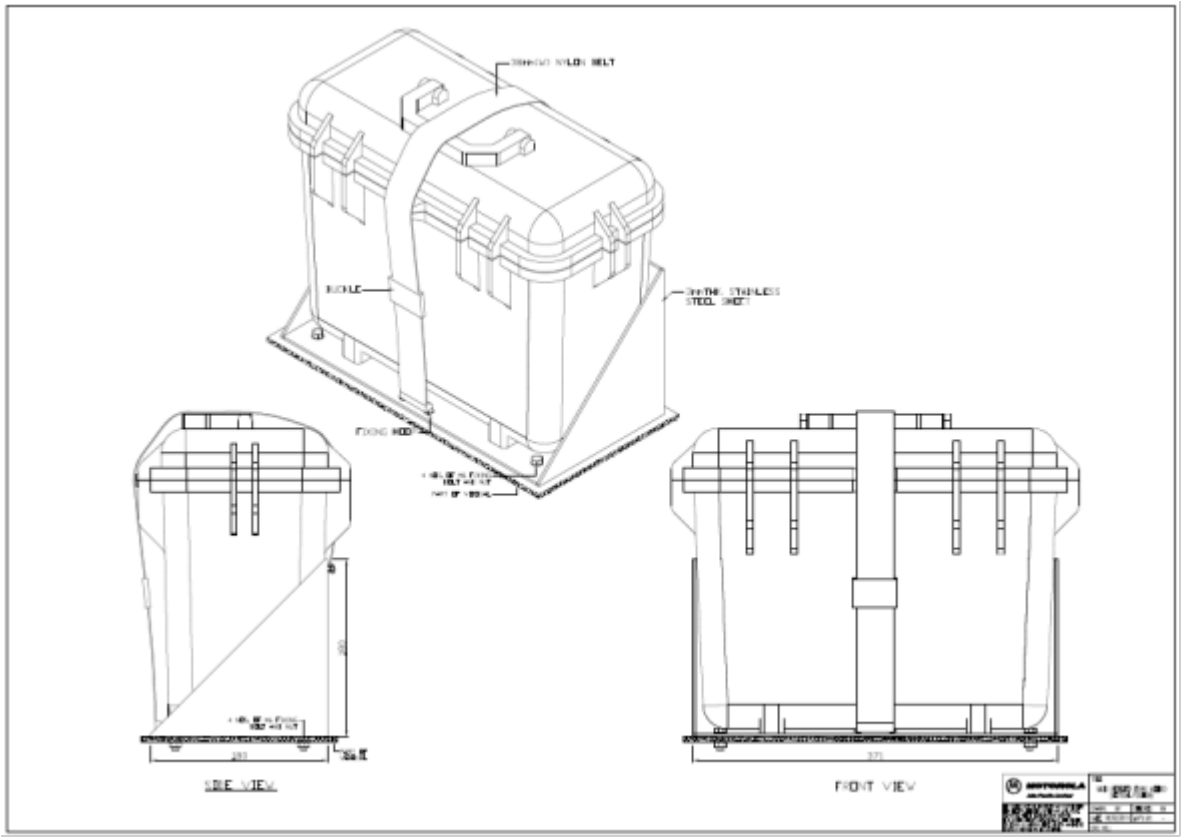
A metallic box shall be installed in the cabinet of the Vessel. TGMS equipment TMR, AVLS OBU and DC-DC converter will be mounted inside the metallic box.

(d) TETRA Mobile Radio Units (TMRU)

A TETRA Mobile Radio consists of enhanced control head and radio terminal. The enhanced control head shall be flush mounted on metal plate in the cabinet while radio terminals are mounted inside the cabinet just behind the enhanced control head. The opening of base plate of the mounting plate shall be around 155 x 35 mm for each enhanced control head.

(e) DTRS Portable Repeater (PR)

It is a box with dimension about 430 mm(Height) x 244 mm(Width) x 341 mm (Depth) to be mounted on the compartment. The Contractor shall provide accommodation for the PR as in recommended in the figure below.



Recommended fixing method of DTRS Portable Repeater

Antenna

There are 1 DTRS TERTA antenna and 2 TGMS TETRA antennas to be mounted on roof or pole of the Vessel. TETRA antennas are marine type dipole antenna which shall be mounted at a minimum separation of **30 cm** from the other antennas.

(f) Interfacing to Electrical Devices of the Vessel

TGMS GPS signal from Vessel's GPS

The signal of Vessel's GPS shall be made available to the OBE box. GPS data format shall be NMEA0183 or NMEA 2000 and serial port shall be RS232. The serial port configurations are as follows:

- Baud Rate : 9600
- Data bits: 8
- Parity : None
- Stop bits: 1

(g) Connecting Cables

(i) The Contractor shall supply all power cables for installation of TGMS equipment through suitable independent fuses.

(ii) The Contractor shall supply and install all RF signal antenna cables. The cables shall be use coaxial cables. (The model currently use is RG type cable.)

(iii) The Contractor shall supply and install all data cables in the table below. The cables shall be of the model specified below or equivalent data cables.

(iv) The routing of the conduits/trunking and cabling shall suit the contour interior compartment to ensure that a proper installation layout can be affected.

(v) The termination of all cables shall be carried out by the Contractor.

(vi) The Contractor shall provide suitable accessories, trunking/conduit facilities and openings for the connecting cables tabulated below:

Summary of Conduits for Wiring Connections

Item	From	To	Purpose	Cable Type	Termination Connector	Dia. (mm)	Min. Bending Radius (mm)	Diameter of conduit (mm)	Max. Length (m)
1	WDN Antenna	TGMS OBE Box	RF Signal	RG58A/U	TNC	5	50	25	10
2	DTRS Antennas	TMRU	RF Signal	RG58	BNC	5	50	25	10
3	MDT	TGMS OBE Box	Data (OBU)	Shielded RS232	FQN14-9Z (Water Proof Connector)	7	75	25	20
4	MDT	TGMS OBE Box	Data (Radio)	Shielded RS232	RS232 DB9 (Female)	7			20
5	TMRU	Main Power	Power	Two Ways Power Cable	Free End	8	50	16	8
6	TGMS OBE Box	12VDC Main Power w/switch from the Battery for TGMS	Power	Welding Power Cable	Free End	4	50	16	8

10.17 Wired Intercom System

10.17.1 General requirements

(a) The intercom system shall consist of at least two master stations and eight slave stations.

(b) All stations (both master and slaves) shall be able to communicate with each other. In addition the master station shall be able to give an emergency call-out to all the slave stations simultaneously.

(c) Weatherproof type enclosure shall be provided for all the stations.

(d) Incoming calls shall be signalled by audible tone.

(e) Incoming calls shall be signalled by visual means with integral flashing indicator.

10.17.2 Specific requirements

(a) The locations of master and slave stations of the intercom system shall be determined in the kick-off meeting after Contract is awarded.

(b) All stations shall be provided with handset type intercom units with weatherproof type enclosure except the following location, where headset type unit shall be provided :-

- Engine Room Control Console (E/R C.C.)
- Emergency Steering Position
- Fire Monitor Platform
- Fire deck (aft) for Daughter Boat recovery.

10.18 Visual Augmentation System

10.18.1 General requirements

(a) The visual augmentation system shall consist of a night vision camera, an infrared searchlight and a payload platform.

(b) The system shall be weatherproof.

(c) The system shall be certified for the HSC Code 2000 or equivalent standard.

10.18.2 Specific requirements

(a) The night vision camera shall satisfy the following minimum requirements:

(i) Sensitivity: 0.000001 lux or better

(ii) Spectral Response: 450 nm- 950 nm

(iii) Resolution: 756 x 484 or better

(iv) Field of view: 20° or better

(v) Focus: Fixed at infinity

(b) The infrared searchlight shall satisfy the following minimum requirements:

(i) Candlepower: 6,000,000 or better

(ii) Short-Arc Lamp: 75-watt Xenon or better

(iii) Beam Width: Adjustable

(c) The payload platform shall satisfy the following minimum requirements:

(i) Dimensions: 45 cm x 55 cm x 35 cm (Depth x Height x Width)

(ii) Tilt Range: -25° to +15°

(iii) Pan Range: ±100° from heading

(iv) Operating Temperature Range: -15°C to +55°C

(v) Pressurised camera and searchlight enclosures

10.19 Installation Requirements

10.19.1 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.

10.19.2 Equipment supplied shall be completed with all standard and/or maker recommended accessories as required for normal operation.

10.19.3 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.

10.19.4 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.

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

10.19.6 Adequate measures, including but not limited to the following, to prevent interference between the electronic equipment shall be taken:

(a) Separate screened conduits or trunkings shall be provided.

(b) Rules, regulations and recommended practices regarding screening of electric wiring must be observed.

(c) 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.

(d) Lightning protection devices shall be fitted.

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

(a) Satisfactory performance of the Equipment.

(b) Protection from mechanical and water damages.

(c) Ease of accessibility for maintenance and repair.

(d) Manufacturers' recommendations shall be strictly observed.

10.19.8 (a) The power, signal and control cables connecting to the flush-mounted equipment shall be long enough to let the equipment wholly place 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.

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

10.19.9 Installation Location

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

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

10.19.10 Material and Workmanship

(a) 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.

(b) All the designs shall be subject to the approval of the Government and the respective works shall be carried out in progress.

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

(d) 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.

10.19.11 Equipment Fixing and Interconnection

(a) 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.

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

(c) 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.

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

10.19.12 Electricity

(a) The power supply shall be compatible with Vessel’s DC electrical system.

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

10.19.13 Cable

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

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

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

(d) 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.

10.19.14 Labelling and Marking

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

(b) Polarity of power cables shall be labelled.

10.20 Acceptance Test

10.20.1 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 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 system. The overall installation standard and operational features of each system shall be evaluated. The test shall be carried out during sea trial.

10.20.2 The Contractor shall submit test reports on the performance of the Equipment and deliver the test reports and equipment to the EMSD representatives for bench acceptance test prior to the installation.

10.20.3 The Contractor shall submit schedule of commissioning test of the electronic equipment installed on board at least one month prior to the on-site commissioning test date.

10.20.4 The Contractor shall provide all the necessary test equipment and tools for carrying out the acceptance tests at no extra cost to Government.

10.20.5 At least one month before the end of the Warranty Period, the Contractor shall arrange and perform final acceptance test in the presence of the representatives from EMSD. Should any defects be found during the final acceptance 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 if the defects are not cleared or fixed by the Contractor.

10.20.6 For significant defects (e.g. involving the replacement of Space Parts/ Equipment etc.) found during the final acceptance test, the Warranty Period of the Equipment shall be properly extended as determined by EMSD.

10.21 Documentation for the Proposed Equipment

10.21.1 Unless proposed by the Tenderer and agreed by the Government in the Contract, the Contractor shall within one month after delivery of the Vessel, supply three sets of operation manual, service manual and integrated system/equipment schematic diagram in English (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 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 (e.g. engine rating, size, etc.).
(b) Initial cost.
(c) On-going cost (e.g. maintenance cost, petrol consumption, spare parts, etc.).
(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 HKSAR.

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 2.4.1 of 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 the HKSAR.

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 includes:
    (i) Item number.
    (ii) Description.
    (iii) Type/model.
    (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 GNC.

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 ship equipment list for all bought-in machineries and electrical equipment. The list shall include:
    (i) Description.
    (ii) Type/model.
    (iii) Makers part no. or equivalent.
    (iv) Location.
    (v) Quantity.
    (vi) Supplier or agents name and contact address.

(d) **FOUR** copies (at least one original) of maker operation, maintenance and workshop manuals for all machineries / equipment in English.

(e) **FOUR** paper copies and **ONE** soft copy in CD-ROM as per the Vessel delivered of "Docking Plan" 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 Traditional 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 Traditional Chinese) shall be submitted to GNC for approval one month before documentation acceptance.

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

11.2.3 Tools and 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

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

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

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

(c) Softcopy of Photographs

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

11.2.5 Certificates and Reports

Copies of the following documents (one original with two copies and one 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 (e.g. electronics, switchboards, etc.).
(c) Main engines performance test certificates.
(d) Complete record of the trial commissioning tests.

(e) Original copy of the warranty certificates of all machineries, equipment and apparatus of the Vessel (valid for 12 months from the date of Acceptance Certificate of the Vessel).
(f) Certificates of light and sound signalling equipment.
(g) Builder certificates.
(h) Certificates of building material.
(i) Deviation card for compass (after adjustment in the HKSAR).
(j) Hull construction material issued by 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 the HKSAR as stipulated in Annex 1 to the TS.
(l) Any other certificates as appropriate.

11.2.6 Ship Model

(a) Tenderer is required to quote a separate price in Schedule 1 of Part V for the supply of ship model(s) (scale 1:25) for display and training purpose. The ship model(s) shall be provided upon Delivery Acceptance.

(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 limiting 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 Electronics 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 Equipment being supplied and installed. The trainer shall be able to communicate in English/Chinese 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 Traditional 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 Equipment. This shall include hands-on demonstrations and operation of all Equipment including the necessary routine cleansing requirement.

(c) The course shall be held immediately before the commissioning of the 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 Contractor shall provide full training facilities (e.g. accommodation, facilities and equipment) with a training schedule. The course shall enable the maintenance staff:

(i) to 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 Equipment being offered; and

(ii) to effectively maintain the Equipment. This shall include practical demonstrations and tests.

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

(i) Introduction of the Equipment locations;
(ii) Equipment operational, working principle and functional descriptions;
(iii) Equipment block and schematic functional descriptions;
(iv) Equipment adjustment/calibration procedure and parameter settings;
(v) Equipment construction and mounting;
(vi) Equipment interfacing and signal interfacing;
(vii) Preventive maintenance and trouble-shooting

(c) The course shall be held immediately after the commissioning of the 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 (as well as the Daughter Boat that is attached to 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 of the manoeuvrability, vessel handling, turning characteristics, engines, etc., the Contractor shall provide an appropriate training course for 20 Government officers of the HKSAR Government 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, etc, the Contractor shall therefore provide appropriate train-the-trainer courses for a total of 20 Government officers/Government Representatives from the Government Dockyard in the HKSAR 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 the above-mentioned training courses and otherwise required in these Technical Specifications shall be provided by the Contractor unless otherwise specified. The training shall also 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
AFFF	Aqueous Film-Forming Foam
AIS	Automatic Identification System
AML	Additional Military Layers
Amp	Ampere
ARCS	Admiralty Raster Chart Service
ARPA	Automatic Radar Plotting Aid
ASTM	American Society for Testing and Materials
AUX	Auxiliary
AWS	American Welding Society
BS	British Standards
BSB	Data encoded in the BSB format
BSI	British Standards Institute
CAT	Categorisation
CDI	Course Deviation Indicator
CD-ROM	Compact Disc Read-Only Memory
CFC	Chlorofluorocarbon
CH	Channel
CO_2	Carbon Dioxide
COG	Course over Ground
CPA	Closest Point of Approach
CPU	Central Processing Unit
dB	Decibel
dBm	Decibel-milliwatts
DC	Direct Current
DGNSS	Differential Global Navigation Satellite System
DGPS	Differential Global Positioning System
DNC	Digital Nautical Chart
DPDT	Double-pole, Double-throw
DSC	Digital Selective Calling
DVI	Digital Video Interface
EBL	Electronic Bearing Line
ECDIS	Electronic Chart Display and Information System
EIAPP	Engine International Air Pollution Prevention
ENC	Electronic Navigational Charts
ENE	Electronic Navigational Equipment
FO	Fuel oil
FTP	Fire Test Procedures
GA	General Arrangement
GB	Gigabyte
GHz	Gigahertz
GM	Metacentric Height
GMDSS	Global Maritime Distress Safety System
GMSK	Gaussian Minimum Shift Keying
GMT	Greenwich Mean Time
GPS	Global Positioning System
GZ	Righting Lever
HCFC	Chlorodifluoromethane
HD	Hard Disk
HDMI	High Definition Multimedia Interface
Hz	Hertz
IEC	International Electro-technical Commission
IEEE	Institute of Electrical and Electronic Engineers
IHO	International Hydrographic Organization
IMD	Intermodulation Distortion
IMM	International Maritime Mobile

IMO	International Maritime Organisation
IP	Ingress Protection
IPX	Internetwork Packet Exchange
IS	Intact Stability
ISO	International Organization for Standardization
ITU-R	International Telecommunication Union – Radiocommunication Sector
JIS	Japanese Industrial Standards
JPEG	Joint Photographic Experts Group
kg	Kilogram
kHz	Kilohertz
Km	Kilometre
kW	Kilowatt
LCD	Liquid Crystal Display
LCG	Longitudinal Centre of Gravity
LED	Light-emitting Diode
LSA	Life-Saving Appliance
LO	Lubricating Oil
m	Metre
M	Mega
m/s	Metre per Second
m^3	Cubic Metre
MCR	Maximum Continuous Rating
MHz	Megahertz
MJ/m2	Megajoule per Square Metre
MKD	Minimum Keyboard Display
mm	Millimetre
MMSI	Maritime Mobile Service Identity
MSC	Maritime Safety Committee
NDT	Non-Destructive Test
nm	Nanometre
NMEA	National Marine Electronics Association
NUC	Not Under Command
ppm	Part per Million
PVC	Polyvinyl Chloride
RADAR	Radio Detection And Ranging
RF	Radio Frequency
RG58U	RG58U Type Coaxial Cable
ROT	Rate of Turn
RPE	Registered Professional Engineer
rpm	Revolutions per Minute
RT	Radioactive Test
RTCM	Radio Technical Commission for Maritime Services
SINAD	Signal-to-noise and Distortion Ratio
SOG	Speed over Ground
SOLAS	Safety of Life at Sea
TCG	Transverse Centre of Gravity
TCPA	Time to Closest Point of Approach
TFT	Thin-film Transistor
TIFF	Tagged Image File Format
TS	Technical Specifications
TTG	Time to Go
UHF	Ultra High Frequency
USB	Universal Serial Bus
UT	Ultrasonic Test
UTC	Coordinated Universal Time
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
VRM	Variable Range Marker
V.S.W.R.	Voltage Standing Wave Ratio
W	Watt
WDN	Wireless Data Network
WMS	Web Map Service

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, including the daughter boat 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 10.1.1 in Chapter 10 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, clean and polish 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
2	Completion of hull structures	The Contractor shall propose the completion dates of Milestones 2-8 for GNC's approval within two (2) months after the Contract Date.
3	Completion of installation of main machinery system	
4	Completion of installation of electronic navigation equipment	
5	Self-righting test trial	
6	Sea trial	
7	Pre-shipment Construction and Handling Inspection	
8	Shipment to Hong Kong	
9	Official sea trial	The Delivery Date for the Vessel shall be no later than the date set out in Schedule 2 (Delivery Schedule) of Part V
10	Delivery Date	

Item No.	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 bulkhead section	
	Daughter Boat Drawings	
	Construction Profile and Deck Plan	
	Shell Expansion Plan	
	Tank Capacity Plan	
	Engine Mounting Arrangement	
	Power / Speed Estimation and Curve	
	Intact, Damaged Stability Plan and Self Righting Stability Criteria	
	Details of Navigational / Communication Equipment	
	Details of Deck Equipment, Outfitting, Furniture, etc.	
	Details of Engines' Arrangement	
	Control Console Arrangement and Schematic Diagram	
	Fire System Diagram	
	Piping Arrangement	
	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 : "Fireboat"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
	Hull Structure, Layout and Outfitting Inspection			
H-1	Mould Lofting			
H-2	Construction Materials – Aluminium plate mark checking for hull & superstructure			
	a. Aluminium plate mark checking for hull & superstructure			
	b. Material certificates verification			
H-3	Welding consumables & welders certificates			
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. Welding			
	d. Workmanship			
	e. Compliance with approved plans			
	f. NDT (X-ray) of welds			
	g. Hull internal aluminium work inspection			
	h. Plating thickness gauging			
H-6	Engine bearers fabrication / welding			
H-7	Superstructure scantling & welding checking			
H-8	Welding construction and pressure tests of tanks			
	Fuel oil tank			
	a. Tank construction (internal/external/fitting)			
	b. Tank pressure test			
	Freshwater tank			
	a. Tank construction (internal/external/fitting)			
	b. Tank pressure test			
	Grey water tank			
	a. Tank construction (internal/external/fitting)			
	b. Tank seating construction/securing arrangement			
	Oily Water tank			
	a. Tank construction (internal/external/fitting)			
	b. Tank seating construction/securing arrangement			
H-9	Hose test for hull & superstructure			
H-10	Mock up inspection for the wheelhouse			
H-11	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-12	Function tests of various outfitting items			

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "Fireboat"				Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected				
H-13	Watertightness or weathertightness of openings				
	a.	Manholes			
	b.	Hatches			
	c.	Doors			
	d.	Windows			
	e.	Ventilator & air pipes			
H-14	Painting inspection of different layers				
H-15	Draught marks and vessel dimensions verifications				
H-16	Arrangement of wheelhouse and accommodation				
H-17	Zinc anodes and lightning system				
	a.	Installation of zinc anodes			
H-18	Inspection of fire, heat and sound insulation				
	a.	Fire insulation			
	b.	Heat insulation			
	c.	Sound insulation			
H-19	Interior furnishings				
	a.	Console area			
	b.	Wheelhouse			
	c.	Passenger space			
	d.	Toilets and pantry			
H-20	Lifesaving appliances and fire fighting appliances				
	a.	Lifesaving appliance			
	b.	Fire fighting appliance			
H21	Inspection of sea chest and grating				
	a.	Sea chest			
	b.	Grating			
H-22	Inclining experiment				
H-23	Self-righting trial test				
H-24	Sea trials including operation test of outfitting equipment				
H-25	Towing hook static bollard pull test				
H-26	Site towing demonstration trial				
H-27	Cleanliness inspection before acceptance				
H-28	Inventory check in the HKSAR				
H-29	Acceptance and delivery				
H-30	Acceptance of As-Fitted drawings and Engines/Equipment Manuals and documentations.				
	Machinery and Electrical 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 machinery				
(d)	General inspection on installation of gearbox and shafting				
(e)	General inspection on installation of hydraulic system				
(f)	General inspection on installation of fire pump				

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "Fireboat"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
(g)	Propeller taper bedding test			
(h)	Coupling taper bedding test			
(i)	Coupling and rudder bolts fitting			
(j)	General inspection on installation of power distribution system			
EM- 2	Main engines:			
(a)	Test of engine safety devices and alarms			
(b)	Test of emergency stop			
(c)	Inspection of exhaust pipe before lagging			
EM- 3	Hydraulic 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)	Hydraulic 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)	Hydraulic 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)	Hydraulic test of piping			

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "Fireboat"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
(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 (gas) fire extinguishing system			
(b)	Hydraulic & blow test of gas fire extinguishing piping			
(c)	Test of (gas) 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	E/R ventilation system:			
(a)	Inspection of E/R ventilation fans installation			
(b)	Function test of start/stop at remote and local control for E/R 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			

Part VII - Annex 4 - Main Items Inspection Timetable				
VESSEL NAME : "Fireboat"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
(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 and functional test of general lighting			
(b)	Inspection and and functional test of emergency lighting			
(c)	Inspection and 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	Shafting (tailshaft and coupling) system:			
(a)	Marking/Stamping and material check			
(b)	Dimension check and taper bedding test			
(c)	Shaft line checking of stern/shaft bracket and alignment of main engines and tailshafts			
EM- 22	Test of window wipers			
EM- 23	Bollard pull test			
EM- 24	Electronic equipment tested by EMSD			
EM- 25	Test of noise level during sea trial			
EM-26	Test of Bow thruster			
(a)	Electrical circuit protection testing			
(b)	Positioning keeping interface testing as recommended by supplier			
(c)	Function test of the system and its associated equipment			
(d)	Manoeuvrability and performance test			

Part VII - Annex 4 - Main Items Inspection Timetable				
VESSEL NAME : "Fireboat"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
EM-27	(a) Official Speed Trial			
	(b) Other Official Sea Trials			
EM-28	Test of Stern Launching System			
	(a) Operation Test of the whole system with daughter boat			
	(b) Function test of the hydraulic and electrical system			
	(c) Water tightness test of the stern ramp in position			
	(d) Hydraulic test of hydraulic piping			

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 Sea Trial, Endurance and Performance Tests

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

Conditions at Endurance and Performance Test (Official Sea Trial)			
Person On board	**10 Persons**	Dummy Weight	**-**
Fuel and Water	**Not less than 50% of Fuel and Water Tank**	Other Equipment	**100 kg**
Sea Conditions	**Sea state 1 - 2 : wave height 0 - 0.5 metres**		

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

Engine Load	**Engine Speed (rpm)**	**Vessel Speed (Knots)**	**Time (Start)**	**Time (Finish)**	Fuel Consumption (litres/minutes)	**Engine Oil Pressure (Bar)**	**Engine (in) CW Temp. (^{o}C)**	**Others**	**Others**
__% of rated Power	At Minimum Cruising Speed		Not less 15 minutes						
40% of Rated Power/rpm			Not less 15 minutes						
60% of Rated Power/rpm			Not less 15 minutes						
80% of Rated Power/rpm			Not less 15 minutes						
100% of Rated Power (Endurance Test)			Not less 30 minutes						

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 Superstructures and deck structural and construction plan.
1.2.15 Hull watertight bulkheads construction plan.
1.2.16 Superstructures to deck connection detailed construction plan.
1.2.17 Deck edge and bulwark (if any) details and construction plan, including detailed structural arrangement drawings of hull to deck connection.
1.2.18 Detailed cathodic corrosion prevention and arrangement plans and drawings for the Vessel throughout.
1.2.19 Mast structural and construction plan and mast equipment arrangement plan.
1.2.20 Anchoring arrangement plan.
1.2.21 Piping diagrams for fuel oil, freshwater, lubrication oil, bilge, firefighting, scuppers and drains, sewage system.
1.2.22 Fire prevention, fire control and firefighting system drawings.
1.2.23 Drawings of the main switchboard and all other switchboards and the electrical system.
1.2.24 Wheelhouse and cabin sound and heat insulation system diagram.
1.2.25 Main engines and generator sets arrangement and sitting plans and drawings of their fuel lines and exhaust gas piping and arrangement.
1.2.26 Vessel ventilation drawings for the wheelhouse, cabins and other spaces.
1.2.27 Main fuel oil tank drawing and its associated piping and manifold(s), and filling, overflow and ventilation system.
1.2.28 Freshwater tank and its associated piping arrangement.
1.2.29 Fuel oil tank(s) and its associated piping system
1.2.30 Drawings for anchor, windlass and the anchoring system.
1.2.31 Lifesaving appliance arrangement plan and fire safety plan.

1.2.32 Distress signals, alarm systems, and internal/external communication arrangement and system plan.
1.2.33 Navigational lights, sound and signal diagrams and any other external lighting arrangement plan.
1.2.34 Vessel overall lighting arrangement and light control plan.
1.2.35 Vessel alarm and signals, internal communication systems and public address systems plan.
1.2.36 General layout and arrangement drawing of the air-conditioning system.
1.2.37 Refrigerant piping layout drawing of the air-conditioning system.
1.2.38 Air-conditioning load calculation.
1.2.39 Detailed bow thruster drawings and its associated electric/hydraulic schematic drawings.
1.2.40 Daughter boat and its associated drawings.
1.2.41 Any drawings as required by GNC.

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, leaflets, literature, manuals and booklets etc. 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	