

Supply of One (1) Hovercraft
for the Agriculture, Fisheries and Conservation Department

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) hovercraft** (viz., “Vessel”) for use by the Agriculture, Fisheries and Conservation Department (“AFCD”).
- 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 which are without any label (viz., [E] or [D]) shall equally form part of the Contract like the specifications labelled as [E], but the Government will not conduct checks at the tendering stage whether the products offered comply with those specifications not labelled with [E]; and
 - (c) Desirable Specifications [D].
- 1.1.3 All this Part VII shall form part of the Contract. As part of the tender evaluation during the tendering stage (viz., completeness check), the Tenderer shall submit all the information 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 The whole of this Part VII, including all Essential Requirements, those without any label (viz., [E] or [D]) and the Desirable Specifications labelled with [D] (if and to the extent the Contractor has indicated compliance in its tender), shall also form part of the Contract and be of equal materiality and importance upon the award of the Contract. The non-compliance with any specifications set out in these TS shall have the same consequences as specified in the Contract. Save during the tendering stage in the manner as mentioned in Paragraph 1.1.2 (b) above, no differentiation shall be made based on the classification unless otherwise expressly specified.
- 1.1.5 The Vessel shall be Ready for Use before the Delivery Date and delivered by the Delivery Date as per the schedule stipulated under Schedule 2 – Delivery Schedule 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 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 AFCD within Hong Kong Waters with its main responsibilities as follows:
- (a) to fulfill the international obligations to protect and manage the Deep Bay Ramsar Site;
 - (b) to carry out enforcement patrols for unauthorized entrance to the Restricted Area; and
 - (c) to provide logistical support to the daily work in the Deep Bay Ramsar Site

1.3 Authorities

- 1.3.1 The Government New Construction Section (GNC) of the Marine Department (MD) is the section responsible for the procurement of the Vessel for the Government.
- 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 Contractor’s nominated shipyard building the Vessel must have the essential shipbuilding and workshop facilities such as lifting gears, hull construction and calibration equipment, machinery installation and calibration equipment and vessel launching or slipping facilities.
- 1.4.2 The Contractor shall employ a team of professional staff to carry out the design of the Vessel and also carry out supervision and quality control work in the course of Vessel construction.

1.5 Design and Construction Responsibility

- 1.5.1 It is the SOLE responsibility of the Contractor to supply the Vessel which is safe, fit and suitable for the intended operational purposes of the AFCD as set out in Paragraph 1.2.1 above and which meets all relevant regulations and all specifications in this Part VII, which include without limitation requirements for safety, health, environmental protection, hull form design features, structure, method and materials for construction and fitting out, stability, sub-division and operational efficiency.
- 1.5.2 The Vessel shall be designed and constructed in accordance with the Hovercraft Code published by the Maritime Coastguard Agency UK on 8 December 2015 as amended (Hovercraft Code), or equivalent. The Tenderer shall state in Schedule 9 of Part V which RO. Unless otherwise expressly stipulated in this Part VII, **(a) references to “RO” in this Part VII shall mean the RO as specified in Schedule 9; and (b) references to “RO Requirements” shall mean the requirement of the rules and regulations of the RO as specified in Schedule 9.** Notwithstanding the foregoing, where it is expressly permitted in this Part VII that in relation to a particular requirement, instead of the RO specified in Schedule 9, another RO which is any one of the ROs listed in Paragraph 2.4.5 (a) to (i) may be designated for compliance with the relevant requirement, references to “RO” shall mean such other RO.
- 1.5.3 The Vessel shall be issued with a Certificate of Compliance as described in Paragraph 2.4.2 of this Part VII by the RO as specified in Schedule 9. Certification of the Vessel refers to the process in facilitating the issuance of this Certificate of Compliance. Although a Hovercraft Safety Certificate of Compliance (Certificate of Compliance) is required instead of a full term Commercial Hovercraft Safety Certificate, this RO shall have received authorisation by a relevant government authority in issuing the full term Commercial Hovercraft Safety Certificate on that authority’s behalf. All plans, particulars and documentations which are required for the certification of the Vessel by the RO, in addition to those listed in Annex 3 to this Part shall be approved by the RO before submission to MD for endorsement and final approval prior to commencement of work. Any subsequent modifications or additions shall be treated in the same manner. Those drawings which are not required under ship certification 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 The Contractor shall design, build and supply the Vessel in full compliance with the requirements given in this Part VII which, to that extent, may be over and above what is normally required by any statutory and RO's rules and regulations. Should there be any contradiction between the rules and regulations of the RO and this Part VII, this Part VII shall prevail unless GNC stipulates or agrees otherwise.
- 1.5.6 Even if the Contractor may appoint a sub-contractor to design the Vessel with the prior written consent of the Government, the Contractor shall not be relieved of its obligations under the Contract through such appointment, and the Contractor shall be responsible for all acts, defaults and omissions of the sub-contractor as if they were its own.

1.6 Survey and Inspection

- 1.6.1 Tenderers shall note that the price of the Vessel quoted in Schedule 1 – Price Schedule in Part V shall be deemed to have included the cost of surveys to be carried out by the relevant RO in respect of that Vessel (if required to be arranged by the Contractor under the Contract).
- 1.6.2 All electronic items and their installations shall be approved and inspected by EMSD or EMSD representatives as part of the Technical Acceptance.
- 1.6.3 Subject to Paragraph 1.6.7 of this Chapter, an advance written notice of not less than five working days (if the Vessel is located in Asia), and ten working days (if the Vessel is located other than Asia) must be given to GNC before the representatives of GNC and other Government officers are invited to conduct a survey visit of the Vessel. The Contractor shall be fully responsible for any delay if the Contractor fails to give adequate notice as aforesaid.
- 1.6.4 The Contractor shall provide
- (a) an Implementation Timetable, in the form set out in Annex 2 to this Part VII, setting out the major milestones and their scheduled completion dates and incorporating the Delivery Dates specified in Schedule 2 of Part V;
 - (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(s) for the Vessel as stated in the Implementation Timetable shall be no later than those set out in Schedule 2 of Part V.

Notwithstanding anything in the Contract to the contrary, the Government may suspend payment of any of the instalment specified in Schedule 3 of Part V of the Contract if any of the timetables required herein has not been submitted for GNC's approval or GNC does not approve any of them or if the progress of work does not comply with any of them as approved by GNC.

- 1.6.5 A weekly work progress report with photos evidencing the progress and material/equipment procurement status is required to be submitted to MD during the construction of the Vessel. The weekly report shall be submitted before noon of every Monday.
- 1.6.6 MD may designate consultant(s) from private sector who will be authorised to represent the GNC in all technical matters including 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 AFCD officers during their survey visits and construction progress visits to the Vessel at the shipyard where the Vessel is constructed. The office space shall include, but not be limited to, two (2) desks, 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 work 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 by the Contractor in each working day.
- 1.6.10 The hours of work of MD officers or AFCD 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, ship handling at sea and performance tests, manoeuvring test, crash stop 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 officers. 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/GNC officers. The location of each person on board (which can affect the centre of gravity of the Vessel under trial) will need to be first agreed by the GNC.
- 1.7.4 The Contractor shall provide a trial report to GNC after completion of the above tests. The report shall contain information regarding the method of test, engine(s) running condition, sea, weather and wind conditions, Vessel loading condition, the heeling angles (steady or varying as the case may be) during each forward turning manoeuvre, and any other relevant information as required by GNC or GNC appointed consultant during the tests; and such information shall be prepared in a format agreed by GNC.

1.7.5 Official Speed Trial

- (a) The Official Speed Trial shall be carried out in the Hong Kong Waters. The Official Speed Trial shall be carried out in accordance with the latest edition of the Hovercraft Code published by the Maritime Coastguard Agency UK on 8 December 2015 as amended.
- (b) As part of the Technical Acceptance as specified in Paragraph 1.8.1 of this Chapter 1, the Contractor shall carry out the Official Speed Trial in the presence of GNC officers or their appointed agents.
- (c) The actual mean speed of the Vessel (i.e. NOT theoretical) shall be measured during the Official Speed Trial runs to determine if the Contract Speed can be achieved. The speed calculations must NOT be corrected by wind, wave, tidal current, shallow water effects and weather condition.
- (d) The actual mean speed shall be calculated as the arithmetic mean of not less than FOUR continuous runs, i.e. TWO runs in each direction. The speed for each run shall be taken by measuring the time of the Vessel running for one nautical mile between two poles or other measuring method acceptable to MD.
- (e) The Contract Speed is considered not achieved if the Contract Speed cannot be attained during the Official Speed Trial after a total of FIVE runs in each direction.
- (f) The Contract Speed to be achieved by the Vessel in the Official Speed Trial shall be the minimum highest achievable speed of 28 knots on water and 15 knots on ground, as specified in Paragraph 2.5.1 of this Chapter 2, with the engine power at 100% Maximum Continuous Rating (MCR) and the Vessel under Official Speed Trial Conditions as stated in Annex 5 to this Part. If the Vessel fails to achieve the 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.
- (g) The instrument use in measuring the Contract Speed for the Official Speed Trial shall be provided either by:
 - (i) the Contractor provided that the speed measuring device has been calibrated by a certified body in Hong Kong acceptable to GNC; or
 - (ii) Global Positioning System (GPS) supplied by the Government.

The GPS or Differential Global Positioning System (DGPS), which is properly calibrated (with supporting calibration documents) and installed on board the Vessel, is acceptable to GNC; or other speed measuring methods that are acceptable to GNC.
- (h) The Vessel must be in the trial conditions (see Annex 5 to this Part for the conditions of the trials) during the Official Speed Trial. All Equipment shall also have passed the Technical Acceptance and be in operation during the Official Sea Trial.
- (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) and the AFCD officers 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.

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

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

- (a) Endurance Test

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

- (b) Manoeuvrability Test

Forward turning circle tests to port and starboard sides shall be carried out. The minimum time for turning to both sides at 15°, 90°, 180°, 270° and 360° shall be recorded.

- (c) Moving on and off landing site and the cradle as detailed in Paragraph 3.13 of this Part VII, under representative loading condition.

- (d) Crash Stop Test

The minimum time and distance achievable by the Vessel when running from full ahead to stop.

- (e) Emergency Steering Test

An emergency steering test shall be carried out to ascertain that the Vessel can still be steered satisfactorily when the electrical power supply to the steering system has been disabled.

- (f) Anchoring Test

- (g) Slow and fast turning to port and starboard.

- (h) Trials shall be carried out to demonstrate that there is no undue vibration in the hull structure or machinery.

- (i) All other test and trials as required in the Hovercraft Code, including but not limited to Section 28 of the Hovercraft Code.

1.8 Acceptance and Delivery

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 and Crash Stop Tests as mentioned in the Paragraphs 1.7.6 (a), (b) and (d), the bench acceptance test and on-site commissioning test for ENE as mentioned in Chapter 7 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 Compliance as described in Paragraph 2.4.2 of this Part VII shall be issued by the relevant RO as specified in Schedule 9 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 8.2 of Chapter 8 of this Part, except Paragraph 8.2.1 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 Hong Kong based on an operation profile and minimum life expectancy as mentioned in this Part VII.

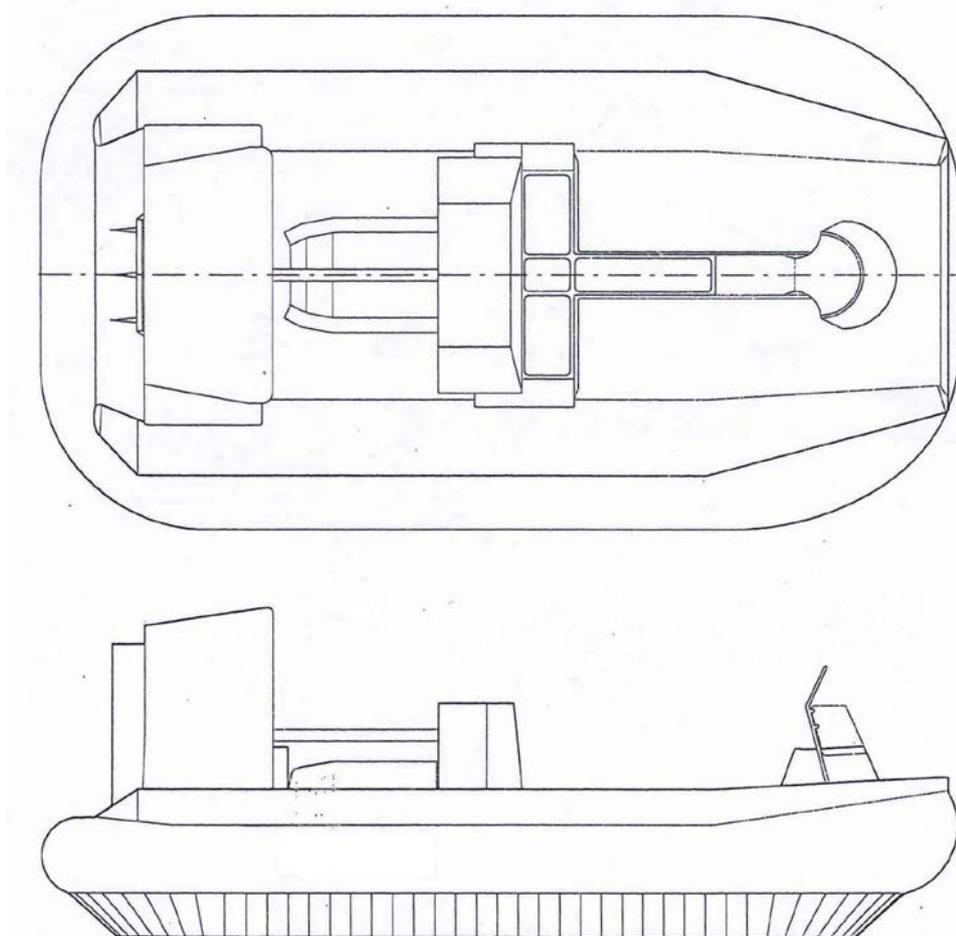
1.10.2 The above applies not only to main engines but also to all other Equipment, hull and skirting, etc., installed in the Vessel. Support and maintenance services must be available (i.e. serviceable) in Hong Kong in respect of all the Vessel and return of the whole or part of the Equipment to the original place of manufacturer or supplier shall not be necessary in order to carry out any repair work.

1.11 Asbestos Free

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

Chapter 2 General Technical Requirements

2.1 Conceptual General Arrangement Plan



2.2 General Provisions

- 2.2.1 Without prejudice to the generality of Chapter 1, this Chapter contains the more particular technical specifications for the Vessel. The significance of Essential Requirements are explained in Paragraph 1.1 of Chapter 1 above.
- 2.2.2 The work to be done under this Contract consists of the design, construction, outfit, testing and delivery of one (1) hovercraft for the Agriculture, Fisheries and Conservation Department. Workmanship, functions, characteristics and performance shall be in accordance with this Part VII, best marine construction practices, and the regulatory standards herein specified or otherwise applicable.
- 2.2.3 The Contractor is required to exercise its professional expertise and knowledge to come up with an appropriate design for the Vessel which can comply with all requirements of the Contract. The conceptual General Arrangement Plan shown above only serves as guidance and reference drawing to help to explain the tender requirements state in this Part VII.
- 2.2.4 During the design and construction of the Vessel, the Contractor is required to submit a detailed General Arrangement Plan (GA Plan) and all relevant construction drawings for GNC's approval and acceptance.
- 2.2.5 ALL the machinery, equipment and facilities, furniture, fixtures and fittings, including outfitting of the Vessel that are described in this Part VII, together with their requirements for design and installation standards that are stipulated in this Chapter and in any other parts of the TS, are the items that must be included in the complete "As-built" Vessel delivered to the Government.

2.3 General Description

- 2.3.1 The Vessel shall be a hovercraft with two engines for propulsion (thrust) and lift. The Vessel shall be an open hovercraft for carrying four (4) persons with seating provided, and has a payload of at least 350 kg. [E]
- 2.3.2 The hull of the Vessel shall be built in marine grade aluminium alloy or fiber reinforced plastic (FRP) suitable for the use in marine environment, sheltered waters overland and mud. [E]
- 2.3.3 The Vessel shall be designed for access to shallow water and intertidal mudflat for conservation, law enforcement purposes and amphibious search and rescue.

2.4 Rules and Regulations

- 2.4.1 The Vessel shall be designed and constructed in accordance with the latest edition of the Hovercraft Code or equivalent. [E]
- 2.4.2 The Vessel shall be issued with a Hovercraft Safety Certificate of Compliance (Certificate of Compliance), the Record of Particulars and Record of Equipment report (or a Record of Compliance Examination Against the MCA Hovercraft Code), as per Section 28 and Appendix 2 of the Hovercraft Code by the relevant RO. This Certificate of Compliance shall not be issued under any authority of any government, but shall be issued under the RO's own capacity in declaring full compliance with the Hovercraft Code. All plans, particulars and documentations which are required for facilitating the issuance of the Certificate of Compliance shall be approved by the RO before submission to GNC for endorsement and final approval prior to commencement of work. Any subsequent modifications or additions are to be treated in the same manner.
- 2.4.3 The Vessel shall be surveyed by the representatives of the RO during construction for compliance with the plans, particulars and documentations approved by the RO and by GNC, including relevant tests and trials. Records of survey shall be submitted to GNC at request.

2.4.4 The Contractor shall design, build and supply the Vessel in full compliance with the requirements given in this Part VII which, to that extent, may be over and above what is normally required by any statutory and RO's requirements. Should there be any contradiction between the RO requirements and this Part VII, the final decision shall rest with GNC.

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

- | | | |
|-----|---------------------------------------|-------|
| (a) | American Bureau of Shipping | ABS |
| (b) | Bureau Veritas | BV |
| (c) | China Classification Society | CCS |
| (d) | Det Norske Veritas Germanischer Lloyd | DNVGL |
| (e) | Korean Register of Shipping | KR |
| (f) | Lloyd's Register 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.
 - (i) IEC 60092 – 350, Electrical Installations in Ships – part 350: Shipboard Power Cables – General Construction and Test Requirements.
 - (ii) IEC 600332-1 (all parts), Test on electrical and optical fibre cables under fire conditions – Part 1: Test for vertical flame propagation for a single insulated wire or cable.
 - (iii) IEC 600332-3-22, Test on electrical cables under fire conditions – Part -3-22: Test for vertical flame spread of vertically mounted bunched wires or cable – Category A.
- (k) International Telecommunications Union recommendations in the International Radio Regulations (ITU-R).
- (l) Quality and standards of the welding shall comply with the rules of one of the ROs listed in sub-paragraph (a) to (i) above or American Welding Society (AWS) or other applicable international standards or rules acceptable by MD.
- (m) International Regulations for Preventing Collisions at Sea 1972, and its latest amendments.

- (n) International Organization for Standardization
 - (i) ISO 12215 – Small craft – Hull construction and scantlings
 - (ii) ISO 12216 – Small craft – Windows, portlights, hatches, deadlights and doors. Strength and watertightness requirements
 - (iii) ISO 10133 – Small craft – Electrical equipment – Extra low-voltage DC installations
 - (iv) ISO 7840 – Small craft – Fire resistant fuel hoses
 - (v) ISO 8846 – Small craft – Electrical devices – Protection against ignition of surrounding flammable gases
 - (vi) ISO 10088 – Small craft – Permanently installed fuel systems and fixed fuel tanks
 - (vii) ISO 13297 – Small craft – Electrical systems -- Alternating current installations
 - (viii) ISO 13929 – Small craft – Steering gear. Geared link systems
 - (ix) ISO 10592 – Small craft – Hydraulic steering systems
 - (x) ISO 9094-1 – Small craft – Fire protection
- (o) All equipment/fittings shall be designed and manufactured to at least the standards as specified in these Technical Specifications. When none of the rules and regulations in Paragraphs 2.4.5 (j) to (n) above are applicable, then the applicable standards specified by the applicable organisations below shall be complied with:

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

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

2.5 Contract Speed

- 2.5.1 In the fully loaded condition (i.e. full fuel plus four (4) persons on board) and with all engines running at their declared Maximum Continuous Rating (MCR), the guaranteed minimum highest achievable speed under the Official Speed Trial Conditions as stated in Annex 5 to this Part shall be as follows: [E]

Maximum instantaneous forward speed in still air on water:	28 knots	[E]
Maximum instantaneous forward speed in still air on hard and soft ground:	15 knots	

- 2.5.2 The Vessel shall also be designed for loitering operations. The Vessel shall be capable of operating at 2 to 5 knots. [E]

2.6 Principal Dimensions

Length Overall:	6.5 – 7 metres	[E]
Extreme Breadth:	3.5 – 4 metres	[E]
Maximum Height:	2.5 – 3 metres	[E]

2.7 Material of the Construction

Hull Structure:	Marine Grade Aluminum or Fiber Reinforced Plastic	[E]
Skirt:	Hypalon Loop and Natural Rubber Segments	[E]
Air Propeller (and Impeller) Blades:	Composite Material	[E]
Air Propeller Duct (Shroud):	Composite Material	[E]
Rudder(s):	Marine Grade Aluminum	[E]
Console:	Composite Material	[E]

2.8 Vessel Operating Profile and Environment

2.8.1 The Vessel shall be a twin-engine hovercraft with separate engine for propulsion (thrust) and lift, and separate fan for propulsion and lift. The Vessel shall be an open hovercraft for carrying four (4) persons with seating provided, and has a payload of at least 350 kg. [E]

2.8.2 Summary of Operational Hours / Range

Number of hours/day	10 hours/day	
Number of days/year	50 days/year	
Endurance for fuel capacity over ground and sea	4 hours at the patrol speed of 20 knots	[E]

2.8.3 The Vessel shall be able to operate (fulfil its operational roles) safely within Hong Kong on ground and sea surface. The vessel will deploy on mudflat areas outside the mangrove forest and along the major channel. It shall capable to operate over mud, very shallow water, swampland, marshland, beaches and concrete slipways, as well as deep water up to 0.6m wave height.

2.8.4 The Vessel shall designed against anticipated wind force up to 11 knots and wave height up to 0.6m.

2.9 Seakeeping and Manoeuvrability

2.9.1 The Vessel shall have good seakeeping performance in head wind speed up to 11 knots. In the service operation condition, the Vessel shall be stable and of high resistant to capsize with sufficient stability.

2.9.2 The Vessel shall have good manoeuvrability and quick response throughout its speed range when carrying its full load and complement.

2.10 Markings and Colour Scheme

2.10.1 The Contractor shall provide the markings and colour scheme for the Vessel. All painting colour scheme for the Vessel and fittings shall be approved by GNC before application.

- 2.10.2 All marks, names, insignia and other colour markings should be in a colour contrasting with the hull and consoles' colour. [D]
- 2.10.3 All labelling shall be both in Chinese and English and as per applicable rules and regulations. The AFCD logo shall also be displayed on both sides of the Vessel and at location as directed by the MD and AFCD.
- 2.10.4 The Vessel's name shall be marked permanently on both sides and console of the Vessel. Details of the size and calligraphy shall be confirmed by the MD and AFCD.
- 2.10.5 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.
- 2.10.6 Safety markings for the prevention of person tripping in the Vessel shall be provided where necessary.

2.11 Tally Plates

- 2.11.1 The following information shall be displayed on the builder's plate.
- (a) Builder's name;
 - (b) Vessel's name;
 - (c) Year of build;
 - (d) Maximum number of persons including the crew that the Vessel is designed to carry.
- 2.11.2 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/fitting as required.
- Information engraved on the tally plates shall include: service, function, mode of operation, source of power, fuse rating, voltage and warning and other information as required by MD.
- 2.11.3 Tally plates exposed to weather shall be made of durable and weatherproof material and be securely fastened.
- 2.11.4 List of tally plates shall be provided as directed by MD.
- 2.11.5 All cable termination shall be identified clearly for disconnection and reconnection.

2.12 Other Design Features

- 2.12.1 Berthing requirement of the Vessel shall match with the designated point of berth at Government Dockyard.
- 2.12.2 Permanent list is not allowed.
- 2.12.3 Permanent ballasts can only be used as agreed by GNC.
- 2.12.4 The Vessel shall be designed and constructed so that there is no undue vibration in the hull structure or machinery.

Chapter 3 Hull

3.1 Structures of the Hull and Scantlings

- 3.1.1 The Vessel shall be designed and built as a rigid inflatable fully amphibious hovercraft, the total weight of which is supported by an air cushion generated by an engine independent from the propulsion engine. Surface effect ship with side walls immersed in water while the Vessel is on cushion is not acceptable. The Vessel shall provide seats for four (4) persons. The hull structure shall be constructed of marine aluminium alloy, attached with full length inflatable sponsons surrounding the deck edges. The Vessel shall be fitted with replaceable landing pads or skids to facilitate parking. The Vessel shall be designed to support the maximum weight on three-quarters of the supports of the landing pad. The landing pads or skids are to be aligned with the hull supporting structure which shall be additionally stiffened where necessary.
- 3.1.2 The vessel's design stresses and load (wave height versus speed), maximum acceleration considered and scantlings calculation including internal structural members and skirt system shall be designed according to the RO rules and the Hovercraft code or equivalent. It shall be capable of withstanding stress coming from wave impact and operation environment conditions. All material 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 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 AFCD at or prior to the kick-off meeting.
- 3.1.4 The hull design shall incorporate bilge system which is capable of draining the cockpit in accordance with the requirements of the RO and the Hovercraft Code or equivalent.
- 3.1.5 The Vessel shall be constructed with watertight compartments or inflatable buoyancy tube around the outside of hull which provides buoyance when the Vessel is not on cushion. Watertight hatches shall be provided for the watertight compartments for ease of inspection.
- 3.1.6 The hull structure design loads shall be in accordance with the Vessel operational profile and other applicable requirements of the RO and the Hovercraft Code.
- 3.1.7 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. All construction materials shall comply with the requirements of the Hovercraft Code.
- 3.1.8 The up-to-date records of the structural materials, with identification details, being used for vessel construction shall be provided to GNC before and/or during the construction stage of the Vessel.
- 3.1.9 The Contractor shall carry out quality control throughout the construction of the Vessel by their quality control personnel.
- 3.1.10 Strength shall be maintained by ensuring hull structural continuity of main members including bottom and deck girders and transverse web frames. Where the strength of a main structural member is impaired by cuts or interruptions in continuity, efficient means of compensation shall be fitted. Special care shall be taken in reinforcing the hull in way of the fenders and areas likely to experience slamming.
- 3.1.11 The hull shall be fitted with appropriate sacrificial anodes suitable for the hull materials.

3.2 Weld and Fabrication

- 3.2.1 All welding and fabrication shall be performed according to the applicable requirements of any one of the Classification Societies listed in Paragraph 2.4.5 (a) to (i) of this Part VII.
- 3.2.2 Welded joints shall be designed and constructed carefully to conform to the latest established standards and shipbuilding practice to prevent fatigue and other failures. Cutting for edge preparation shall be performed by qualified persons to achieve the correct angle, shape, profile and smooth finish of the edges. Only qualified welders acceptable to the RO shall perform the welding work.
- 3.2.3 The Contractor shall submit certification of the qualifications of each individual welder and inspector. Welds installed using unqualified procedures or welding performed by non-certified welders shall be subject to removal by the Contractor at its own expense.
- 3.2.4 The structure fabrication and quality control regime shall include but not limited to the following:
- (a) Inventory of incoming material, consumables components and machinery;
 - (b) Traceability procedures for materials together with traceability identification codes which shall be serial and indexed to the controlled manufacturing procedures;
 - (c) Lofting, cutting, fit up, welding, forming and dimensions of structural components;
 - (d) Welding and inspection procedures identifying clearly the type and extent of NDT inspection carried out on the Vessels' structure. Normally, not less than 10% of the structure shall be subjected to Ultrasonic Test (UT) and Radioactive Test (RT);
 - (e) Machining, measuring and inspection equipment maintenance and calibration;
 - (f) Finish surfaces and bolting;
 - (g) Procedures for non-conformance reporting and rectification of defects; and
 - (h) Design and manufacturing drawing control and procedures for revisions, updates and reissue of drawings.

3.3 Skirt

- 3.3.1 The skirt shall be an open loop and segment type. The loop shall be made from rubber coated polyester weave. For ease of maintenance, the segments shall allow to be unbolted for replacement and the whole skirt system shall be accessible without having the Vessel lifted out of the parked position on hard surface.
- 3.3.2 The air cushion shall have sufficient depth to provide stable performance whilst going into wind and waves, also traverse over higher obstacles and mounds.
- 3.3.3 Details of the skirt system with detail dimensions and specifications shall be submitted to the RO and MD, including but not limited to the following:
- (a) The skirt is securely attached around its periphery and shall be suitably reinforced by the use of backing plates;
 - (b) Where the skirt is retained by bolting the retaining bars are to be as long as practicable with a fastener spacing of not more than 50 mm; and

- (c) Where the design of the skirt is such that the flexible edge is retained by the use of a pre-formed channel, only the bolted hull connection of the preform to the hull structure is considered.

3.3.4 The construction and materials of the skirt shall also comply with the Hovercraft Code, Section 4.8, or equivalent.

3.3.5 The skirt system shall be such as to ensure adequate stability when hovering on cushion under all operating conditions. The skirt shall be designed by taking Sections 11.1, 11.4 and 11.5 of the Hovercraft Code into account. Please refer to Paragraph 3.4 of this Part VII below.

3.4 Stability

3.4.1 The offered Vessel shall meet the stability requirements of the RO and the Hovercraft Code or equivalent. [E]

3.4.2 The Vessel is required to comply with the intact stability requirements when the Vessel is in the displacement mode (off cushion stability – intact), on cushion stability, off cushion stability – open craft swamped, person recovery stability test and operational damage stability requirements of the RO and the Hovercraft Code or equivalent.

3.4.3 The skirt system shall be such as to ensure adequate stability as required in Section 11 of the Hovercraft Code.

3.4.4 When the Vessel is floating with the lift system not operating, the freeboard shall be not less than 200 mm, where details of freeboard measurement are given in Section 12 of the Hovercraft Code.

3.4.5 Final stability assessment result shall be delivered to MD prior to the Official Sea Trial mentioned in Paragraph 1.7 of this Part VII.

3.5 Painting

3.5.1 Paints shall be of a fire-retardant marine quality and applied in accordance with the manufacturer's specification.

3.5.2 The volatile organic compounds (VOC) content limits of the paints shall comply with the Hong Kong Air Pollution Control (Volatile Organic Compounds) Regulations CAP 311W.

3.5.3 The Painting Schedule shall be submitted for MD's approval before commencement of work. The proposal shall contain a list and the detailed specification of the paint intended to be used. Thickness of each coating shall be specified.

3.5.4 The Contractor shall guarantee all painting work for one (1) year against defects in material and workmanship. At Delivery Acceptance the Contractor shall provide MD with a letter of certification from the paint manufacturer signed by coating inspectors with qualifications of NACE Level 2 or FROSIO Level III, to certify that the paint was applied under the paint manufacturer's quality control and in accordance with the manufacturer's requirements including but not limited to the surface preparation (blasting profile and water soluble salt content), surface temperature of the metal surfaces above dew point, atmospheric conditions, (temperature and relative humidity), dry film thickness and method of application.

3.5.5 A Tributyltin (TBT) free fouling-release/anti-fouling paint shall be applied on the exterior of the hull below the water line to provide at least two years protection against marine growth. A TBT free certificate issued by the paint manufacturer shall be submitted before the Delivery Acceptance. The fluoropolymer foul release coating / antifouling paint (e.g. Intersleek 1100SR or equivalent) shall comply with the International Convention on the Control of Harmful Anti-fouling Systems on Ships.

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

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

3.6 Console

3.6.1 The offered Vessel shall have an operational console. The layout of the console shall be submitted for MD's approval before any construction work on the consoles commences. To facilitate the efficient visualisation and inspection of the design of the console, the Contractor, apart from a drawing submission on a layout plan, is required to build a full size mock up to show the positions and arrangement of deckplate, seats, the ENE, and any other fixtures that may influence on user friendly operational convenience and, ease of accessibility for inspection and maintenance, are to be manufactured for inspection, modification (if necessary) and confirmation by MD and the AFCDC. The console of an existing craft may be used as the basis for initial discussions.

3.6.2 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.

3.6.3 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.

3.6.4 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 190 degrees.

3.6.5 The control 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.

- (a) Steering handle bar with engine throttle control;
- (b) Engine monitoring display panel;
- (c) Engine start control;
- (d) Loudhailer control unit and microphone;
- (e) 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;
- (f) Electric horn;
- (g) Siren and flashing beacon control panel;
- (h) Navigation lights, search lights and flood lights switch panel;
- (i) GPS receiver; and
- (j) Fuel tanks level gauge, if possible.

3.6.6 The controls, displays and equipment

- (a) All the controls, displays and equipment shall be waterproof, shockproof and suitable for external marine use.

- (b) All indication lights, illumination of instrumentation gauges and panel lighting shall be fitted with dimmers for day and night operation.
- (c) Lockers shall be provided, if space permits, to allow for the watertight storage of items of officer's equipment. The console and locker(s) shall be designed to ensure easy access for the maintenance and repair of equipment mounted, installed or stored therein.
- (d) The arrangement shall be designed to protect the crew and persons on board from injury inflicted by the console and the equipment installed on them.
- (e) Sufficient legroom shall be provided to obviate the risk of impact injury during rough weather or hard manoeuvres in both the seated and standing positions.
- (f) A waterproof black/grey cover shall be provided to cover the console down to deck level when the Vessel is not in use;
- (g) Vibration absorbing mats shall be provided on the deck.

3.7 Lockers/Void Spaces

3.7.1 Lockers / Void Spaces

- (a) Watertight lockers/storage acceptable to the AFCD shall be provided.
- (b) The location and dimensions of lockers or other storage acceptable to the AFCD shall be discussed at the kick-off meeting and agreed by the AFCD.
- (c) Lockers or other storage acceptable to the AFCD shall be provided for one set of emergency repair tool kit and all lifejackets onboard.

3.7.2 Air pipes shall be fitted to all tanks, cofferdams, void spaces, tunnels and other compartments which are not fitted with alternative ventilation arrangements.

3.7.3 The design of lockers or other storage acceptable to the AFCD, or void spaces and their mounting facilities, shall be approved by MD and the AFCD during the kick off meeting. Lockers or other storage shall be ready in the mock-up for inspection before finalisation.

3.8 Deck, Seating and Attachment Systems

3.8.1 High quality upholstered bench seating for four (4) persons, anti-vibration deck covering and handrails shall be provided to reduce the risk of impact injury and long-term health damage to both coxswain and boarding officers resulting from the harsh maritime environment in which the Vessel will operate.

3.8.2 The seats shall be designed to prevent occupants from falling or being thrown onto the deck or overboard, to optimise body posture thereby minimising the potential for spinal or other injuries and to mitigate the potentially harmful forces to which the Vessel and crew conducting the type of operations specified in Paragraph 1.2.1 according to the operational profile specified in Paragraph 2.8 of this Part VII may be subjected.

3.8.3 Basic requirements of the seats:

- (a) Materials of upholstery: Water resistant materials such as fire retardant foam/reinforced nylon laminated neoprene/heavy duty cordura laminate.
- (b) Protective covers: Covers shall be supplied to protect all of the seats from rain and ultraviolet radiation when not in use.

- 3.8.4 Suitable handrails and grips, coated with appropriate anti-slip material, shall be provided at the console and at other locations around the Vessel to enable operators to move safely around the Vessel at all times.
- 3.8.5 All flat, horizontal surfaces above deck level where personnel may step shall be coated with an appropriate anti-slip material.
- 3.8.6 The designs of the fixtures, fittings and finishing specified shall be discussed during the kick-off meeting and drawings shall be submitted to GNC of MD and AFCD within one month from the date of the kick-off meeting for approval.

3.9 Gunwale Fittings

- 3.9.1 All gunwale fittings such as cleats and bollards shall be designed to minimise the risks of line tangling or snagging. All deck level tie-down points shall be flush fitting or removable to minimise trip hazards.

3.10 Stern Area

- 3.10.1 The stern area shall be designed to provide safe and easy access to the machineries for routine checking and troubleshooting including while the Vessel underway at sea.
- 3.10.2 All machineries shall be protected by a suitable guard. Details of the design shall be discussed at the kick-off meeting and submitted to the MD for approval before the completion date stipulated in Annex 2 to this Part VII.

3.11 Anchor, Chains and Strong Points

- 3.11.1 The Vessel shall be equipped with one aluminium or stainless anchor with certificate issued by the RO and suitable swivel, shackles and secured stowage shall be provided by the Contractor.
- 3.11.2 Two 30 m long 20 mm diameter braided nylon warps for anchoring and towing shall be provided by the Contractor in a suitable stowage.
- 3.11.3 Two 30 m long 16 mm diameter nylon warps for mooring shall be provided by the Contractor in a suitable stowage.
- 3.11.4 The strong points shall be designed and installed with sufficient safety factor to prevent material yield of the strong points or surrounding structures to which they are attached in a welded condition. Calculation of the horizontal load shall be in accordance with the requirements of ISO 15084 or other equivalent international standards. The following strong points shall be provided:
 - (a) Anchoring/towing point forward (port and starboard);
 - (b) Mooring point aft (port and starboard); and
 - (c) Lifting strong points for a four-point lift.
- 3.11.5 Devices for Lifting the Vessel
 - (a) The Vessel shall be provided with two means of lifting for docking, storage, inspection and maintenance purposes, designed for use with fixed jib cranes, telescopic cranes, travel hoists and truck mounted cranes:

(i) 4-Points Lifting Method

The Vessel shall be designed with strong point lifting attachments permanently fitted to the hull. A spreader shall be provided if the bending stress induced during lifting exceeds the Vessel's permissible tolerance or if the lifting wires/strops would otherwise foul the radar frame or equipment fitted thereto. The design of the lifting attachments, wires/strops and spreader, etc, shall be approved by the RO complying with Hong Kong Merchant Shipping (Local Vessels)(Works) Regulation and shall match, where practical, the lifting facilities at the AFCD's operational bases.

(ii) Lifting Slings Method

The Vessel shall be designed to allow the Vessel to be hoisted ashore by means of lifting slings around the hull with permanent markings at designated points. The hull structure shall, if it is necessary, be strengthened appropriately and the locations at which the slings are to be positioned shall be marked clearly.

- (b) The lifting points and locations shall be designed and installed with sufficient safety factor to prevent material yield of the strong point or surrounding structure in a welded condition. Detailed drawings of the lifting arrangements shall be approved by the RO.

3.11.6 All the lifting devices/accessories shall be designed to withstand at least six times the mass of the Vessel with all the equipment. All devices and accessories shall be certified by the RO in accordance with the laws of Hong Kong prior to delivery. The 4-point lifting and lifting sling method designs shall be discussed at the kick off meeting and agreed by MD and AFCD. To avoid the need for costly and unnecessary alteration or modification of existing equipment, the Contractor shall, prior to any construction, submit detailed drawings of both methods so that AFCD can check dimensional compatibility with its existing lifting facilities.

3.12 Cathodic Protection

3.12.1 Sacrificial Anodes

- (a) Sacrificial anodes suitable for the hull materials shall be installed on the hull
- (b) The hull shall be provided with adequate cathodic protection to protect the Vessel against corrosion for one year.

3.13 Cradles

3.13.1 The Contractor shall supply the Vessel with a suitably designed metal slipping cradle with appropriate safety features on which the Vessel can be slipped ashore and tied down during tropical cyclones. The cradle shall have stoppered wheels and shall be designed to be towed by plant within the AFCD's operational base compounds and be steerable for manual positioning. This cradle is not required for use on public roads. The design shall be submitted to MD for approval.

Chapter 4 Machinery

4.1 General Requirements

- 4.1.1 The Contractor should note that the Vessel is for use in Hong Kong and it is desirable that the main engines and any other machinery offered by the Contractor are those at present commonly used by ships operating in Hong Kong Waters, and that they have good support for spare parts and after sale services locally in Hong Kong.
- 4.1.2 The Vessel shall be powered by two engines for propulsion (thrust) and lift. Both engines shall be four-stroke diesel engines of adequate power to deliver the Contract Speed as stated in Paragraph 2.5 of this Part VII. [E]
- 4.1.3 If either engine is having an output power of 130 kW or more, such engine(s) shall have the Type Approval Certificate(s) issued by an RO or other entities acceptable by MD in compliance to meet IMO Tier 2 emission requirements, and shall be provided to MD. [E]
- 4.1.4 The design and installation of machineries shall comply with the requirements of the RO and the Hovercraft Code or equivalent.
- 4.1.5 The Contractor shall be responsible for ensuring the correct installation and setting up of the engines including the choice of air propellers and lifting fans in accordance with the manufacturer's recommendations
- 4.1.6 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.
- 4.1.7 Sufficient space 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, 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.
- 4.1.8 The electrical cables, piping for diesel and hydraulic oil lines run between the console, fuel tanks and the stern shall be suitably designed for ease of maintenance. They shall be supported properly to prevent chafing and unnecessary tension.
- 4.1.9 Each engine system shall include the following accessories:
- (a) 12V electrical alternator and remote starting control;
 - (b) Dead-man switch and 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.
- 4.1.10 The Contractor shall supply the Vessel with a comprehensive vessel information and display on the displays located at the console information including but not limited to the following:
- (a) Engine rpm;
 - (b) Engine running hours;

- (c) Oil temperature and pressure;
- (d) Fuel level and range until the fuel tank is empty;
- (e) Battery voltage;
- (f) Course and speed;
- (g) Engine faults and notification alarms; and
- (h) Any other data which the supplied system and outboard engines are capable of generating.

4.2 Propulsion and Lift System

4.2.1 The Vessel shall be operated by a propulsion (thrust) and lift system. The diesel propulsion engine and diesel lift engine shall drive the propulsion fan and axial (lift) fan.

4.2.2 Propulsion and Lift Engine

- (a) The vessel shall be powered by two (2) diesel engines for propulsion (thrust) and lift to have efficient control in slow manoeuvres.

4.2.3 Air Propeller and Lifting Fan

- (a) The Vessel shall be equipped with one (1) air propeller as part of the propulsion (thrust) system and one (1) lift fan to reduce over hump speed and more improves overall performance of the vessel. The air propeller and lifting fan shall be made of composite material and suitable for the use in the environment condition that the Vessel will be operated.
- (b) The front of the air propeller and the top of lift fan shall be protected by suitable size of mesh guard in accordance with the requirement of the Hovercraft Code or equivalent.
- (c) Composite fan duct (shroud) shall be fitted for the air propeller for enhancing the safety and performance of the Vessel.
- (d) The failure of one air propeller or lift fan, or its control system, shall not render any other air propeller or lift fan inoperative.
- (e) The propulsion and fan system shall comply with the requirements of the RO and the Hovercraft Code or equivalent.

4.3 Rudder System

4.3.1 Directional control of the vessel shall be provided by a air rudder type manoeuvring system, which consists of vertical aluminium rudders abaft of the propeller or fan, which are being controlled from the steering console, allowing the craft to manoeuvre and turn in its own length.

4.4 Engine Compartments

4.4.1 All engine compartments shall have weathertight hatches/covers/casings, which are made of GRP or Marine Grade Aluminium, so as to allow optimal reach for maintenance and to facilitate visual check of the engine and other main components of the Vessel.

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

4.5 Fuel Oil Tank

- 4.5.1 The fuel oil of the engines shall be supplied from one or more fuel oil tanks. The maximum capacity of the fuel tank(s) shall provide endurance of the Vessel for 4 hours at the maximum speed capability of the Vessel. The Contractor shall design and locate the fuel oil tank in accordance with the RO and the Hovercraft Code or equivalent.
- 4.5.2 Fuel filters shall be provided on the suction side of the fuel pump. The system design and filtration systems shall be approved by the engine manufacturer.
- 4.5.3 The tanks shall be hydrostatically tested as required by an approved standard and connections shall be proven tight.
- 4.5.4 The Contractor shall provide the initial fills of fuel oil, lube oil, coolant, and hydraulic fluids using fluids and additives prescribed by engine manufacturer. The Contractor shall provide a summary listing of all fluids and quantities used.
- 4.5.5 All materials used in the fuel system shall be resistant to deterioration by its designated fuel and to other liquids or compounds with which it may come into contact under normal operating conditions, e.g. grease, lubricating oil, bilge solvents and sea water.
- 4.5.6 Fuel Oil Tank(s)
- (a) Fuel oil tank(s) shall be arranged to allow the Vessel to operate at acceptable trim in all operating conditions and with consideration for the requirements for good static and running trim, ensuring unobstructed visibility. The Vessel shall be designed and built with one or more fuel tank(s) to service the Vessel's engines. The tank(s), if more than one, shall be interconnected.
 - (b) The location of the fuel oil tank(s) shall not render the Vessel being non-compliance with the requirements given in this Part VII.
 - (c) The fuel oil tank(s) shall sustain the loads due to the mass of the fully filled and partially filled tank(s) 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) A quick closing valve or cock shall be fitted in the fuel supply line pipe as close as possible to the fuel tank (or each fuel tank if there is more than one fuel tank) or a spill proof fuel pipe connector which allows rapid disconnection of the fuel supply in emergency.
 - (e) Provisions to the fuel oil tank
 - (i) A tank content gauge shall be fitted in the console. A level gauge in litres shall be provided for each tank;
 - (ii) Suitable provision such as drip tray shall be made for collecting the oil discharge;
 - (iii) The tanks shall be designed and installed to prevent water from being trapped on the exterior surface;
 - (iv) Tank drain shall be provided;
 - (v) The fuel oil tank shall be fitted with ventilating device acceptable to GNC.

4.6 Bilge System

- 4.6.1 The Vessel shall be fitted with a bilge system to the requirements of the RO and the Hovercraft Code or equivalent.
- 4.6.2 A bilge audible and visual alarm panel shall be fitted in the console.
- 4.6.3 Electric bilge pumps with manual back up shall be provided by the Contractor. Details of the design shall be discussed at the kick-off meeting and submitted to the MD for approval before the completion date stipulated in Annex 2 to this Part.
- 4.6.4 The Vessel shall be designed and constructed to minimise the potential for the accidental overboard discharge of pollutants (oil, fuel).

Chapter 5 Electrical System

5.1 General Requirements

- 5.1.1 All the electrical equipment and installation shall meet the RO Requirements or the Hovercraft Code or equivalent.
- 5.1.2 Engine alternators, at idle conditions, shall provide sufficient power to maintain the battery charged.
- 5.1.3 All electrical equipment, fittings, instruments, switches, cables, insulation, sheathing, circuit breakers, rating standards and their installations shall comply with the latest Regulations of the International Electro-technical Commission (hereinafter referred to as IEC), Electrical Installations in Ships. The electrical system shall be an insulated two-wire Direct Current (DC) system. The hull shall not be used as a current-carrying conductor.
- 5.1.4 Protective devices such as circuit breakers or fuses shall be provided at the source of power, e.g. the switchboard, to interrupt any overload current in the circuit conductors before heat can damage the conductor insulation, connections or wiring-system terminals.
- 5.1.5 The electrical equipment shall be capable of operating simultaneously without causing interference to any electronic equipment including the compass. The system shall provide sufficient power to operate all installed electrical systems using a 12-volt DC System.
- 5.1.6 The Vessel shall be supplied with a comprehensive wiring diagram schematic. The Contractor shall submit a layout plan showing the exact locations of the Equipment. All Equipment shall be easily and safely accessible for inspection and maintenance.
- 5.1.7 Essential drawings and detailed particulars (such as the rating and capacity, type of all electrical equipment as well as the wiring, circuit breakers, lighting and sockets) shall be submitted for the MD's approval before the completion date stipulated in Annex 2 to this Part VII.
- 5.1.8 Detailed wiring diagrams of the complete supply and distribution network, including wire size, insulation and sheathing shall be approved by the RO when required by the rules and submitted for the MD's approval before the completion date stipulated in Annex 2 to this Part VII.
- 5.1.9 Adequate clearance shall be maintained around equipment to provide space for resiliently mounted equipment excursion, for ventilation and maintenance. Shields shall be installed as necessary to protect electrical equipment from drips or spray resulting from normal operation of or damage to, piping systems. Insofar as practical, equipment shall be located to reduce the possibility of damage or malfunction caused by partial flooding of the space in which the equipment is located and to protect the equipment from accidental physical damage.
- 5.1.10 All 12-volt DC equipment shall function over a voltage range of 10.5V to 15.5V at the battery terminals.
- 5.1.11 The length and cross-sectional area of conductors in each circuit shall be such that the calculated voltage drop shall not exceed 10% of the nominal battery voltage for any appliance when every appliance in the circuit is switched on at full load.
- 5.1.12 The Contractor shall submit a layout plan showing the exact locations of the Equipment. All Equipment shall be easily and safely accessible for inspection and maintenance.
- 5.1.13 All Equipment installed shall be accompanied by operation and maintenance manuals.

5.1.14 The Equipment's installation standards shall serve to enhance safety and not present hazards to the operators, 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 recognisable labels.

5.2 Batteries

5.2.1 At least one group of 12-volt maintenance-free batteries shall be provided for engines and shipboard services.

5.2.2 The capacities of the batteries shall be sufficient to provide at least six (6) consecutive starts of the engines from cold without recharging and maintain an uninterrupted power supply to the shipboard services (e.g. navigation lights, general lights, alarm).

5.2.3 A separate battery shall be dedicated to the emergency services (e.g. radio communications and signalling, emergency and navigation lights) is required and conform to the RO Requirements specified in Schedule 9.

5.2.4 The engine-driven alternators shall be able to charge the batteries and to provide 12V DC power to the shipboard services.

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

5.2.6 In consideration of the intended operational role of the Vessel, the batteries shall be installed in a manner that restricts their movement horizontally and vertically. A battery, as installed, shall not move more than 10 mm in any direction when exposed to a force corresponding to twice the battery's weight.

5.2.7 Batteries shall be installed, designed or protected so that metallic objects cannot come into unintentional contact with any battery terminal.

5.2.8 Batteries, as installed, shall be protected against mechanical damage at their location or within their enclosure.

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

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

5.2.11 Battery cable terminals shall not depend upon spring tension for mechanical connection.

5.2.12 All circuits (with the exception of those required for starting the engines and powering navigation lighting, electronic devices with protected memory and protective devices such as bilge pumps and alarms, which are to be protected individually with a circuit breaker or fuse as close as practical to the battery terminal) will be connected to the supply system voltage in a readily accessible location through a master battery disconnection switch, installed at or as close as possible to the positive conductor from the battery, or group of batteries.

5.3 Distribution Network

5.3.1 12V DC services shall be supplied from the switchboard in the 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 the consoles;
- (f) Hand-held searchlight;
- (g) Siren;
- (h) Electric bilge pumps; and
- (i) All other navigational and electronic equipment (as applicable).

5.4 Cables

- 5.4.1 No electrical equipment, components or cables shall run through or be installed inside the petrol tanks' compartments.
- 5.4.2 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.
- 5.4.3 Sheathed cables and battery cables to the battery disconnection switch shall be supported at maximum intervals of 300 mm, with the first support not more than one metre from the terminal. Other sheathed cables shall be supported at maximum intervals of 450 mm.
- 5.4.4 Conductors which may be exposed to physical damage shall be protected by sheaths (armoured cables), conduits or other equivalent means. Cables passing through bulkheads or structural members shall be protected against damage to insulation by chafing.
- 5.4.5 The metallic sheathing, armour or braid of cable shall be earthed properly at both ends. All bare terminals shall be insulated properly with approved cable insulators.
- 5.4.6 Wiring shall run along conduits with openings and be secured in such a manner as to allow easy maintenance. Type approved cable penetrations shall be provided at the openings of watertight compartments or deck penetrations.

5.5 Overcurrent Protection

- 5.5.1 A manually reset trip-free circuit-breaker, or a fuse, shall be installed within 200 mm of the source of power for each circuit or conductor in the system or, if impractical, each conductor shall be contained within a protective covering, such as a sheathing conduit or cable trunking, for its entire length from the source of power to the circuit-breaker or fuse.
- 5.5.2 The voltage rating of each fuse or circuit-breaker shall not be less than the nominal circuit voltage. The current rating shall not exceed the value for the conductor of smallest diameter in the circuit.

5.6 Switchboard (Panel Board)

- 5.6.1 Switchboards or panel boards shall be installed in such a way that the control elements, indicating instruments, circuit-breakers and fuses are readily accessible. The terminal side shall be accessible.
- 5.6.2 Connections and components on panel-boards shall be in locations protected from the expected conditions in conformity with IEC 60529:

- (a) IP 67 as a minimum, if exposed to short-term immersion; IP 55 as a minimum, if exposed to splashing water;
- (b) IP 20 as a minimum, if located in protected locations inside the Vessel.

5.6.3 Panel-boards (switchboards) shall be marked permanently with the nominal system voltage.

5.7 Receptacles/Sockets

5.7.1 Receptacles/sockets installed in locations subjected 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.

5.8 Lighting

5.8.1 All lighting, including the navigation lights, shall be equipped with LED bulbs and digital switching.

5.8.2 Independently controlled dimmable walkway lights shall be supplied to cover the fore and aft decks and Vessel's sides.

5.8.3 The arrangements and positioning of the lighting shall be discussed at the kick-off meeting and shall be agreed by the AFCD.

5.9 Navigational and Signalling Equipment

5.9.1 Navigation Lights

- (a) Navigation lights shall comply with the requirement specified in the International Regulations for Preventing Collisions at Sea 1972 (as amended by IMO Resolution A. 464 (XII) and A. 626 (XV)).
- (b) The lights shall be controlled from the control and alarm panel at the console. Each navigation light circuit shall be provided with a switch, protection fuse, indicating lamp and alarm.
- (c) A dimmer(s) for the panel indication lights, buzzer stop and lamp test buttons shall be fitted.
- (d) Navigation light circuits shall be independent of any other electrical circuits. There shall be two separate power supply systems to the distribution board.
- (e) The following navigation lights shall be provided together with double-pole circuit-breaker:
 - (i) Port side light;
 - (ii) Starboard side light;
 - (iii) Stern light;
 - (iv) Masthead light; and
 - (v) Anchor light;
 - (vi) An air-cushion vessel when operating in the non-displacement mode shall, in addition to the lights prescribed in Rule 23 in COLREG, exhibit an all-round flashing yellow

light.

- 5.9.2 Type Approval Certificates for all navigation lights shall be submitted prior to Delivery Acceptance.
- 5.9.3 The Contractor shall provide the following signalling equipment of a type approved by the AFCD:
- (a) One siren; and
 - (b) One horn.

5.10 Lightning Protection

- 5.10.1 The Vessel shall be fitted with a proven lightning protection system to protect the personnel on board and the electronic equipment installed. The method and working principle of protection shall be approved by the RO before submission to MD by the completion date stipulated in Annex 2 of this Part VII for endorsement.

5.11 Searchlight

- 5.11.1 The Contractor shall supply a high-powered hand-held white searchlights. They shall be connected to sockets on board with coiled extension cables of appropriate lengths. Sockets shall be installed on both the port and starboard sides of the console. Facilities for storing the hand-held searchlights shall be provided. The type of searchlight, the length of the extension cables, the positioning of the sockets and the stowage shall be discussed at the kick-off meeting and shall be agreed by the AFCD.

5.12 Floodlight

- 5.12.1 Independently controlled high-powered white floodlights shall be supplied to cover the fore and aft decks and Vessel's sides.

Chapter 6 Life-Saving Appliances (LSA) and Fire-fighting Equipment

6.1 General Provision

6.1.1 The life-saving appliances and fire-fighting equipment shall comply with the RO Requirements and the Hovercraft Code as applicable.

6.2 Lifesaving Appliances

6.2.1 The lifesaving appliances shall include a life ring buoy with marker light and a rescue quoit with line attached.

6.2.2 Four (4) self-inflatable life jackets shall be provided.

6.3 Fire-fighting Equipment

6.3.1 Two of 2-kg dry powder fire extinguishers shall be provided with holding rack.

Chapter 7 Electronic Navigational Equipment

7.1 Description of Electronic Equipment System

- 7.1.1 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 for the following equipment/systems to be fitted on board the Vessel:
- (a) Loudhailer/Siren and Public Address System with USB player
 - (b) Magnetic Compass
 - (c) International Maritime Mobile VHF Radio Compatible with GMDSS
 - (d) GPS / DGPS Receiver
- 7.1.2 The Contractor shall provide all labour, material, transportation, installation calibration, testing and commissioning, Warranty Services in Warranty Period and test equipment etc. which are necessary to complete the work required in this chapter.
- 7.1.3 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 onboard.
- 7.1.4 All components of the Equipment exposed to the weather shall be sea water resistance. Internal components shall be fully enclosed with heavy duty seals and sufficient heat dissipation mechanism (e.g. ventilation, conduction, etc.) to protect the Equipment.
- 7.1.5 All electronic equipment and electrical appliances shall have Hong Kong warranty and their on-site maintenance shall be locally available.
- 7.1.6 The circuit-breaker for the electronic equipment shall equip with lockout device so that the breaker can be locked during the equipment maintenance.
- 7.1.7 Lightning protection shall be provided and installed wherever applicable. The lightning arresters for all outdoor antennas shall be installed at the antenna ends.
- 7.1.8 Equipment supplied shall complete with all standard and/or maker recommended accessories as required for normal operation.

7.2 Loudhailer / Siren and Public Address System with USB player

- 7.2.1 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.
- 7.2.2 Loudhailer/Siren
- (a) The system shall comprise a master control unit in 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 wheel house 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 front panel of the master control unit and the fist microphone shall be splash-proof, and preferably water-proof.
- (f) The amplifier shall be with a rated power output of not less than 30 watts per speaker and shall have the following characteristics:
 - (i) Mic in (Hail) sensitivity : 10 mV or better
 - (ii) Hail distortion : Not greater than 10% at rated power output at 1 kHz
- (g) The horn type loudspeaker shall be weatherproof reflex type, and with an impedance compatible with the amplifier and with power rating not less than 30 watts.
- (h) A USB player shall be provided with the system in such a configuration that the audio signal from the USB player can be broadcasted through the loudhailer system.
 - (i) An electric fog horn shall be installed.

7.2.3 Public Address System

- (a) There shall be at least two (2) 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 loudhailer/siren system, control panel and both the position & quantity of speakers of public address system shall be finalised in the detailed design stage.

7.3 Magnetic Compass

7.3.1 The Contractor shall provide one magnetic compass.

7.3.2 The compass dome shall be constructed of heavy duty, optically clear polymer, and shall provide clear and accurate magnification of the dial.

7.3.3 Performance requirements of magnetic compass:

- (a) Card Diameter 100 mm or larger

- (b) Resolution 2° or better
- (c) Reading Top or direct
- (d) Mounting option Binnacle or flush or bulkhead mount
- (e) Compensator Built-in
- (f) Waterproofing IPX5 or better

7.4 International Maritime Mobile (IMM) VHF Radio compatible with GMDSS

7.4.1 The IMM VHF radio shall be of a type approved make by The Office of Communication Authority of Hong Kong.

7.4.2 The Radio shall be fully compatible to Global Maritime Distress Safety System (GMDSS) and equipped with a lithium battery of lifetime at least 5 years.

7.4.3 The Radio shall be a class A Digital Selective Calling (DSC) transceiver fully compatible with the International Maritime Organization (IMO) GMDSS carriage requirements.

7.4.4 The equipment shall be equipped with all the entire international maritime VHF channels complete with a fist microphone with press-to-talk switch or telephone handset, mic/handset hanger, mounting bracket and loud speaker.

7.4.5 The equipment shall be able to dual watch Channel 16 and another channel of the operator's choice.

7.4.6 The equipment shall complete with antenna and integrated microphone, loudspeaker, control knobs/keys, display screen, etc., necessary for a stand-alone operation. The equipment including the main unit shall be waterproof to IPX6 or better.

7.4.7 The following facilities shall be provided at the front panel of the equipment:-

- (a) Power ON/OFF;
- (b) "Transmit" indicator, volume and squelch controls;
- (c) Socket for plug for microphone and external speaker;
- (d) Quick selection of Channel 16 (156.8 MHz);
- (e) Channel selection and indicator;
- (f) Dual watch mode selection; and
- (g) Transmission power selector for HIGH and LOW Power (5W/ 1W).

7.4.8 Performance Requirements

(a) Transmitter Characteristics

Frequency Range:	156.025 MHz to 157.425 MHz, or better
Frequency Deviation:	Frequency modulation with maximum frequency deviation of +5 kHz
Spurious and harmonics emissions:	-65 dB or better
RF Output Power:	5/ 1W(High / Low)

(b) Receiver Characteristics

Frequency Range:	156.050 MHz to 161.425 MHz, or better
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

7.4.9 Aerial and Feeder

- (a) The aerial provided shall be marine type aerial with at least 3 dBi gain, vertically polarized, omni-directional and suitable for mounting on the launch.
- (b) The V.S.W.R. of the aerial installed shall be less than 1.5 : 1
- (c) The aerial feeder shall be RG58U type or equivalent.
- (d) Coaxial cable lightning suppresser with appropriate earthing connection shall be provided for protecting the radio equipment. All outdoor connector joint should be properly covered by waterproof tape or material.

7.5 GPS / DGPS Receiver

- 7.5.1 One set of GPS / DGPS receiver complete with antenna units shall be installed.
- 7.5.2 Capable of input not less than 20 routes of 100 waypoints with 20 character alphanumeric names and icons.
- 7.5.3 Language to be used is English and desirably with Chinese.
- 7.5.4 Performance requirements

(a) Display

Display unit:	True sunlight readable 640 x 480 pixel (or better) back-lit LCD Display
Position indication:	Latitude/ Longitude, UTM
Position resolution:	4 decimal places
Others:	NAV data, panoramic display

(b) GPS Receiver

GPS Receiver Type:	Equipped with 8 channel parallel receiver or better
Frequency Range:	157.425±1MHz (C/A code), L1
Sensitivity:	-130 dBm or better
Dynamic Range:	25 dB or better
Warm start fix time:	Less than 30 seconds
Cold start fix time:	Less than 3 minutes
Position Accuracy:	15 m or better
Tracking Velocity:	999 kt or better

(c) Differential Beacon Receiver

Frequency range:	283.5-325 kHz
Frequency Step:	500 Hz
Position Accuracy:	5m or better

7.5.5 Environmental Requirements

Operating temperature:	-15°C to +55°C or better
Waterproofing:	IPX5 or better (display and receiver units); IPX6 (antennas)

7.6 Installation Requirements

7.6.1 General

- (a) The control panel of all Equipment shall be installed and flush-mounted in the coxswain operation area unless otherwise specified. The mounting screw shall be detachable from the front of the Equipment and the Equipment shall be taken out at the front for further checking or replacement. The Contractor shall submit a layout plan showing the exact locations of the Equipment.

- (b) Equipment supplied shall be completed with all standard and/or maker recommended accessories as required for normal operation.
- (c) The Equipment supplied shall be completed with all the auxiliary items required for normal operation including connectors, circuit breakers, power sockets, interface device, plugs and cables with conduits. Additional power conditioners, filtering devices, power stabilizer or regulator shall be provided and installed at no extra cost if required.
- (d) RF connectors of suitable impedance shall be provided and used for connections of the RF cables, antennae and other equipment. Connectors between the feeder cables and antennae shall be protected by weatherproof material to avoid water seepage.
- (e) All wiring shall be finished in a neat and appropriate manner approved by the Government.
- (f) Adequate measures to prevent interference between the electronic equipment shall be taken which include:
 - (i) Separate screened conduits or trunkings shall be provided;
 - (ii) Rules, regulations and recommended practices regarding screening of electric wiring must be observed;
 - (iii) Receiving apparatus and other electronic equipment which may be affected by radio frequency induced voltages must be effectively earthed, screened and protected against such voltages; and
 - (iv) Lightning protection devices shall be fitted.
- (g) All sitting, installation and cabling work shall be undertaken to the highest standard to ensure:
 - (i) Satisfactory performance of the Equipment;
 - (ii) Protection from mechanical and water damages;
 - (iii) Ease of accessibility for maintenance and repair; and
 - (iv) Manufacturers' recommendations shall be strictly observed.
- (h) 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.
- (i) Induced mutual interference should be within an appropriate level which would not affect normal operation.
- (j) Installation location
 - (i) Installation location of the Equipment shall be easily accessible for inspection and maintenance. Exact location shall be subject to the approval of the Government.
 - (ii) Installation location of the Equipment shall not cause interference to other Equipment by way of the emitted interference.

(k) Material and Workmanship

- (i) Material and Equipment shall be of high quality, and shall comply with, where applicable, the appropriate British Standards and Code of Practice, together with any amendments made thereto, suitable for installation in the Vessel.
- (ii) All the designs shall be subject to the approval of the Government and the respective works shall be carried out in a first class workman-like manner.
- (iii) The Government reserves the right to reject any part of the installation not comply to this Specification. The Contractor shall carry out the necessary remedial work or replacement at its own cost and expense and without delay.
- (iv) The Contractor shall provide all installation materials including cables, casing, mounting accessories and etc. which are durable and fire retarding. Where it is impracticable for signal cables for data to be run inside conduits, PVC insulated and sheathed with armoured cable shall be used.

(l) Equipment Fixing and Interconnection

- (i) All switches, connectors, jacks and receptacles shall be clearly, logically and permanently marked during installation. All wires and cables shall be identified at every termination and connection point with permanent type markers suitable for installation in the Vessel.
- (ii) Interconnection of various items of Equipment shall be mechanically and electrically connected by multi-pin connectors or terminals.
- (iii) All cables shall be joined by properly designed connectors or inside joint boxes. Where terminal blocks are used for connection cables, the tip of each conductor shall be crimped with a suitable terminal pin before it is inserted into the terminal block.
- (iv) The Contractor shall be responsible for providing and installing properly rated power cables from the power points to its own equipment.

(m) Electricity

- (i) The power supply shall be compatible with Vessel's DC electrical system.
- (ii) The Equipment shall be protected by appropriately rated fuses. The fuses shall be contained in independent fuse holders which are easily accessible.

(n) Cable

- (i) All exposed cables and wiring shall be sheathed or protected by metal conduits.
- (ii) Watertight cable glands shall be provided by way of watertight bulkhead or deck penetration.
- (iii) Signal wiring shall be separated from power supply cables and housed in separate screened conduits or cable trunks.
- (iv) Cables and wirings shall run behind the compartment lining. Where electric cables are necessary to be fitted on the decorative surface of bulkheads, they shall be enclosed in proper metal conduits.

(o) Labelling and Marking

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

(ii) Polarity of power cables shall be labelled.

7.7 Acceptance Test

7.7.1 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 specification.

(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 and basin trial.

7.7.2 The Contractor shall submit test reports on the performance of the Equipment and deliver the test reports to the EMSD representatives prior to the installation.

7.7.3 The Contractor shall submit schedule of commissioning test of the electronic equipment installed onboard at least one month prior to the on-site commissioning test date.

7.7.4 The Contractor shall provide all the necessary test equipment and tools for carrying out the acceptance tests at no extra cost to Government.

7.7.5 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.

7.7.6 For significant defects (e.g., involving the replacement of Spare Parts/ Equipment etc.) found during the final acceptance test, the Warranty Period of the Equipment shall be properly extended as determined by EMSD.

7.8 Documentation for the Proposed Equipment

7.8.1 The Contractor shall supply with the tenders the following documentation:

(a) Technical and proposed equipment information including integrated system equipment schematic diagram of all these general electronic equipment, in English and sufficiently detailed to enable a technical appraisal of the Equipment in this Chapter to be made.

(b) Lists of marine electronics equipment with unit price.

7.8.2 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 onboard for the purpose of future maintenance; and
- (l) The design conduit/trunking route diagrams submitted to MD and EMSD for approval during construction stage.

7.8.3 In addition, the Contractor shall submit a list to show the unit price and the installation cost for each proposed Equipment and the accessories, as well as the recommended maintenance spares for the first year following the Warranty Period. The name of the manufacturer and model / type shall also be included in the above list for MD and EMSD's consideration / evaluation.

Chapter 8 Services Support

8.1 General Requirement

- 8.1.1 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.
- 8.1.2 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 2.8.1 of this Part VII.
- 8.1.3 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.

8.2 Information to be Provided Prior to and at Delivery Acceptance

- 8.2.1 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.

8.2.2 “As Fitted” drawings and other information shall be supplied.

At Delivery Acceptance, the Contractor shall provide the MD with the following:

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

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

8.2.3 Tools & Test Equipment for Electronics

- (a) All test and tool equipment for the electronics equipment of the Vessel shall be delivered directly to EMSD.

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

8.2.4 Photographs

The Contractor shall at Delivery Acceptance provide the following:

- (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; and
 - (ii) Each print shall be enclosed in a suitable album and labelled showing the position of the content.
- (b) Official Photographs
 - (i) Four framed colour photographs of picture size not less than 350 mm x 270 mm and frame size not less than 510 mm x 400 mm showing the profile of the Vessel in Hong Kong Waters;
 - (ii) Four 200 mm x 150 mm colour photographs with specifications of Vessel particulars showing the profile of the Vessel in HKSAR Waters; and
 - (iii) Four 150 mm x 100 mm colour photographs showing the profile of the Vessel in Hong Kong Waters.
- (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 Mega pixel. The photographs shall be stored in Compact Disk (CD-ROM) and forwarded to GNC.

8.2.5 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 of this Part VII - Technical Specifications.
- (l) Any other certificates as appropriate.

Chapter 9 Training

9.1 Training on Electronic Navigational Equipment (ENE)

9.1.1 General requirements

- (a) All training courses shall be held in Hong Kong and delivered by qualified instructors.
- (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 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 Tenderer shall submit a detailed course syllabus and a schedule for conducting the training course.
- (e) Each trainee shall receive one copy of comprehensive training documents before the start of each course.
- (f) Training manual in Chinese and English shall be provided and submitted to MD and EMSD for approval at least one month prior to commencement of the aforementioned two types of training respectively.

9.1.2 Operator Training Course

- (a) 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.
- (b) The course shall be held immediately before the commissioning of the Equipment on the Vessel.
- (c) A total of up to 6 trainees will attend the course for sufficient training. The training course shall accommodate the specified number of trainees.

9.1.3 Equipment Maintenance Training Course

- (a) The equipment maintenance training course shall enable the maintenance staff to:
 - (i) acquire full knowledge and appreciation of all aspects of the design considerations, day-to-day operation, inter-connected system operation, fault breakdown, routine maintenance and fault finding / repairing procedures of the ENE being offered; and
 - (ii) effectively maintain the ENE. This shall include practical demonstrations and tests.
- (b) The maintenance training shall include, but not 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 enable technical staff to effectively maintain the Equipment.
 - (d) The course shall be held immediately after the commissioning of the Equipment on the Vessel.
 - (e) A total of up to 6 trainees will attend the course for sufficient training. The training course shall accommodate the specified number of trainees.

9.2 Training on Operation and Maintenance of the Vessel

- 9.2.1 In addition to the training to be provided for the ENE, the Contractor shall provide training in relation to the operation of the Vessel for the operational staff of the user department, training in relation to maintenance of engine and equipment on board for the technical staff of the user department and for the Maintenance Section of Government Dockyard.
- 9.2.2 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 6 officers of the MD for sufficient training in the HKSAR upon 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.
- 9.2.3 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 training courses for a total of 6 engine operators and 6 maintenance personnel from the Government Dockyard in the HKSAR or overseas for sufficient training at the delivery 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.
- 9.2.4 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 10 Abbreviations

ABS	American Bureau of Shipping
AC	Alternating Current
AIS	Automatic Identification System
AML	Additional Military Layers
ARCS	Admiralty Raster Chart Service
ARPA	Automatic Radar Plotting Aid
ASTM	American Society for Testing and Materials
ASWF	American Standard Window Film
AV	Audio Video
AWS	American Welding Society
BS	British Standards
BSB	data encoded in the BSB format
CCTV	Close Circuit Television
CD	compact disc
cd/m ²	candela per square metre
CD-ROM	Compact Disc Read-Only Memory
CFC	Chlorofluorocarbon
CH	Channel
cm	centi metre
CO ₂	Carbon Dioxide
COG	course over ground
CPA	Closest Point of Approach
CPU	Central Processing Unit
dB	Decibel
dBi	decibel isotropic
dBm	Decibel-milliwatts
DC	Direct Current
DDR	Double Data Rate
DGPS	Differential Global Positioning System
DNC	Digital Nautical Chart
DSC	Digital Selective Calling
DVD	Digital Versatile Disc
DVI	Digital Video Interface
DVR	digital video recorder
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
ENC	Electronic Navigational Charts
ENE	Electronic Navigational Equipment
FTP	Fire Test Procedures
GB	Gigabyte
GeoTIFF	GeoTIFF Format File
GHz	Gigahertz
GM	Metacentric Height

GMDSS	Global Maritime Distress Safety System
GMT	Greenwich Mean Time
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
GZ	Righting Lever
HCFC	Chlorodifluoromethane
HD	Hard Disk
HDD	Hard Disk Drive
HDMI	High Definition Multimedia Interface
HPS	Harbour Patrol Section
Hz	Hertz
ICR	Information Collection Request
IHO	International Hydrographic Organization
IMM	International Maritime Mobile
IMO	International Maritime Organisation
IEC	International Electro-technical Commission
IP	Ingress Protection
IPX	Internetwork Packet Exchange
IS	Intact Stability
ISO	International Organization for Standardization
ITU-R	International Telecommunication Union – Radiocommunication Sector
K	Kilo
kΩ	Kilo Ohm
kg	Kilogram
kHz	Kilohertz
km	Kilometer
kW	Kilowatt
LCD	Liquid Crystal Display
LCG	Longitudinal Centre of Gravity
LED	Light-emitting Diode
LSA	Lifesaving Appliance
m/s	Metre per Second
m ³	Cubic Metre
MARPA	Mini-automatic Radar Plotting Aid
MCR	Maximum Continuous Rating
MFD	Multi-function Display
MHz	Megahertz
MJ/m ²	Megajoule per Square Metre
MKD	Minimum Keyboard Display
mm	Millimetre
MMC	Multi Media Card
MMSI	maritime mobile service identity
MS PRO	Memory Stick PRO
MS PRO Duo	Memory Stick PRO Duo

MSC	Maritime Safety Committee
mV	Milli Voltage
NAVSEA	Naval Sea Systems Command
NIR	Non-Ionizing Radiation
Nm	Nanometre
NMEA	National Marine Electronics Association
NTRIP	Networked Transport of RTCM via Internet Protocol
NUC	Not Under Command
OSHA	Occupational Safety and Health Administration
PVC	Polyvinyl Chloride
RAM	Random Access Memory
RF	Radio Frequency
RG58U	RG58U Type Coaxial Cable
RH	Relative Humidity
ROT	rate of turn
rpm	revolutions per minute
RT	Radioactive Test
RTCM	Radio Technical Commission for Maritime Services
SATA	Serial Advanced Technology Attachment
SINAD	Signal-to-noise and Distortion Ratio
SOG	speed over ground
SOLAS	Safety of Life at Sea
SPL	Sound Pressure Level
SSD	Solid-state Drive
STANAG	NATO Standardization Agreement
TCG	Transverse Centre of Gravity
TCPA	Time of Closest Point of Approach
TIFF	Tagged Image File Format
TS	Technical Specifications
UHF	Ultra High Frequency
UPS	Uninterruptible Power System
USB	Universal Serial Bus
UTC	coordinated universal time
uV	nano voltage
UV	Ultraviolet
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
V.S.W.R.	Voltage Standing Wave Ratio
VTC	Vessel Traffic Centre
VTS	Vessel Traffic Services
W	Watt
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 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 7.1.1 in Chapter 7 of the TS.

2. Guarantee Slipping

- 2.1 As stated in the section "Warranty" above, Guarantee Slipping shall be carried out at the end of the original Warranty Period regardless of any subsequent extension in relation to any Warranty Item under the terms of the Contract.
- 2.2 At the Guarantee Slipping, the Contractor shall carry out the following work and provide all necessary materials, labour and equipment in order to carry out such work:

2.2.1 Engines

- (a) Renew the lubricating oil and replace the filters for the main engines as per the manufacturer's recommendations;
- (b) Clean all the engine air filters and change the filter elements as necessary;
- (c) Clean the coolers of the engines and renew all zinc anodes if provided;
- (d) Check all the engines' belts and adjust if necessary;
- (e) Check tappet clearances for the inlet and exhaust valves, ignition timing and idle speed and adjust if necessary;
- (f) Conduct function tests for the engines' protection system and their associated sensors, gauges and other measuring devices; and
- (g) Any other work required or recommended by the engine manufacturer.

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

2.2.2 Hull and Deck Items (where applicable)

- (a) Paint Under the Water Line
 - (i) Paint under the water line shall be checked by the paint manufacturer's representative for the effectiveness of one year's protection against marine growth;
 - (ii) The hull shall be cleaned;
 - (iii) Damaged paint shall be repaired according to the paint manufacturer's procedures;
 - (iv) After the repair of the damaged paint as specified at Paragraph 2.2.2(a)(iii) above, two coats of touch up primer and one coat of touch up shall be applied; and
 - (v) One full coat of finishing paint shall be applied to the hull below the water line.
- (b) Paint Above the Water Line
 - (i) Damaged paint on the hull above the water line shall be repaired properly. After repair, two coats of touch up primer and one coat of touch up shall be applied;
 - (ii) Two coats of paint shall be applied on the Vessel's name, draft marks and insignia; and

- (iii) One full coat of anti-slip paint shall be applied to the open and side deck.
 - (c) Inspect and clean waterjets.
 - (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 2-6 for GNC's approval within two (2) months after the Contract Date.
3	Completion of installation of engines, propellers and steering gear	
4	Completion of installation of electronic navigation equipment	
5	Pre-shipment Construction and Handling Inspection	
6	Shipment to Hong Kong	
7	Delivery Date	

Drawings Approval	Completion Date
General Arrangement Plan	<p>All the drawings are required to be submitted within two (2) months after the signing of Articles of Agreement for GNC's approval / reference.</p>
Structural General Arrangement	
Fuel System Diagram	
Coolant Systems Diagrams	
Electrical Single Line Diagrams	
Operational Manual	
Service Schedule	
Maintenance Manual	
Others as required	

Part VII Annex 4 - Main Items Inspection Timetable

Item No.	Items to be inspected		Completion Date
	Hull Structure, Layout and Outfitting Inspection		
H-1	Mould Lofting		
H-2	Construction Materials – Aluminium plate mark checking for hull & superstructure (if any)		
	(a)	Aluminium plate mark checking for hull & superstructure	
	(b)	Material certificates verification	
H-3	Welding consumables & welders certificates (if any)		
H-4	Keel laying for hull		
H-5	Fabrication of hull up to main deck in stages of work, including:		
	(a)	Alignment	
	(b)	Edge Preparation	
	(c)	Welding (if any)	
	(d)	Workmanship	
	(e)	Compliance with approved plans	
	(f)	NDT (X-ray) of welds (if any)	
	(g)	Hull internal work inspection	
	(h)	Plating thickness gauging	
H-6	Engine bearers fabrication / welding		
H-7	Scantling & welding checking		
H-8	Welding construction and pressure tests of tanks		
	(a)	Fuel oil tank	
		(i) Tank construction (internal/external/fitting)	
		(ii) Tank pressure test	
H-9	Hose test for hull		
H-10	Mock up inspection		
H-11	Installation of various outfitting items		
	(a)	Anchor and chain	
	(b)	Windlass	
	(c)	Hand pump	
	(d)	Hatches	
	(e)	Doors	
	(f)	Seating of heavy equipment and masts	
H-12	Function tests of various outfitting items		
H-13	Watertightness or weathertightness of openings		

	(a)	Manholes	
	(b)	Hatches	
	(e)	Ventilator & air pipes	
H-14	Painting inspection of different layers		
H-15	Draught marks and vessel dimensions verifications		
H-16	Arrangement of console		
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	
H-20	Lifesaving appliances and fire fighting appliances		
	(a)	Lifesaving appliance	
	(b)	Fire fighting appliance	
H-21	Sea trials including operation test of outfitting equipment		
H-22	Site towing demonstration trial		
H-23	Cleanliness inspection before acceptance		
H-24	Inventory check in the HKSAR		
H-25	Acceptance and delivery		
H-26	Acceptance of As-Fitted drawings and Engines/Equipment Manuals and documentations.		
	Electrical and Machinery Installation		
EM-1	General inspection on installation of machinery:		
	(a)	General inspection on installation of propulsion engine	
	(b)	General inspection on installation of lift engine	
EM-2	Propulsion engine:		
	(a)	Test of engine safety devices and alarms	
	(b)	Test of emergency stop	
	(c)	Inspection of exhaust pipe before lagging	

EM-3	Lift engine:	
	(a)	Test of engine safety devices and alarms
	(b)	Test of emergency stop
	(c)	Inspection of exhaust pipe before lagging
EM-4	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-5	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-6	Functional test of drainage system	
EM-7	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-8	Electrical installation:	
	(a)	Inspection of lightning conductor
	(b)	General inspection of cable layout & checking of cable sizes
	(c)	Inspection of cable penetrations of bulkhead and deck
	(d)	Inspection of transformers
	(e)	Inspection of tally plates
EM-9	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-10	Control console:	
	(a)	Inspection of control console
	(b)	Functional test of console controls
	(c)	Inspection of navigation equipment control panel

EM-11	Lighting:	
	(a)	Inspection and functional test of general lighting
	(b)	Inspection and functional test of emergency lighting
	(c)	Inspection and functional test of floodlight installation
	(d)	Inspection and functional test of searchlight installation
EM-12	Navigational lights and signals	
	(a)	Inspection and functional test of navigational lights
	(b)	Test of horn/whistle
EM-13	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-14	Test of window wipers	
EM-15	Inspection of lightning conductor	
EM-16	Electronic equipment tested by EMSD	
EM-17	Inclining experiment	
EM-18	(a)	Official Speed Trial
	(b)	Other Official Sea Trials

Note:

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

Part VII - Annex 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. formats of the following plans and drawings that contain the technical information of the Vessel and its machinery and equipment as they are on the day when the Vessel is accepted by the MD. These are termed the final version of the “As-Fitted” Plans and Drawings, and they shall consist of the following plans and drawings as well as any other plans and drawings 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 in the professional manner, scale, size and style normally required in the ship design and construction business sector. All plans and drawings shall show and be clearly marked with the profile, plan, and section views of the layout, arrangement details, and construction details in the manner required by GNC.
 - 1.2.1 General Arrangement Plan.
 - 1.2.2 Lines plan and offsets data and table if have.
 - 1.2.3 Stability information booklet and the inclining experiment report.
 - 1.2.4 Hydrostatics, cross curves and intact and damage stability calculations for the 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 Detailed arrangement and layout plan showing the disposition of all of the main equipment, fittings and fixtures, furniture, hatches, manholes and access openings. The down-flooding openings (points) shall be indicated clearly on the drawings.
 - 1.2.8 Equipment layout diagram.
 - 1.2.9 Hull structural construction and hull scantlings drawings, including main longitudinal girders and beams, main transverse and diagonal girders, frames and beams, Watertight bulkheads and integral buoyancy tanks, machinery foundations.
 - 1.2.10 Hull shell and frames and the framings’ arrangement and construction plan.
 - 1.2.11 Hull shell expansion plan.
 - 1.2.12 Keel construction plan.
 - 1.2.13 Propulsion system arrangement diagrams and details
 - 1.2.14 Lift system arrangement diagrams and details
 - 1.2.15 Steering system and steering arrangement diagrams.
 - 1.2.16 General arrangement and attachments of skirts..
 - 1.2.17 Hull watertight bulkheads’ construction plan.
 - 1.2.18 Console to deck connection detailed construction plan.
 - 1.2.19 Deck edge and bulwark (if any) details and construction plan, including detailed structural arrangement drawings of hull to deck connection.
 - 1.2.20 Detailed cathodic corrosion prevention and arrangement plans and drawings for the Vessel throughout.
 - 1.2.21 Mast structural and construction plan and mast equipment arrangement plan.
 - 1.2.22 Anchoring arrangement plan.
 - 1.2.23 Piping diagrams for fuel oil, lubrication oil, bilge, firefighting, scuppers and drains system.
 - 1.2.24 Fire prevention, fire control and firefighting system drawings.
 - 1.2.25 Drawings of the main switchboard and all other switchboards and the electrical system.

- 1.2.26 Engines arrangement and setting plans and drawings of their fuel lines and exhaust gas piping and arrangement.
 - 1.2.27 Main fuel oil tank drawing and its associated piping and manifold(s), and filling, overflow and ventilation system.
 - 1.2.28 Fuel oil tank(s) and its associated piping system.
 - 1.2.29 Drawings of the anchor, and the anchoring system.
 - 1.2.30 Lifesaving appliance arrangement plan and fire safety plan.
 - 1.2.31 Distress signals, alarm systems, and internal/external communication arrangement and system plan.
 - 1.2.32 Navigation lights, sound and signal diagrams and any other external lighting arrangement plan.
 - 1.2.33 Vessel overall lighting arrangement and light control plan.
 - 1.2.34 Vessel alarm and signals, internal communication systems and public address systems plan.
- 1.3 Documents to be provided by the Contractor

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

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 – World Meteorological Organisation (WMO) - State of the Sea

Beaufort scale number	Description	Wind speed	Wave height	Sea conditions	Land conditions
0	Calm	< 1 km/h (< 0.3 m/s)	0 m	Flat.	Calm. Smoke rises vertically.
		< 1 mph			
		< 1 knot	0 ft		
		< 0.3 m/s			
1	Light air	1.1–5.5 km/h (0.3–2 m/s)	0–0.2 m	Ripples without crests.	Smoke drift indicates wind direction. Leaves and wind vanes are stationary.
		1–3 mph			
		1–3 knot	0–1 ft		
		0.3–1.5 m/s			
2	Light breeze	5.6–11 km/h (2–3 m/s)	0.2–0.5 m	Small wavelets. Crests of glassy appearance, not breaking	Wind felt on exposed skin. Leaves rustle. Wind vanes begin to move.
		4–7 mph			
		4–6 knot	1–2 ft		
		1.6–3.4 m/s			
3	Gentle breeze	12–19 km/h (3–5 m/s)	0.5–1 m	Large wavelets. Crests begin to break; scattered whitecaps	Leaves and small twigs constantly moving, light flags extended.
		8–12 mph			
		7–10 knot	2–3.5 ft		
		3.5–5.4 m/s			
4	Moderate breeze	20–28 km/h (6–8 m/s)	1–2 m	Small waves with breaking crests. Fairly frequent whitecaps.	Dust and loose paper raised. Small branches begin to move.
		13–17 mph			
		11–16 knot	3.5–6 ft		
		5.5–7.9 m/s			
5	Fresh breeze	29–38 km/h (8.1–10.6 m/s)	2–3 m	Moderate waves of some length. Many whitecaps. Small amounts of spray.	Branches of a moderate size move. Small trees in leaf begin to sway.
		18–24 mph			
		17–21 knot	6–9 ft		
		8.0–10.7 m/s			
6	Strong breeze	39–49 km/h (10.8–13.6 m/s)	3–4 m	Long waves begin to form. White foam crests are very frequent. Some airborne spray is present.	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic bins tip over.
		25–30 mph			
		22–27 knot	9–13 ft		
		10.8–13.8 m/s			
7	High wind, moderate gale, near gale	50–61 km/h (13.9–16.9 m/s)	4–5.5 m	Sea heaps up. Some foam from breaking waves is blown into streaks along wind direction. Moderate amounts of airborne spray.	Whole trees in motion. Effort needed to walk against the wind.
		31–38 mph			
		28–33 knot	13–19 ft		
		13.9–17.1 m/s			
8	Gale, fresh gale	62–74 km/h (17.2–20.6 m/s)	5.5–7.5 m	Moderately high waves with breaking crests forming spindrift. Well-marked streaks of foam are blown along wind direction. Considerable airborne spray.	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
		39–46 mph			
		34–40 knot	18–25 ft		
		17.2–20.7 m/s			
9	Strong gale	75–88 km/h (20.8–24.4 m/s)	7–10 m	High waves whose crests sometimes roll over. Dense foam is blown along wind direction. Large amounts of airborne spray may begin to reduce visibility.	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over.
		47–54 mph			
		41–47 knot	23–32 ft		
		20.8–24.4 m/s			

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

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