

OUTLINE SPECIFICATION
FOR
National Security Multi-Mission Vessel
FOR



U.S. Maritime Administration
1200 New Jersey Avenue
Washington, DC 20590-0001

Contract DTMA91C1600014

2015-017-03-20

December 07, 2016

Rev: -

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Abbreviations

AMR	Auxiliary Machinery Room
ASTM	American Society for Testing and Materials
B	Beam
BWTS	Ballast Water Treatment System
CAMS	Control, Alarm and Monitoring System
dia	Diameter
ER	Engine Room
Fwd	Forward
HA/DR	Humanitarian Aid/Disaster Relief
IMO	International Maritime Organization
ISO	International Standards Organization
ISPS	International Ship and Port Facility Security Code
JIS	Japanese Industrial Standards
KS	Korean Standards association
MARPOL	International Convention for the Prevention of Pollution from Ships
MGO	Marine Gas Oil
MPS	Multi-Purpose Space
MR	Motor Room
mt	metric ton
p	person
PSPC	Performance Standard for Protective Coatings (IMO document)
RoRo	Roll On Roll Off
SOLAS	International Convention for the Safety of Life at Sea
SPS	Special Purpose Ships
SW	Seawater
SWBD	Switchboard
TEU	Twenty foot Equivalent Unit

I. GENERAL PART

1. GENERAL DESCRIPTION

- Kind of ship: Multi-Mission Vessel for State Maritime Academy training purposes and Humanitarian Assistance and Disaster Relief (HA/DR).
- Type of ship: Passenger type vessel with RoRo and on deck cargo and container stowage capability. Able to expand the number of persons onboard during HA/DR missions. Fitted with single screw and single rudder with bow and stern thrusters. Bow thruster to have a retractable azimuthing capability to provide "take home" power. Dual engine and propulsion motor rooms for redundancy and training purposes. The accommodation spaces are located over the forward and mid-part of the vessel.
- Number of Persons: 700 persons total with 600 cadets and 100 non-cadets in training ship mode. Surge capacity of up to 760 persons in HA/DR mode. Up to 1,000 persons aboard while pierside.
- RoRo Space: Single RoRo deck with side ramp in after part of the vessel.

2. GENERAL REQUIREMENTS

The Owner of the Vessel is the U.S. Maritime Administration (MARAD) or its designated representative. The Builder is the shipyard contracting to build and deliver the vessels and all its subcontractors and suppliers.

It is the Owner's intent that safety, reliability, environmental compliance, maintainability and operational efficiency be of top priority in the vessel design. The working environment conditions for personnel onboard with regard to safety, noise levels and interior climate are of importance. Consideration shall be made to minimize harmful emissions, both air and liquid, from vessel's machinery and hull.

All material shall be new and unused, and shall be high quality and proven design. Asbestos, PCB's and refractory ceramic fiber shall not be used anywhere in the construction or equipment of the vessel. Where stainless steel is mentioned in this specification without indication of grade, it shall mean an alloy at least equivalent to AISI 316.

Materials and workmanship shall be in accordance with a major recognized national standard, such as ASTM, JIS, KS, or the Builder's standard and manufacturer's standard, unless otherwise specified. The Builder is responsible for ensuring the selected equipment meets the requirements of the Specification.

Inspection, tests and trials of the vessel shall be carried out by the Builder or the manufacturers at their shops or on board the vessel throughout the construction period. The Builder shall specify the types of tests to be made, which shall be in compliance

with the Class Rules and Regulations. The Owner has the right to attend all tests and trials and will advise the Builder on which events he plans to attend upon sufficient notice, per agreed schedule, by the Builder. The Builder's Specification shall include a list of the major tests and trials.

The Builder shall base the design upon the hull form provided by the Owner, and may suggest modifications to the hull form in order to improve efficiency, suit the detailed design of the vessel or to suit available designs. Full results of all model tests and CFD optimizations prepared by the Owner shall be presented to the Builder for reference. The Owner shall have the right to attend any model tests carried out by the Builder after contract signing.

- Classification: ABS, +A1 (E) "Special Purpose Vessel", +AMS, +ACC, UWILD, CRC, CPS, ENVIRO, GP, HELIDK
- Flag: United States
- Regulation: The following Rules and Regulations, including amendments which enter into force at the date of contract signing shall be complied with:
- ABS Steel Vessel Rules, latest version
 - Maritime Regulations of the United States
 - IMO SPS Code [Code for Safety of Special Purpose Ship – Resolution A.534(13)]
 - SOLAS Safe Return to Port requirements
 - ILLC 1966 and amendments
 - MARPOL 73/78 and amendments {Annex I, IV, V and VI}
 - International Convention for Tonnage Measurement of Ships, 1969
 - International Convention for the Prevention of Collision at Sea, 1972, and amendments
 - International Telecommunication Union Radio Regulations
 - IMO Performance Standard for Protective Coating (PSPC)
 - US 46CFR Subchapter R, Part 167, Public Nautical School Ships
 - Handbook on Sanitation of Vessel Construction, U.S. Public Health Service (Publication No. 393)
 - US 40CFR Parts 94, 1042, 1043, & 1048: Control of Emissions from Marine Compression Ignition Engines (US EPA)

- IMO Res. MSC 267(85), International Code on Intact Stability (except part A Dynamic Stability Phenomena in Waves)
- Rules and Regulations Governing Navigation of the Panama Canal
- ILO Convention concerning Crew Accommodation on Board Ship, Nos. 92 and 133
- IMO Resolution A.708(17) Navigation Bridge Visibility and Functions
- ISPS Code, Annex Part B, Guidance Related to the Provisions of Section 9 Ship Security Plan, as applicable to the ship's design and construction
- IMO Resolution A.468(XII), code on Noise Levels on Ships
- ISO 6954-2000 (E) – Guidelines for the Measurement, Reporting and Evaluation of vibration with regard to Habitability on Passenger and Merchant Ships
- IMO Resolution A.601(15) – Provision and Display of Maneuvering Information on Board Ships
- US Clean Water Act and National Pollutant Discharge Elimination System (NPDES) and related State regulations in states bordering the Atlantic, Pacific and Gulf coasts.
- IMO MSC.1/Circ. 1369 – Interim Explanatory Notes for the Assessment of Passenger Ship Systems' Capabilities After a Fire or Flooding Casualty

Certificates:

The Builder shall provide a list of certificates to be provided, which would be normal for this type of vessel and as required by the Classification Society and cited Regulations, except as indicated by the Owner. In some cases the Owner may request a voluntary certificate of compliance be issued rather than the actual certificate. The extent to which voluntary certificates of compliance are required, in lieu of actual certificates, shall be described in the Contract. Certificates shall include EIAPP issued by US EPA for each engine.

3. PRINCIPAL DIMENSIONS

Length, overall	159.85 m
Length, between perpendiculars	154.00 m
Breadth, molded	27.00 m
Depth, molded, to upper deck	16.80 m

Draft, design, molded	6.50 m
Draft, load line, molded	7.25 m
Draft, scantling, molded	7.50 m
Max Masthead Height, above Keel	44.00 m

4. COMPLEMENT

Training Ship Mode

Highest officer	4
Distinguished Visitor	4
Senior Officer & Faculty Class	21
Faculty Class	34
Crew & Staff Class	37
Cadet (4p cabin)	384
Cadet (18-36 p berthing)	216
Total	700 persons

All Officer, Distinguished Visitor and Senior Faculty cabins are for 1 person (1p) with private toilet/shower unit. In addition, 60 other non-cadet cabins shall be capable of sleeping 2 persons, but shall have 1 person berthing in training ship mode (in above listed complement).

HA/DR Mode

Highest officer	4
Distinguished Visitor	4
Senior Officer & Faculty Class	21
Faculty Class	68
Crew & Staff Class	63
Cadet (4p cabin)	384
Cadet (8-36 p berthing)	216
Total	760 persons

In HA/DR mode, 2 persons can berth in some Faculty, Crew and Staff cabins. All other cabins are the same as in Training Ship Mode.

5. LOADING CAPACITIES

5.01 Deadweight

Load Line draft (molded) abt. 8,487 mt

5.02 Cargo Capacity

Number of stowed containers on Main Deck Aft and on Multi-purpose Space

Aft deck (2 tiers)	abt.	54	TEU
Multi-purpose Space Roof (1 tier)	<u>abt.</u>	<u>6</u>	<u>TEU</u>
Total Containers (2 tiers)	abt.	60	TEU
RoRo Deck	abt.	1,015 m ² (10,925 ft ²)	

The deadweight and stability shall be sufficient to carry approx. 1,530 mt of combined cargo weight, including containers and RoRo.

15 reefer container receptacles shall be arranged on the Main Deck and 5 reefer outlets on the RoRo Deck.

5.03 Special Cargo

In place of some of the containers loaded on the main deck, mission cargo and modules may be stowed. This stowage will not exceed the overall deck strength ratings for containers. Securing shall be specially considered.

5.04 Tank Capacity (100% Full)

Diesel fuel oil tanks (including service and settling tanks)	abt.	2,200 m ³ (1,850 mt)
Fresh water tanks	abt.	1,375 m ³

6. TRIM AND STABILITY

The Builder shall carry out both intact and damage stability analyses to determine the required subdivision and watertight compartment requirements. Minimum GM or maximum KG curve shall be prepared based on the analyses. Stability should be optimized for loading conditions from 1 m below design draft to design draft.

The Builder shall prepare sample loading cases for the vessel that indicate it can achieve the desired loading capacity. As a minimum, the below listed sample loading cases shall be considered. For each sample load case, departure (full consumables), 50% consumables, and arrival (10% consumables) conditions shall be considered. GM shall be in compliance with intact stability and damage stability requirements. In sample loading conditions, at least 0.3 m margin shall be applied above minimum required to account for being able to empty and fill ballast tanks underway and to account for variations in weights in real service. Sample load conditions shall be based on full complement of persons onboard depending on whether in training ship mode or HA/DR mode.

- Ballast condition (similar to sea trial condition)
- Load Line draft condition with full cargo (1,530 mt)
- Full load condition with full cargo (1,530 mt) and 760 persons onboard (HA/DR mode)
- Full load condition with no cargo and 700 persons onboard (Training ship mode)

7. WEIGHT CONTROL

The Builder shall be responsible for developing and maintaining a weight control plan for the vessel.

Within 120 days of the contract award, the Builder must submit for approval an independently prepared detailed initial estimate of the light ship weight and center of gravity.

Approval action will consist of reaching a mutual agreement between the Builder and Owner on the light ship weight, center of gravity, and margins. Thereafter, the Builder is responsible for obtaining, in the completed ship, the approved weight and center of gravity characteristics, adjusted for any authorized departures from the approved estimate.

8. PROPELLING MACHINERY

Integrated Diesel Electric system. Refer to Section IV for detailed description.

9. SPEED AND ENDURANCE

Service speed at load line draft with a 15% sea margin shall be 18 knots. The main diesel generators shall be capable of supplying the propulsion motors and the ships electric load for 700 persons onboard with a growth allowance of 10% for the non-propulsion loads while operating at no more than 90% MCR. Fuel oil consumption at the above conditions, based on 42,700 kJ/kg lower heating value (LHV) and electric load equivalent to 700 persons onboard in summer conditions to be abt. 60 mt/day.

Endurance at design draft, based on consumption at 18 knots with electric load equivalent to 700 persons onboard in summer, fuel oil of 42,700 kJ/kg LHV, 95% full fuel oil tank capacity, with 10% consumption in reserve, to be a minimum of 10,000 nautical miles.

10. VIBRATION AND NOISE

Vibration levels in the deckhouse and engine control room shall be within the criteria contained in ISO 6954-2000(E). The acceptable level shall be below the values above which adverse comments are probable for Area Classification "B" during all operating conditions and at all engine rpm's. Vibration levels shall be validated during design by calculation or by reference to sister/parent vessels and submitted to the Owner for review. Vibration levels shall be measured during sea trials and where they exceed the ISO criteria, the Builder shall make necessary improvements, which shall be agreed between the Owner and Builder.

Noise criteria shall be in accordance with IMO Resolution A.468 (XII) "Code on Noise Levels on Board Ships". Noise levels shall be measured during the sea trials and when the noise levels exceed the designated values by more than 3 dB(A), the Builder shall make necessary improvements, which shall be agreed between the Owner and Builder.

11. OWNER'S FURNISHED EQUIPMENT

The following items of equipment are to be furnished by the Owner at his own expense.

- All portable hoses, etc., other than those required by the Rules and/or this specification
- Mooring Ropes in excess of the requirement of Classification Society and/or this Specification
- Deck, engine and cabin stores in excess of those specified in the Specification
- All bedding, napery, cook's/steward's utensils, chandlery, charts and nautical books.
- Water, fuel oil, lubricants and grease, and all consumable liquid except for those necessary for trials and tests
- Fireman's outfit in addition to that required by the Rules
- Container and vehicle loose lashing gear with container securing manual
- Personal computers and loading computer (to be installed by Builder)
- Ship Oil Pollution Emergency Plan (SOPEP) and associated materials
- Cabin art work and pictures with frame
- Entertainment equipment (to be installed by Builder)
- All spare parts and tools for all machinery and equipment in excess of those provided in paragraph 12 below
- Class Room, Lab, Workshop and Training Space furnishings, equipment and special outfitting (to be installed by Builder)
- Medical Equipment

12. SPARE PARTS AND TOOLS

Spare parts shall be supplied in accordance with the requirements of the Classification Society, the manufacturer's standard for equivalent one year operation (8,000 hours) and the Builder's standard. Tools shall be supplied according to the manufacturer's standard.

13. REFERENCE DRAWINGS

The following drawings show the intent of the Outline Specification. The requirements of the Outline Specification take precedence over the drawings.

2015-017-03-01 General Arrangement

2015-017-03-11 Midship Section

2015-017-03-14 List of Machinery

2015-017-03-30 Electric One Line Diagram

2015-017-03-34 Electrical Functional and Operating Philosophy

2015-017-03-07 Rules and Regulations Applicable to the NSMV

In addition to the key drawings specified above, the attached list of reference drawings shall provide guidance on what is the intent of the Outline Specification.

14. ENVIRONMENTAL & HULL EFFICIENCY CONSIDERATIONS

Areas where the vessel design is expected to exceed environmental regulatory requirements include the following:

- Consideration shall be given to minimizing air resistance when designing the superstructure.
- The Owner encourages design features that minimize the need for loading and discharging of ballast without sacrificing propulsion efficiency.
- The Owner encourages design features that minimize energy use during normal operations. Multi-speed or variable speed motors should be considered for major fans and pumps. Controls for lighting shall be readily accessible and bundled to enable efficient operation. Increased insulation of living spaces suitable for the tropical conditions consistent with the intended service should be considered.
- All tanks intended for carriage of oil or oily-water substances including the oily bilge tanks and the main engine sump shall be arranged with double hull protection.

15. SAFE RETURN TO PORT

The Vessel shall meet SOLAS Safe Return to Port regulations. Proper Safe Areas shall be ensured as well as critical system functions ensured. For details on the Safe Return to Port requirements for this vessel, refer to document 2015-017-03-26 Safe Return to Port Analysis.

The following systems are affected by the Safe Return to Port regulations:

- Propulsion
- Steering systems and steering control systems
- Navigational systems
- Systems for fill, transfer, and service of fuel oil
- Internal communication between the bridge, engineering spaces, safety center, fire-fighting and damage control teams, and passenger and crew notification and mustering
- External communication
- Fire main system
- Fixed fire-extinguishing systems

- Fire and smoke detection systems
- Bilge and ballast systems
- Power-operated watertight and semi-watertight doors
- Flooding detection systems
- Systems intended to support safe areas as follows:
 - sanitation
 - water
 - food
 - alternate space for medical care
 - shelter from the weather
 - means of preventing heat stress and hypothermia
 - lighting
 - ventilation

16. SAFETY CENTER

In accordance with SOLAS Regulation 28, the vessel shall have a Safety Center whose purpose is to assist with the management of emergency situations. It shall be located adjacent to and have direct access to the navigation bridge and be arranged such that the management of emergencies can be performed without distracting watch officers from their navigational duties.

Means of communication shall be provided between the Safety Center, Navigation Bridge, engine control rooms, and the fire extinguishing system storage rooms and fire equipment lockers.

The full function of the following systems shall be made available from the Safety Center:

- All powered ventilation systems
- Fire doors
- General emergency alarm system
- Public address system
- Electrically powered evacuation guidance systems
- Watertight and Semi-watertight doors
- Indicators for shell doors, loading doors and other closing appliances
- Water leakage of inner/outer bow doors, stern doors and any other shell doors
- Television surveillance system

- Fire detection system
- Fixed fire-fighting local application system
- Sprinkler and equivalent systems
- Water-based systems for machinery spaces
- Alarm to summon the crew
- Flooding detection system
- Fire pumps and emergency fire pumps

II. HULL PART

1. HULL STRUCTURE

Higher tensile steels (up to Yield Point of 315 N/mm² and 355 N/mm²) can be used in longitudinal structures in the lower part of the hull girder, but shall not make up more than 15% of the hull steel weight.

Plating in ballast tanks shall be a minimum of 11 mm for primary structure and 10 mm for secondary structure. Shell plating shall be a minimum of 12 mm thickness to provide long life and good strength against damage from contact and waves. Innerbottom plating shall be a minimum of 12 mm to provide for longer life. Shell plate in way of anchor rub area shall be increased by 5 mm thickness above the minimum class requirements.

Permissible loads and scantlings shall be in accordance with the rules of the Classification Society. Local strength of main deck aft to be sufficient for container stack loads of 40 mt for 20' containers or 50 mt each for 40' containers. In addition, the main deck aft, in way of where cargo loading is possible, shall be designed for general cargo loads of 1.0 mt/m² (200 psf). RoRo space shall have deck strength for loading of 1.25 mt/m² (250 psf).

Allowable bending moments and shear forces shall be such that there is at least a 5% margin over the envelope of actual bending moment and shear force values from any expected combination of loading in ballast and with cargo. These loading combinations should include a full load in the RoRo space with full container stowage.

Primary framing system of the hull structure shall be longitudinal with transverse web frames and bulkheads arranged as shown on the General Arrangement Plan.

Integrity of fire zone boundary bulkheads shall be maintained for the full depth of the vessel and bulkheads shall be kept in one plane to the extent possible. Penetrations through watertight and fire zone boundary bulkheads shall be minimized and shall not exceed the quantities allowed by the applicable Rules and Regulations. Closing mechanisms for doors through these bulkheads shall be remotely operable. All vertical and horizontal trunks for piping, ducts and electrical cable shall be insulated with A-60 insulation where required by SOLAS or Class Rules.

Primary deck longitudinal support structure in the deckhouse and hull shall align with pillars fitted vertically in line from top to bottom of the vessel. Full extent of steel bulkheads shall be utilized to support structure in decks above to minimize use of pillars in accommodation spaces. Stair towers and vertical trunks shall be aligned with primary longitudinal structure so that they can be effective in supporting deck structure. In the RoRo space, installation of pillars shall be minimized.

The stern frame and rudder horn shall be constructed of fabricated welded steel in conjunction with steel castings and designed to obtain adequate clearances for the propeller. Propeller shall be removable without drawing in the tailshaft or removing the rudder. Stern tube cooling water tank is to be provided in the lower part of the Aft Peak.

Rudder is to be of twisted shape, double plate, spade type with flap, Becker or similar. It shall be capable of rotating to 45 degrees to either side plus an additional 45 degrees flap rotation, while in maneuvering conditions (10 knots or less). Maximum turning shall be 35 degrees to either side above 10 knots. For Becker rudder, the Becker Intelligent Monitoring System shall be provided to show rudder force with display on the bridge.

The stem area above the bulb, because of its narrow beam, shall utilize closing plate type construction with welding of the closing shell plate from the exterior only. The stem area with this construction, where internal access is not possible, shall be a watertight void space with appropriate anti-corrosion coating. Provide drain plug in the bottom stringer of the void space to check for water leakage into the void space.

Tug pushing areas shall be provided, two each side, in way of transverse bulkheads and one on CL on the transom with required local strengthening. The tug push areas on each side shall have a vertical extent at least from 1m above the light draft to 3m above the load line draft, and a horizontal extent of at least 2 full web frame spaces.

Bilge keels are to be fitted through about 25% of the ship's length amidship.

Piping mains shall be run above the inner bottom rather than in a pipe tunnel in the double bottom. Pipes for systems that can lead to flooding of spaces shall be inboard of B/5 in general, as required by the Rules and Regulations.

A Bulwark shall be arranged on the main deck forward of the deckhouse as shown on the General Arrangement Plan.

Deckhouse exterior boundary walls to be of plane construction with internal vertical stiffeners. Inside division bulkheads to be of vertically stiffened flat type or swage type where not visible from the passageway. The arrangement of internal webs, pillars and steel bulkheads shall be specially designed to minimize vibration within the deckhouse. Where the deckhouse sides align with the side shell below, smooth transitions with large radius shall be fitted at any openings (such as for the lifeboats) and at the ends of the house, as shown on the General Arrangement drawing. Inside the deckhouse, bulkhead plating shall be a minimum of 7 mm and deck plating shall be a minimum of 8 mm exterior and 7 mm interior.

The RoRo deck (3rd deck) shall not act as the top of a tank so as to avoid manholes and vent pipes intruding into the main part of the RoRo deck. Piping and fittings can be installed on the RoRo deck within the extent of the shell and bulkhead framing. Any voids or cofferdams above tanks shall have a minimum depth of 1.3 m to allow easy passage through the void for inspection.

Openings in way of the side shell for the RoRo side ramp, stores sideports and quarterdeck access shall be fitted with generous radius and proper compensation fitted where needed to maintain the strength of the hull.

Finite element structural analysis shall be carried out in conformance with Class Rules and shall include a detailed analysis of the transition areas from the hull to the deckhouse side and in way of openings in the side shell. Vibration analysis shall be carried out for the after part of the hull and shall include confirmation that the deckhouse has adequate structural support and stiffness against excessive vibration.

2. PARTICULARS OF HULL OUTFITTINGS

2.01 Steering Gear

Quantity & Type 1 set, electro-hydraulic, rotary vane type with 2 power units (2 x 100%), one of the motors may be two-speed type.

2.02 Windlass

Quantity, Type & Capacity 2 sets, electric motor driven, each with 1 wildcat (cable lifter), 1 hawser drum, and 1 warping head, local and ship side control, with auto-tension. Wildcat continuous pull rating of 26.5 mt, overload rating of 40 mt, and hoisting speed of 9 m/min. Hawser drum rating of 20 mt x 15 m/min. Hawser drums shall be split type with storage section and tension section.

2.03 Mooring Winch

Quantity, Type & Capacity Fwd: 1 set, electric motor driven, 2 hawser drum, 2 warping head, local and ship side control, with auto-tension, rating of 20 mt x 15 m/min. Hawser drum shall be split type with storage section and tension section.

Aft: 2 sets, electric motor driven, 2 hawser drums, 2 warping heads, local and ship side control, with auto-tension, rating of 20 mt x 15 m/min. Hawser drums shall be split drum type with storage section and tension section.

2 sets, similar design, with 1 hawser drum and 1 warping head. One winch shall be on the main deck, starboard, for aft spring line to run forward of the side ramp.

2.04 Capstan

Quantity, Type & Capacity 2 sets, electric motor driven, 500 kgf x 40 m/min, 1 forward and 1 aft.

2.05 Bow Thruster

Quantity, Type & Capacity 1 set, electric motor driven, about 1,425 kW, 6600 VAC, 60 Hz, 3 phase. Combination type that can operate as azimuthing retractable thruster for "Take Home" power purposes and alternatively as tunnel thruster in raised position for normal maneuvering. Nickel aluminum bronze, controllable pitch propeller.

		Hydraulic system for pitch control and extend/retract system.
2.06	Stern Thruster	
	Quantity, Type & Capacity	1 set, electric motor driven, about 890 kW, 6600 VAC, 60 Hz, 3 phase. Tunnel type with Nickel aluminum bronze, controllable pitch propeller. Hydraulic system for pitch control.
2.07	Anchor	
	Quantity & Type	2 sets, superior holding power, with 1 spare anchor, about 6,525 kg each (per Class requirements)
2.08	Anchor Chain	
	Type	Grade 3 welded stud link extra high strength, 73 mm diameter (per Class requirements)
2.09	Mooring Rope	
	Quantity & Type	8 sets, high strength synthetic fiber rope with minimum breaking strength of 51 mt. Each to be 200 m long
3.	TRAFFIC EQUIPMENT	
3.01	Accommodation Ladder	
	Quantity & Type	2 sets, electric motor driven hoist, aluminum alloy construction, 600 mm width
	Location	Accommodation ladder shall be installed in a recess in the shell plate above the 2 nd Deck in way of the Quarterdeck access passageway. Recess in the shell plate shall extend forward to allow access from shore based gangway to the quarterdeck access doors.
3.02	Pilot Slant Ladder	
	Quantity & Type	None required
3.03	Pilot Ladder	
	Quantity & Type	2 sets, rope pilot ladder to be deployed from the forward end of accommodation ladder recess, port and starboard (in way of quarterdeck access doors).
3.04	Access Hatch	
	Quantity & Type	Forward Lower Bosun's Stores Spaces: 1200 x 1200 raised watertight, dogged, 1 set on

2nd Deck, forward

Bosun's Stores: 1200 x 1200 raised watertight, dogged, located forward of the windlass, outfitted to also act as a rope hatch with round bar around the lower edge.

Rope Lockers: 600 mm dia, flush round type with round bar around lower edge, located aft, port and starboard.

Motor Room Escape: 800 x 800 raised watertight with quick acting dogs activated by single wheel type handle and counterbalance weight to allow opening from below. 2 sets on Main Deck aft, above escape trunks from the two Motor Rooms.

3.05 Stores Hatch

Engine Room Stores Hatch

1500 x 1500 hinged dogged hatch, flush type, 2 sets total, 1 mounted on 2nd Deck and 1 mounted on 3rd Deck. Hatch on 3rd Deck is watertight.

Stores Side Port

Watertight double wide door in the side shell at about Fr. 72, port and starboard, above the 2nd Deck shall provide access to the main food and engine room stores areas from pierside. Sideport dimensions are about 2.75 m wide and 2 m high. Overhead trolley beam in the passageway shall lift parts from shore and transfer them to the stores passage or down the engine room stores hatch.

Forward Stores Hatch

1500 x 1500 mm hinged raised watertight dogged hatch, 2 sets, on the Main Deck forward.

1500 x 1500 mm, hinged, flush type watertight dogged hatch, 2 sets, on the 2nd Deck forward.

Auxiliary Machinery Hatch

1500 x 1500 mm hinged dogged hatch, flush type, 4 sets total, mounted on the 4th Deck above each Auxiliary Machinery Room.

3.06 Manhole Covers

Quantity & Type

600 x 400 mm bolted type

Location per Builder standard, except tank or void with longer dimension of 9 m or more shall have at least two manholes.

3.07 Remote Operated Watertight Doors

Remote operation of all sliding watertight doors shall be provided. The power for each door shall be supplied from the emergency switchboard. Controls and monitoring for the system shall be available from at least two locations separated by A class fire boundaries. One of the locations shall be the Safety Center.

3.08 Access to Containers

Deck containers	Access shall be possible to both the forward and aft ends of all containers stowed on the Main Deck and Multi-purpose Space (MPS) Roof.
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3.09 Access to RoRo Spaces

Access shall be via inclined ladder, port and starboard, at the forward end and near centerline at the aft end, as shown on the General Arrangement drawing with watertight doorway leading to the stairways. Access to the engine rooms shall be available from 3rd Deck via passages.

3.10 Engine Room Escape Trunk

Escape Trunks	Escape trunks shall be provided in both engine rooms, one on port and one on starboard, with access to the trunk at each deck level in the engine room and from the control rooms with exit doors on the 3 rd Deck. One of the engine room escape trunks can be an enclosed inclined ladder trunk and one can have vertical ladders. Escape trunks from the lower level of both Motor Rooms shall be provided with exit hatches installed on the Main Deck. Two means of escape shall be provided for each Auxiliary Machinery Space, one of which can be an escape trunk leading to the 4 th Deck.
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4. CONTAINER STORAGE

4.01 Container Length Stowage Flexibility

On Main Deck	40' containers, alternative loading is 2 x 20' containers, stowed 6 rows across in fwd bay and 8 rows across in aft bay. 40' or 45' containers on 2 nd tier. 1x slot for 20' container, 2 tiers high.
MPS Roof	40' containers for outboard rows. Two inboard

rows are 1 x 20' only.

4.02 Specialized Containers

Reefer Containers

On Main Deck and RoRo Space,. Reefer containers can be 20' or 40' long. Total number of reefer outlets shall be 15.

Design of access and reefer receptacle locations shall be based on all reefer containers being stowed with the machinery on the forward side.

4.03 Container Securing System

Deck Foundations

Low profile Dovetail type foundations shall be provided for securing containers on deck with manual Dovetail twistlocks (SEC type DF or similar)

Lashing system

Single cross lashing system. Fixed lashing equipment is Builder supply. Portable lashing equipment is Owner supply. Lashing securing fittings on the deck shall be low profile or flush type.

Storage of lashing rods

On racks along deck

Storage of twistlocks

In storage bins on deck

5. CLASSES OF DANGEROUS GOODS INTENDED TO BE CARRIED

Class of Dangerous Goods		Weather Deck	RoRo Spaces
1	Explosives (all divisions).	N	N
1.4(S)	Explosives, division 1.4, compatibility group S".	Y	Y
2.1	Flammable gases: Compressed, liquefied or dissolved under pressure.	Y	N
2.2	Non flammable, non poisonous gases: Compressed, liquefied or dissolved under pressure.	Y	Y
2.3	Poisonous gases: Compressed, liquefied or dissolved under pressure.	Y	N
3.1 & 3.2	Flammable liquids: Low flash point below -18 °C, Intermediate flash point -18 to 23 °C	Y	N
3.3	Flammable liquids: high flash point 23 to 61 °C	Y	Y

Class of Dangerous Goods		Weather Deck	RoRo Spaces
4.1	Flammable solids: Readily combustible solids and solids which may cause fire through friction	Y	N
4.2	Flammable solids: Substances liable to spontaneous combustion	Y	N
4.3	Flammable solids: Substances which, in contact with water, emit flammable gases	Y	N
5.1	Oxidizing substances (agents)	Y	Y
5.2	Organic peroxides	Y	N
6.1(A)	Toxic substances (liquids) - Non flammable	Y	Y
6.1(B)	Toxic substances (liquids flash point less than 23 °C) - Low flash	Y	N
6.1(C)	Toxic substances (liquids with flash point of 23 to 61 °C) - High flash	Y	Y
6.1(D)	Toxic substances (solids)	Y	Y
8(A)	Corrosive (liquids) - Non flammable	Y	Y
8(B)	Corrosive (liquids flash point less than 23 °C) - Low flash	Y	N
8(C)	Corrosive (liquids with flash point of 23 to 61 °C) - High flash	Y	Y
8(D)	Corrosives: (solids)	Y	Y
9	Miscellaneous dangerous substances and articles	Y	Y

Notes:

- 1) Y : Dangerous goods intended to be carried.
- 2) N : Dangerous goods not to be carried.
- 3) Dangerous goods shall be stowed in closed freight container in accordance with the requirements of Chapter II-2, Part C, Regulation 19 of SOLAS.
- 4) Reefer containers on the weather deck shall be stowed 3 m away from the natural ventilation air outlet of RoRo space, when dangerous cargo is loaded.
- 5) RoRo spaces with Dangerous goods shall be fitted with gas detectors.

6. RORO SPACE LOADING

All RoRo space equipment shall meet the requirements of the Regulatory Bodies, and shall be designed to operate properly with heeling angles of up to 3 degrees and trim

angles of 2 degrees. Autos, Trucks, Special Purpose Vehicles, and Trailers shall be able to be stowed in the RoRo space. Maximum Trailer size shall be 53' L x 8'-6" W x 13'-6" H or 45' L x 8'-0" W x 13'-6" H. Average weight of trailers is 25 mt (55,000 lbs). Trailers shall be stowed, in general, with 450 mm (18") clearance between trailers. Autos shall include passenger cars, SUVs and light trucks. Average deck area per auto is 14.2 m² (150 ft²), including space around the auto. Average auto weight is about 2 mt (4,400 lbs). Trucks and special purpose vehicles shall be intermediate in size and weight to the autos and trailers.

6.01 Side Ramp

Quantity & Type

One (1), hinged, two section folding ramp, 6.1 m (20') clear width, about 13 m length, 40 mt maximum load, 1.25 mt/m² (250 psf) maximum uniform load with anti-skid surface. Self-deploying with winches, king posts and hydraulic system. Clear opening in the side shell for the ramp shall be 6.5 m (W) x 4.6 m (H). In the up position, the ramp shall be folded in half. Ramp shall be able to function from 10 degrees down to 2 degrees up.

6.02 RoRo Space Ventilation

Enclosure & Ventilation

The RoRo space shall be considered a closed RoRo deck. Three mechanical supply fans are to be provided at the forward end with natural exhaust through louvers to the aft mooring deck. Duct layout shall provide for supply and exhaust to be well distributed from the upper and lower levels of the space. Inlet and exhaust louvers shall be remotely closeable in the event of a fire to seal the space before the fixed gas fire-extinguishing system is activated. Ventilation shall be adequate for 10 air changes per hour for the empty space per SOLAS Ch. II-2, Reg. 20, 3.1.1.

6.03 Deck Strength and Fairness

RoRo Deck

The RoRo deck (3rd Deck) shall be designed for uniform loading of 1.25 mt/m² (250 psf)

Aft Main Deck

The Aft Main Deck shall be designed for container loading with a stack weight of 50 mt per 40' container slot and 40 mt per 20' container slot. Aft Main Deck shall also be designed for uniform loading of 1.0 mt/m² (200 psf).

Multi-purpose Space Roof	The roof of the Multi-purpose Space shall be designed for container loading with a stack weight of 30 mt per 40' container slot and 24 mt per 20' container slot. The deck shall also be designed for a uniform loading of 1.0 mt/m ² (200 psf) on areas suitable for cargo stowage.
Helicopter Landing Area	The helicopter landing area on the Aft Main Deck shall be suitable for landing a SH-60 Seahawk Helicopter and meet the requirements for strength and landing area size.
All Decks	All deck plating shall be fabricated with a minimum of deflection and in no case greater than +/- 6 mm per 1000 mm or between stiffeners.
6.04 Clear Height RoRo Space	Minimum clear height = 4.6 m (15'-1")
6.05 Vehicle Lashing RoRo Deck	Low Profile or flush Cloverleaf type, 30 mt breaking strength, spaced about every 800 mm (L) and 800 mm (B).
Storage	Suitable number of 16 mm round bar hanger for stowage of loose lashing gear shall be provided on the RoRo deck.
Crinkle bar	Crinkle bar shall be provided in way of side shell, bulkhead and pillar.

7. HELICOPTER DECK

7.01 Safety Equipment Safety Net	The unprotected perimeter of the helicopter landing deck is to be provided with a fold down safety net system. The safety net is to extend 1.5m horizontally away from the deck when folded down with the outer edge of the safety net no more than 150mm above the edge of the deck. The safety net structure is to act as a handrail when folded up with a height approximately 1.1 m above the deck.
Access Opening Handrails	The two access stairways down to the mooring space in the aft corners of the main deck shall

	be fitted with removable handrails, and a safety net should be available to close off the opening when the handrails are removed.
Fire Fighting Systems	See section II.8.08.
7.02 Outfitting	
Deck Surface	The helicopter deck is to have a non-skid surface.
Markings	The helicopter deck is to be painted and marked in accordance with ABS Guide for the Class Notation - Helicopter Decks and Facilities (HELIDK and HELIDECK(SRF)), Section 2, Part 9.7.
Lighting	Omni-directional perimeter lighting shall be provided in accordance with the ABS Guide for the Class Notation - Helicopter Decks and Facilities (HELIDK and HELIDECK(SRF)), Section 2, Part 9.9. Floodlights shall be provided to illuminate the helicopter deck markings while minimizing shadows and arranged so as to avoid glare to the pilots.
Wind Indicator	A wind direction indicator located in an unobstructed area readily visible to helicopters approaching the helicopter deck is to be provided. The wind indicator shall be illuminated for night operations.
Tie Downs	The helicopter deck is to have recessed tie-down points for securing a helicopter or cargo.

8. HULL PIPING SYSTEMS

8.01 Seawater Ballast System

Piping	A ring main ballast system for seawater ballast with port and starboard mains connected at the forward end shall be provided. The ballast main shall be run above the innerbottom through the engine rooms and auxiliary machinery rooms. The system shall have isolation valves in the mains to allow for transfer of ballast from any tank to other tanks not on the same ballast main.
Valve Operation	Ballast system branch valves to SW tanks shall be rubber lined butterfly type with electric or

electro-hydraulic actuators controlled from the ballast control module of the Control, Alarm and Monitoring System (CAMS). Valves shall be located near the innerbottom tank top level to be accessible at all times. System isolation valves, CAMS operated gate valve type, shall be fitted in the ballast main cross over at the forward end and at aft end of the two ballast mains, port and starboard.

Ballast Pumps

Two (2) combined service Bilge & Ballast Pumps (one per ER). Both pumps: motor driven, vertical, centrifugal, self-priming. Capacity about 250 m³/hr @ 28 m, each pump. Pumps to be suitable for ballast tank stripping operations.

Ballast Water Treatment

One Ballast Water Treatment System (BWTS), approved for use on US flag vessels, shall be provided. BWTS shall be suitable for full ballast flow, about 500 m³/hr and shall include a self-cleaning filter. Selection of BWTS shall be approved by the Owner.

8.02 Fresh Water Ballast system

Piping

A connection from the seawater ballast main shall be provided to each fresh water ballast tank. FW tanks shall be isolated from the SW main by a line blind and a valve.

Valve Operation

FW ballast system branch valves to FW tanks shall be gate type. All valves shall be locally, manually operated.

8.03 Cross Flooding System

Cross Flooding Pipes

In Double Bottom tanks 7C and 9C a cross flooding pipe is required to supplement the cross flooding between the port and starboard sides of the tank through the double bottom trunk connecting the two sides in case of damage induced flooding of the tanks. The pipe shall be installed in the forward part of the tank and run from the inboard longitudinal bulkhead of each side tank, across the intervening double bottom tank (6C and 8C). See guidance document 2015-017-03-09 NSMV Stability Analysis for an illustration of the cross flooding pipe location. Pipe length is

15.2 m, outside diameter is 550 mm and thickness is 12 mm. Pipe is open at each end and located at about the mid-height of the double bottom. Pipe shall be coated externally and internally with the same coating system as the ballast tank.

Cross Flooding Air Vents

All double bottom ballast tanks which require cross flooding to maintain vessel damage stability shall have enlarged air vent pipes to ensure cross flooding occurs in regulatory required time. Following table lists the minimum required air vent sizes, pipes shall be Sch. 80, galvanized.

Tank	Diameter	Quantity
3C	250	2
5C	250	2
7C	300	2
9C	300	2

8.04 Fuel Oil Systems

Piping

Piping shall be provided for filling all MGO storage tanks from port and starboard bunkering stations. Piping shall also be provided to transfer oil to and from the fuel oil storage tanks to the settling tanks aft.

Valve Operation

Electric or electro-hydraulic remote control for valves in the engine room and the fwd auxiliary machinery room controlled from the fuel oil transfer module of the CAMS.

High Level Gauge

High level alarm integrated into the tank level gauge system in the CAMS.

Bunker Stations

Located on Main Deck, port and starboard, near frame 56, each with a 1 mt hose davit.

8.05 RoRo Deck FW Wash Down & Drainage

FW Wash Down

A FW wash down system shall be provided for the RoRo deck with two hose outlets, one port and one starboard on the 3rd Deck. FW supply shall be from the ship's FW system.

Drain Wells

The RoRo deck shall have five drain wells with normally closed stop check valves that drain

	directly overboard. Dip pipes in the drain wells are to be provided to allow removal of oily debris using a portable air driven pump.
Drain Well Portable Pump	One (1) portable, dual diaphragm, air driven pump to be provided for removal of oily debris from drain wells. Pump to include suction and discharge hoses with suitable end connections to pull suction from drain well dip pipes, and discharge to a bucket or drum.
8.06 Bilge System	
Piping	One (1) common main type to serve all compartments of the ship on the tank top level. Bilge main to be located inside of B/5 from the side.
Valve Operation	Electric or electro-hydraulic actuators for suction valves located in each of the engine rooms, the motor rooms and auxiliary machinery rooms, controlled from the bilge control module of the CAMS. In general, a stop check valve and a strainer shall be provided at each bilge suction.
Bilge Pumps	Two (2) combined service Bilge & Ballast Pumps (as listed in Section II.8.01). Two (2) combined service Bilge / Aux. SW Cooling Pumps (as listed in Section IV.8.02).
Bilge Eductors	One (1) Store Room & Chain Lockers Eductor, 5 m ³ /hr, driving water supplied from Fire Main. One (1) Bow Thruster Room Eductor, 10 m ³ /hr, driving water supplied from Fire Main
High Level Alarms	Float type for each compartment bilge well with high level alarm integrated into the CAMS.
8.07 Tank Level Gauge	
Type	Electric pressure sensor type remote reading level gauge integrated into the CAMS. All gauges shall be mounted on gate valves so that they can be replaced while the tank is full.
Draft Gauge	Four (4) sets
Fuel Tanks	All fuel storage, settling and service tanks shall have a tank level gauge
Ballast Tanks	All SW and FW ballast tanks shall have a tank level gauge.

Misc Tanks	Bilge holding tanks, fresh water storage tanks, distilled water storage tank, gray and black water tanks, bilge oil tanks, lube oil storage tanks over 5 m ³ in capacity, and waste oil tanks shall have a tank level gauge.
8.08 Fire Fighting Systems	
RoRo Deck	Closed RoRo decks shall be protected by the combined Engine Rooms' Full Flooding Clean Agent fixed gas fire-extinguishing system (INERGEN® or similar), Portable fire extinguishers, and Fire hydrant (seawater) system.
RoRo Decks with vehicles	All RoRo decks shall be suitable for stowage of vehicles with partial or full fuel tanks and connected batteries. RoRo decks shall have portable fire extinguishers separated by no more than 20m, plus at least 3 water fog applicators and 1 portable foam applicator unit.
Helicopter Deck	Helicopter deck is to be fitted with a fixed foam system (for Category H2), at least two fire hose connections from the fire main, dry powder extinguishes, and carbon dioxide extinguishers in accordance with ABS SVR 4-7-2/5.3.
Engine Rooms	Full Flooding Clean Agent (INERGEN® or equivalent) fire extinguishing system with separate systems protecting each engine room and the storage room for each system located in separate fire zones from the engine room being protected, Portable fire extinguishers, Local water mist systems according to SOLAS requirements, and Fire hydrant (seawater) system.
Auxiliary Machinery Rooms	Fire hydrant (seawater) system and portable fire extinguishers.
Motor Rooms	Full Flooding Clean Agent (INERGEN® or equivalent) fire extinguishing system Portable fire extinguishers, and Fire hydrant (sea water) system.
Electrical Equipment Rooms	Portable fire extinguishers – clean agent type.

Accommodation Spaces	Water mist system, Fire hydrant (seawater) system, Portable fire extinguishers, Fixed fire extinguishing system and related safety equipment for deep fat fryer.
Open Deck	Fire hydrant (seawater) system.
Paint Lockers	Fixed fire extinguishing system – water mist, or clean agent type.
Fire pumps	Two (2) Main Fire & General Service Pumps - one (1) in each engine room, One (1) Emergency Fire Pump in AMR 2, All pumps: motor driven, vertical, centrifugal, self-priming. Capacity: 210 m ³ /hr, per regulations.
Fire System Hydrophore	One (1) Fire System Hydrophore, internally coated or rubber-lined, Capacity: 1,000 L, approx. 90 mlc set pressure, Two (2) hydrophore pumps rated 12 m ³ /h each.
Water Mist Pumps	Pumps shall be provided per system maker's requirements.
Approval	All Fire Fighting equipment shall be USCG certified, where required by regulations.

8.09 Fire Detection Systems

RoRo Decks	Fixed fire detection and alarm system
Engine Room	Fixed fire detection and alarm system
Aux. Mach. Rooms	Fixed fire detection and alarm system
Living Quarters	Fixed fire detection and alarm system
Open Deck	Manual fire alarm system
Approval	All Fire Detection equipment shall be USCG certified, where required by the regulations.

8.10 Fire Control Stations

The primary Fire Control Station shall be the primary Safety Center located adjacent to the navigating bridge. A fire control station shall be provided in a separate main fire zone outfitted with backup controls and detection systems as required by SOLAS.

8.11 Material of Pipes

The piping materials shall be in accordance with the below table. U.S. standard piping is indicated, however, alternative, internationally recognized standards can be applied with equivalent thickness and material properties. Alternative

standards shall be Owner and Class approved.

System	Size (NPS)	Material	Remarks
Ballast, in tanks	10 & above	ASTM A53 Type E or S Grade B, Steel, Extra Strong	galvanized
	8 & below	ASTM A53 Type E or S Grade B, Steel, Sch 80	galvanized
Ballast, outside tanks	12 & above	ASTM A53 Type E or S Grade B, Steel, Standard	galvanized
	10 & below	ASTM A53 Type E or S Grade B, Steel, Sch 40	galvanized
Fuel Oil	1 to 10	ASTM A53 Type E or S Grade B, Steel, Standard	
	$\frac{3}{4}$ and below	ASTM A106 seamless Grade B, Steel, Sch 80	
Bilge	10 & above	ASTM A53 Type E or S Grade B, Steel, Extra Strong	galvanized
	8 & below	ASTM A53 Type E or S Grade B, Steel, Extra Strong	galvanized
Fire and Deck Wash	1 to 10	ASTM A53 Type E or S Grade B, Steel, Standard	galvanized
	$\frac{3}{4}$ and below	ASTM A106 seamless Grade B, Steel, Sch 80	galvanized
Compressed Air (Ship's Service)	1 & above	ASTM A53 Type E or S Grade B, Steel, Standard	galvanized
Hydraulic valve control	All sizes	ASTM A 213 type 316 Stainless Steel	
Potable Water in accommodation		ASTM B88 Type K Seamless Drawn Copper	
Hot Water in Accommodation		ASTM B88 Type K Seamless Drawn Copper	
Plumbing, Scupper Soil in Accommodation		ASTM A53 Type E or S Grade B, Steel, Extra Strong or Specialized Piping system such as Loro (stainless steel)	Steel pipe galvanized

9. CORROSION PROTECTION

9.01 Painting

Area	System	No. of coat	DFT in total (microns)	Note No.
Bottom	Epoxy	2	300	1
	Epoxy Tie	1	100	
	Self- Polishing AF	2/3	See Note	
Top Side	Epoxy	2	250	
	Polyurethane	2	100	
Exposed Deck	Epoxy	2	250	
	Polyurethane	1	75	
Exposed Deck House	Epoxy	2	200	
	Polyurethane	1	50	
RoRo deck and ramp	Epoxy nonskid	2	250	
Seawater Ballast Tank	Epoxy	2	320	2
Fresh water Ballast Tanks	Epoxy	2	250	
Fresh Water Tank	Pure epoxy	3	300	
Fuel Oil & Lube Oil Tank	Rust prevent oil	---	---	
Void Tanks	Epoxy	2	250	3
Engine Room & Mach. Space Bilge Area, Bilge Wells, Bilge Tank	Epoxy	2	250	3

Note:

1. The DFT and number of coats to be based on maker's recommendation for 60 months life and suitable for maker guarantee of life.
2. Water Ballast Tank coating shall meet the requirements of PSPC.
3. Stripe Coats to be applied as follows:
 - a. Seawater Ballast Tanks: 2 stripe coats
 - b. FW Tanks and FW Ballast Tanks: 2 stripe coats
 - c. Void/Cofferdam: 1 stripe coat
 - d. Bilge Tank: 1 stripe coat
 - e. ER Bilge Well: 1 stripe coat
4. The sharp edges of structural members and holes (slots, scallops, air and drain holes, etc.) shall be removed as follows:
 - a. 2 pass grinding: water ballast tanks, fresh water tanks, house exposed deck edge

b. 1 pass grinding: voids, sea chest

9.02 Cathodic Protection

Seawater Ballast Tank	Aluminum alloy anodes, 5 years life (ballast ratio: 50%)
Underwater Area	Impressed current system, 35 mA/m ²

10. LIFE SAVING EQUIPMENT

Lifeboat:	Eight (8), totally enclosed with launch and retrieve system x 76p min capacity. One lifeboat shall be set up to act as Lifeboat/Rescue boat
Liferaft:	10 sets x 39 person, self-righting type with davit launching.
Rescue Boat	One (1) rigid inflatable type with outboard motor and davit for 6 persons, SOLAS approved and capable of launch/retrieval at 5 knots.
Approvals	All Lifesaving Equipment shall be USCG approved, as required by regulations.
Muster Areas	Interior muster areas shall be provided on the 01 level in each fire zone, port and starboard. In addition, on the exterior deck along the house side on the 01 level, and on the roof of the Multi-purpose Space.

11. CARGO CRANE

1 set of conventional, electro-hydraulic (or all electric) wire luffing type, single crane with self-contained hydraulic power unit to be provided as shown on the General Arrangement Plan. The crane to be equipped with hoisting, luffing and slewing device.

The crane pedestal to be designed to be operated satisfactorily at vessel's heeling by 5 deg. and trim by 2 deg.

Jib Boom rest shall be provided for the crane at a suitable position when the crane is not in use.

PRINCIPAL PARTICULARS

Lifting capacity	35 mt S.W.L.
Lifting/Lowering speed	Min. 18.0 m/min at full load
Luffing speed	Maker's standard

Angle of slewing	360 deg (except where blocked by the deckhouse).
Slewing speed	Maker's standard
Maximum working radius	Abt. 24.0 m

12. PROVISIONS/ENGINE PARTS HANDLING GEAR

12.01 Forward Stores Cranes

Electro-hydraulic (or all electric), rotating jib boom type crane for stores handling, 2 sets, installed on forward side of deckhouse at 01 Level, P/S.

Capacity:	3 mt SWL x 10 m/min hoisting, 0.5 RPM
Outreach:	6 m, with minimum of 2.5 m over ship's side
Controls:	Portable controls for operation from Main Deck

Boom rests shall be provided for each crane at a suitable position for when the crane is not in use.

12.02 Provisions/Engine Parts Trolleys

Trolley beams with electric hoist for handling stores and engine parts through the stores sideports, P/S, on 2nd Deck. Trolleys shall have powered traversing with automatic lock to prevent sliding when not in use.

Capacity:	2 mt SWL x 10 m/min hoisting
Outreach:	2 m over ship's side using removable or rotating section of trolley beam
Height of Lift	Hoists shall be able to lower to 4 th Deck
Controls:	Portable controls for operation from 2 nd Deck

13. HULL MARKINGS

Underwater hull markings shall be provided suitable for underwater inspection in lieu of drydocking. Boundary marks shall be provided at each tank boundary and at transverse watertight bulkheads or floors. Boundary marks shall indicate the location of the tank boundary and indicate tank name on either side of the boundary by abbreviation. Bulkhead marks indicating the frame number shall be placed on the flat bottom near the keel, near the turn of the bilge, and along the upper side of the hull on both sides of the vessel. Hull markings shall be permanently marked with weld bead.

Tug Push Marks shall be provided on the side of the vessel.

Other normal hull marks, including IMO number and ship's name, shall be provided along the hull and accommodation. Line between anti-fouling and topside paint shall be marked with intermittent weld bead.

Owner shall provide details of Funnel and Bow Symbol marking.

III. ACCOMMODATION PART

1. CABIN ARRANGEMENT

1.01 Cabin arrangement

Highest officer:	Day room & bed room with double bed with private shower/lavatory, total of 4 cabins
Distinguished Visitor:	Large cabin with seating area and double bed with private shower/lavatory, total of 4 cabins
Senior Officer/Faculty:	Single berth cabin with private shower/lavatory
Faculty/Staff/Crew:	One or two high berth cabin with private shower/lavatory
Upper Cadets:	Two high berth cabin for 4 persons with private shower/lavatory with the sink in the main cabin space
Cadet Berthing, Large	Three high berth cabins for 18 to 36 persons, with adjacent shower / lavatory spaces with at least one toilet, shower and sink per 6 cadets

1.02 Public / Control Space

Officer/Faculty Mess Room (seats 40)
 Crew/Staff Mess Room (seats 30)
 Cadet Mess Room (seats 260)
 Officer/Faculty Lounge (seats 20)
 Crew/Staff Lounge (seats 15)
 Conference Room (Large & Small)
 Ship's Office (Engine & Deck Offices)
 Faculty & Administration Offices
 Barber Shop
 Gymnasium
 Wheelhouse with radio space
 Engine Control Rooms (two)
 Communications Room
 Fire Control Room
 Multi-purpose Space
 Safety Centers

1.03 Other Space

- Hospital & Treatment Rooms
- Alternate Medical Treatment Room
- Quarantine Room
- Laundries
- Public Toilets
- Stores/Lockers

1.04 Food Service Spaces

- Galley
- Food Service Area – Non-cadets
- Food Service Area – Cadets
- Scullery
- Pantry (at Multi-purpose Space)
- Ship Store & Café
- Dry Provision Stores
- Refrigerated Provision Stores
- Garbage Rooms

1.05 Training & Class Spaces

- Class Rooms (8)
- Library
- Computer Lab
- Study (2)
- Training Bridge
- Navigation Lab
- Machinery Labs
- Deck Training Area
- Cadet Workshops

2. JOINER CONSTRUCTION

2.01 Insulation

Heat and Sound insulation shall be installed where appropriate for air conditioned spaces and in accordance with Regulatory requirements. Insulation material shall be USCG approved where required by regulations.

2.02 Joiner Work and Cabin Construction

Joiner construction shall be Method IC in accordance with SOLAS. Joiner material shall be USCG approved where required by regulations.

In general, joiner construction shall be standard marine commercial practice with joiner liner panels and removable ceiling panels with sound absorption. Robust joiner construction shall be used from a recognized, approved maker with an integrated joiner construction system for bulkhead panels and ceiling panels.

In way of berthing areas, mess areas, training areas and passageways used by cadets, any joiner panels shall be sheathed with steel sheet (galvanized or other non-corrosive covering).

Use of pre-fabricated or modular cabin units and toilet/shower units shall be used to the extent possible to expedite construction.

3. WINDOW

Material	Steel window frame with toughened safety glass
Size	1,500 x 1,100 mm for wheelhouse 1,000 x 800 mm for lounges, ship cafe, conference room, library, highest officer class day rooms 450 x 600 mm for cabins and other public spaces 450 mm diameter portholes below Main Deck
Others	5- window wipers for main bridge and training bridge 2- clear view screens for main bridge

4. DECK COVERING

Carpet	Highest Officer and Distinguished Visitor class cabins
Vinyl sheet or tile	Other non-cadet cabins, Upper Cadet cabins, Study areas main deck and above, Lounges, Library, Computer Lab, Navigation Lab Hospital and treatment spaces, Offices, Barber shop, Ship store & Café, Conference rooms, officer & crew mess rooms
Stud type rubber mat	Wheelhouse and machinery control room, Passageways on Main Deck and above, Training bridge, Class rooms, Multi-purpose Space, Gymnasium

Quarry Tile	Galley, Scullery, Laundries, Toilet/shower spaces (or maker standard for prefabricated units), Garbage rooms
Steel Deck, Painted	Cadet mess room, Food Service areas, Cadet workshops, Cadet laboratories, Passageways below Main Deck, Cadet large berthing areas, Fire Control Room, Lockers & Store Rooms, Fan Rooms, Study areas below main deck, Deck Training Area

5. CEILING & BULKHEAD PANEL

Main Deck & Above	Cabins, passageways and public spaces on Main Deck and above shall be fitted with ceiling and bulkhead panels that are part of the joiner work system used on the vessel
Below Main Deck	Galley Spaces, Mess Rooms, Class Rooms and any Office spaces shall be fitted with ceiling and bulkhead panels. All other spaces, including cadet berthing spaces, can have bare ceilings and walls, but joiner panels can be used for dividing spaces

6. FURNITURE

Wooden Furniture	Constructed of particle board finished with melamine film
Upholstery	Woven fabric or vinyl leather for sofas and chairs.
Steel Furniture	With hard coating finish. All beds, desks, chairs and lockers in cadet berthing spaces shall be steel construction (except for cushion areas on chairs)
Cabin Furniture	<p>All non-cadet cabins shall include as a minimum the following furniture:</p> <ul style="list-style-type: none"> – Bed with drawers below – Wardrobe – Desk and chair – Night table – Sofa or Settee <p>All 4 person cadet cabins shall include the following minimum furniture:</p>

- Two high bunk beds with storage below at each level
- Locker for each person
- Desk and chair for each 2 persons

All large cadet berthing cabins shall include the following minimum furniture:

- Three high bunk beds with storage below at each level
- Locker for each person

Mess Room Furniture

The following type of table and chairs shall be provided in the mess rooms

Officer/Faculty & Crew/Staff Mess Rooms:

- Tables and chairs for 6 persons each

Cadet Mess Room:

- Fixed Tables and Benches for 8 to 12 persons each

7. SECURITY ZONES

The forward accommodation spaces in way of Fire Zone 2 for the Main Deck and above, including the navigation and communications spaces on 04 and 05 level, shall be considered a higher security zone. All doors leading to the spaces shall have coded access to restrict entry, except for doors in the stairways leading to the embarkation deck.

Other areas of the vessel shall meet normal security requirements as per ISPS Code.

8. PUBLIC SPACES - LEVEL OF OUTFIT

8.01 Empty Spaces

In general, the below listed public spaces shall not be outfitted with equipment or furniture. Only deck covering, ceiling, joiner work, and ventilation shall be provided, plus lighting and electrical connections.

- Class Rooms – 8 total to be provided
- Multi-purpose Space – to be provided with divider so can be made into two spaces
- Training Areas
- Library
- Computer Lab

- Navigation Lab
- Training Bridge, except as required to comply with IMO circular MSC.1/Circ.1369
- Communications Space
- Cadet Workshops (fitted with sinks with hot and cold water & compressed air)
- Cadet Labs
- Faculty Offices
- Administration Offices on Main Deck, except for Medical offices just forward of the hospital and treatment space

8.02 Fully Outfitted Spaces

The following public spaces shall be fully outfitted including furniture as described in this specification.

- Mess Rooms & Pantry
- Lounges
- Ship Store Café
- Conference Rooms
- Study Areas – outfitted with built in countertops or desks and chairs with electric receptacle and internet connection at each desk
- Ship Offices above Main Deck and Medical Offices
- Barber Shop
- Store Rooms

9. HOSPITAL & TREATMENT SPACES

Hospital and Treatment Spaces to be provided on the Main Deck suitable for serving 700 persons onboard the vessel. Basic requirements are as follows:

- Ward spaces for 10 patients in 2 high bunk beds
- Separate quarantine room with space for 4 patients in 2 high bunk beds and outfitted with one desk and chair, 4 lockers, and private toilet/lavatory.
- 3 examination rooms
- Waiting room for 10 persons
- Adjacent offices shall be for medical personnel
- A separate medical treatment space in a different fire zone for use in case of casualty to the main treatment spaces.

- Medical equipment shall be Owner supplied

10. GALLEY & LAUNDRY

10.01 Service Areas

For cafeteria style self-service, Service Areas to be provided adjacent to the galley. Separate service areas for cadets and for use of officers, faculty, staff and crew. Service areas to be open on one side for access from the mess rooms and passageways. Service areas and adjacent areas of the mess rooms shall include service windows with roll down shutters from galley, dressers, cabinets, coffee makers, hot water dispensers, toasters, microwave ovens, beverage dispenser bar (with beverage dispenser machines), salad bar, ice cream freezer, ice cube maker, dish, glass, silverware and tray storage racks, and tray racks near serving windows.

10.02 Galley Equipment

Galley Equipment shall be suitable for feeding 700 persons in two shifts with up to 400 persons eating at any one time. Full range of galley equipment shall be provided including cooking ranges with oven and griddle, mixers, electric soup kettle, deep fat fryers, exhaust hoods with fire extinguishing system and grease filter, microwave ovens, meat slicers, baking ovens, refrigerators, hot and cold meal serving tables adjacent to serving windows, dressers, working table with cutting board, sinks with food disposer, dish racks.

10.03 Scullery

Scullery area for cleaning dirty dishes, pots, glassware and silverware shall be provided. It shall have window for dirty dishes with roll down shutter, dishwashers, sinks, Macerator type sink disposer (marine type) sized for large food service system, storage racks for dishes, glassware and silverware

10.04 Multi-purpose Space Pantry

For serving food to the Multi-purpose Space, an adjacent Pantry shall be provided. It shall also function as a backup food preparation space for preparing simple meals in case of damage to the main galley. It shall be fitted with a countertop range, refrigerators, dishwasher, working table with cutting board, sinks, dish racks, microwave oven, dressers, coffee maker, and beverage dispenser.

10.05 Garbage Room

On the 2nd and 3rd Decks as shown on the General Arrangement, Garbage Rooms shall be provided. Each garbage room shall be fitted with a hose outlet for cleaning garbage cans and cleaning the floor. Drain to gray water system shall be provided in the floor. Bulkheads shall be lined with stainless steel (AISI 304) sheathing. Eyes shall be fitted along the

bulkheads for securing garbage cans. Compactor for dry waste shall be provided.

10.06 Catering Furniture

Metal parts to be stainless steel (AISI 304).

10.07 Laundry Equipment

Laundries shall be provided on each berthing deck in each fire zone, for both cadets and non-cadets. Approximately 1 washer/dryer unit for each 6 persons in non-cadet berthing areas and 1 unit for each 8 to 10 persons in cadet berthing areas. A ship's laundry shall be provided on the 3rd deck level. It shall have three large industrial type washers and three large dryers.

Each Laundry Combination Washer Dryer Units, marine type

1 – hand iron

1 – metal sink

1 – soap cabinet

Dryer shall be 220 V, 60 Hz, single phase type so as to be suitable for future replacement by US standard machines. Dryers to be vented to outside.

Galley and Laundry equipment shall be certified to US standards in accordance with regulations.

11. STAIRWAYS AND MEANS OF ESCAPE

All spaces shall have escape routes in compliance with the Regulations. Builder shall prepare an evacuation analysis and calculation of required stair width and stair landing area in compliance with SPS requirements (from SOLAS) and noting any differences from 46CFR subchapter H requirements.

Main Stair towers shall be continuous vertically from the lower part of the vessel and shall have an exit to the weather at the 05 level, where possible, or an alternative exit route to the weather. A minimum of 2 main stair towers shall be provided in each of Fire Zones 2 and 3 as shown on the General Arrangement.

The engine rooms shall have two means of escape by inclined ladder, plus an emergency escape trunk with access at each deck level starting from the lower engine room level and including direct access from the control rooms that exits to outside the engine rooms.

The motor rooms shall have escape trunks from the lower level up to the weather deck.

Auxiliary Machinery spaces shall have two means of escape to outside the space, at least one of which is an inclined ladder.

The emergency escape trunks can have a vertical ladder but the ladder rungs must be transversely oriented so that the ladder can still be used when the vessel is heeling in

either port/stbd direction.

The RoRo space will be used for assembly of cadets and for possible assembly of large groups of people in port while in emergency response mode. The RoRo space shall, therefore, have means of escape to the weather and to the lifeboat embarkation decks as if it were a large public space with 300 persons. In general, escape routes shall be provided at both the forward and aft ends, and on port and starboard, as shown on the General Arrangement.

12. SANITARY AND POTABLE WATER SYSTEM

Fresh Water	Common supply for drinking, cooking, toilet flushing and washing.
Equip. for water supply	<p>2 – Potable Water Hydrophore, 1500 L, with 2 pumps rated 300 L/min each, set pressure to service 01 through 05 Levels in Fire Zone 2</p> <p>2 – Potable Water Hydrophore, 1500 L, with 2 pumps rated 300 L/min each, set pressure to service 4th through Main Decks in Fire Zone 2</p> <p>2 – Potable Water Hydrophore, 1500 L, with 2 pumps rated 300 L/min each, set pressure to service 01 through 05 Levels in Fire Zone 3</p> <p>2 – Potable Water Hydrophore, 1500 L, with 2 pumps rated 300 L/min each, set pressure to service 4th through Main Decks in Fire Zone 3</p> <p>Hydrophores shall be installed in the Auxiliary Machinery Room (AMR) containing the fresh water tanks in the fire zone which they service. Fresh water supply system shall have ability to interconnect so that hydrophores can supply alternate system or zone in case of failure of one unit or in case of damage to space containing hydrophores in one fire zone.</p>
Potable Water Tank Dosing	4 – Brominators, 5 m ³ /hr ea., two located in AMR 2 and two located in AMR 3
Hot Water Heaters	<p>2 – Electric hot water heater, 1000 L storage capacity, heating capacity 750 L/hr from 40°F Inlet to 120°F Outlet, located on 03 Level of Fire Zone 2</p> <p>4 – Electric hot water heater, 1500 L storage capacity, heating capacity 1150 L/hr from 40°F Inlet to 120°F Outlet, two located on 01 Level of Fire Zone 2, two located on 01 Level of Fire Zone 3</p>

	<p>4 – Electric hot water heater, 2000 L storage capacity, heating capacity 1500 L/hr from 40°F Inlet to 120°F Outlet, two located on 3rd deck of Fire Zone 2, two located on 03 level of Fire Zone 3</p> <p>10 – Hot water circulating pumps, one per hot water heater</p> <p>Areas not supplied by accommodation hot water heaters shall have under sink instantaneous hot water heaters (e.g. galley, scullery, engine control rooms, service sinks for parts washing, etc.).</p>
Drinking Fountains	20 – refrigerated drinking fountain
Module FW Supply	Provide 1" quick connect type hose connection for FW supply to modules on deck, 2 connections on Main Deck and 4 connections on RoRo deck. See Module Connection Stands below for details on location of hose connections. Provide FW supply pipes to the hose connections.
Toilets	Vacuum type, one system for Fire Zone 2, one system for Fire Zone 3. Vacuum collection tanks are located in AMR 1 and 4. Vacuum collection systems to have macerator discharge pumps for discharging sewage to holding tanks, ashore, or directly overboard where permitted.
Sewage treatment	1 – Membrane Bioreactor or Electrochemical type sewage treatment plant, 15 m ³ /day.
Gray Water treatment	2 – Membrane Bioreactor or Electrochemical type gray water treatment plant, 50 m ³ /day ea. (can be used for sewage treatment in emergency), one located in AMR 1 and one located in AMR 4.
Food Waste Macerator Drain	Direct Overboard
Collecting Tanks	<p>Sewage collecting tanks (Min 14 days for 700 persons)</p> <p>Gray water collecting tanks (Min 7 days for 700 persons)</p>

Black Water Disch. Pumps	4 – electric motor driven, horizontal centrifugal, 20 m ³ /hr @ 35 m, Two (2) in each AMR 1 and AMR 4.
Gray Water Disch. Pumps	4 – electric motor driven, horizontal centrifugal, 20 m ³ /hr @ 35 m, Two (2) in each AMR 1 and AMR 4.
BW Treatment Supply Pumps	2 – per black water treatment unit manufacturer's specification, One (1) in each AMR 1 and AMR 4.
GW Treatment Supply Pumps	2 – per gray water treatment unit manufacturer's specification, One (1) in each AMR 1 and AMR 4.
Sewage Sludge Disch. Pumps	2 – electric motor driven, rotary type, 20 m ³ /hr @ 35 m, Two (2) in AMR 4.
Module Drains	For modules installed on the Main Deck and in the RoRo space, provide hose connections for gray water and black water. Hose connections are quick connect type for 2" hoses. Module drains shall run down to a lift unit in ER2.
Lift Unit for Module Drains	In the lower part of ER2, install a lift unit with two drain tanks, one for gray water and one for black water, with a 5 m ³ /hr pump for each. Lift unit pumps should discharge to respective gray water and black water holding tanks in AMR 4.

Sewage treatment system and equipment shall be in compliance with latest regulations in MARPOL Annex IV and shall be USCG approved, where required.

13. AIR CONDITIONING SYSTEM

Central, High speed, Single Duct, Terminal Reheat system with Regenerative Rotary Heat Exchangers for the deckhouse accommodation spaces.

Details of the specified Air Conditioning system are shown in drawing 2015-017-03-61 HVAC Layout Diagram and in design document 2015-017-03-15 HVAC System Design & Calculations.

Design condition of plant shall be as follows:

Season	Outside air		Inside air		Sea Water Temp.
	Temp.	Rel. Humid	Temp.	Rel. Humid	
Summer	95 °F (35 °C)	70%	78 °F (25.6 °C)	app. 50%	90 °F (32.2 °C)
Winter	0 °F (-17.8 °C)	-	70 °F (21.1 °C)	app. 40%	28 °F (-2.2 °C)

- Fresh air supply: abt. 40%
- Rotary heat exchanger: 2 sets, capable of transferring sensible heat and humidity, with selective adsorption to minimize bacterial growth and odor transfer.
- Air handling unit: 9 sets
- Refrigeration (Chiller) plant: 4 sets x 25% (See Section 0)
- HVAC Circulating Water Heaters: 2 sets (See Section IV.9.06)
- Separate Air Conditioning & Heating Unit (package type units):
- 2 – Engine Control Rooms (1 per room)
 - 2 – High Voltage Rooms (1 per room)
 - 2 – Prop. Motor Electrical Rooms (1 per room)
 - 1 – Galley
 - 1 – Scullery
 - 2 – Dry Provision Space
 - 1 – Hospital
 - 2 – Multi-purpose space

14. PROVISIONS

Provisions shall be located on the same deck as the galley to the extent possible. Replenishment of provisions shall be via stores port from shore and along a central corridor with access to the primary provision stores spaces and to the galley. The intent is for the vessel to have sufficient food provision storage space for 700 persons for 60 days.

14.01 Refrigerated Provisions

<u>Compartment</u>	<u>Volume (m³)</u>	<u>Temp (deg C)</u>
Meat room	abt. 235	- 20
Fish room	abt. 115	- 20
Vegetable room	abt. 260	+ 2
<u>Lobby</u>	<u>abt. 40</u>	<u>+ 8</u>
Total	abt. 650	

Two (2) compressors/condenser sets shall be provided. One compressor and condenser shall be capable of normally cooling the rooms using direct expansion coils working at full load not more than 14 hours per day. For "cooling down" both compressor/condenser units can be operated in parallel. The Refrigerant shall be as approved by the Owner.

14.02 Dry Provisions

Dry provisions shall be stored in two separate storage rooms located convenient to the galley and the stores side port. The separate storage rooms shall have A-class boundaries between them with water mist fire extinguishing systems so they qualify as separate food storage rooms under SOLAS Casualty Threshold requirements.

Total Volume

About 670 m³

Shelving

Galvanized steel shelving shall be provided throughout the dry provision stores space for storing the food. Shelves shall have vertical facing and dividers to prevent food from falling off and from sliding along the shelf.

15. ELEVATOR

One (1) elevator, 1000 kg x 30 m/min, extending from the 3rd Deck to the 01 Level Deck shall be provided. Elevator shall be sized for carrying a stretcher with attending persons. Elevator shall have doors opening on two sides as shown on the General Arrangement.

16. MODULE CONNECTION STANDS

Stands shall be provided containing hookup connections for modules which may be loaded aboard to support the training or HA/DR missions. Two stands shall be located on the main deck about frame 43 spaced about 4 meters apart transversely. Four stands shall be located on the RoRo deck about frame 57. Each stand shall contain connections for freshwater, gray water, black water, 110 V electrical service with suitable interlock to prevent connecting and disconnecting with the circuit energized, and LAN service as detailed elsewhere in this specification.

IV. MACHINERY PART

1. GENERAL

The main propulsion system shall consist of two (2) variable speed electric propulsion motors arranged in series, one (1) fixed pitch propeller, and necessary auxiliaries.

Electrical power shall be supplied by four (4) medium speed marine diesel driven generator sets. Two gensets shall be located in Engine Room 1 while the other two gensets shall be located in Engine Room 2. The diesel generator engines shall be Category 3 engines as defined by the US EPA (> 20 liters/cylinder displacement).

The diesel engines shall be designed to burn Marine Gas Oil (MGO) ISO 8217 DMA, and Ultra Low Sulfur Diesel fuel (ULSD) meeting the requirements of ASTM D975 for No. 2-D S15 with viscosity as low as 1.9 cSt at 40 °C and maximum sulfur content of 15 PPM.

A diesel oil service system shall be provided for the diesel generator engines.

Each engine room shall have a central fresh water cooling system to serve the diesel engines and other equipment requiring cooling located in that engine room.

Exhaust emissions from the generator engines shall comply with all applicable regulations of the US Environmental Protection Agency for a US flag ship with a Category 3 main engine and with MARPOL Annex VI, Tier II, for operation outside the ECA. Each engine exhaust shall be provided with a selective catalytic reduction (SCR) unit to meet MARPOL Annex VI Tier III emissions for operation inside an ECA.

2. DESIGN CONDITIONS

For Main and Auxiliary Machinery

Sea water temperature	32 °C
Ambient temperature (machinery spaces)	45 °C
Atmospheric pressure	1,000 mbar
Relative Humidity	60%

3. ELECTRIC PROPULSION MOTORS

Quantity	Two (2), (mounted in series with a common shaft line, but in separate watertight and fire tight compartments)
Type	Synchronous or induction type marine propulsion motor with double tube water cooled heat exchanger for air cooler and built in motor driven fans
Input Voltage	Manufacturer's standard

Output Power (ea.)	4,500 kW
Rated Speed Range	0 - 115 RPM, reversible over full range
Accessories	Variable Frequency Drive

4. MAIN GENERATOR ENGINE SETS

Quantity	Four (4)
Type	Medium speed four-stroke in-line marine diesel generator engine set
Engine Output (ea.)	Approx. 3,900 kW
Generator Output (ea.)	Approx. 3,775 kW, 6,600 VAC, 60 Hz
Anticipated fuel oil consumption rate	abt. 187 g/kW-hr (@ 85% Engine Output, with fuel oil of 42,700 kJ/kg lower heating value and ISO standard ref condition) with 5% allowance
Accessories	<ul style="list-style-type: none"> • Engine driven lube oil and cooling water pumps. • Selective Catalytic Reduction (SCR) system to meet IMO Tier III emissions.

5. SHAFTING AND PROPELLER

- 2 - Intermediate shaft. Shafting arrangement shall allow for rotor removal from either propulsion motor without disturbing the other propulsion motor or the thrust bearing.
- 1 - Propeller shaft
- 1 - Propeller, nickel aluminum bronze (spare: one per class), with 3% light running margin. Diameter 5.85 m, number of blades 5, fixed pitch
- 1 - Stern tube, welded steel construction with bronze carrier and non-metallic elastomeric polymer bearing lubricated by seawater (Thordon or equal type) with water circulating pump.
- 1 - Thrust bearing (Additional intermediate bearing may be added at detail design stage)
- 1 - Fwd stern tube seal, double lip type
- 1 - Turning gear
- 1 - Rope guard with zinc anode of 5 years life time
- 1 - Net Cutter
- 1 - Shaft Torsion and kW Meter

Stern tube wear down should be measurable with the ship in the water to permit

underwater inspection.

6. ELECTRIC GENERATING PLANT

The electrical generating plant shall consist of the four main diesel generators. The main generators provide 6,600 VAC, 3 Phase, 60 Hz electrical power for the propulsion motors and the bow and stern thrusters. 450 VAC, 3 Phase, 60 Hz electrical power is provided via step-down transformers between the 6,600 V and 450 V switchboards for all other services.

6.01 Step-Down Transformer for ship's service for ER Switchboards

Quantity	Four (4)
Primary (single)	6,600 V, 3 Phase, 60 Hz
Secondary (dual)	450 V, 3 Phase, 60 Hz 120 V, 3 Phase, 60 Hz

6.02 Step-Down Transformer for ship's service for Substation Switchboards

Quantity	Four (4)
Primary (single)	6,600 V, 3 Phase, 60 Hz
Secondary (dual)	450 V, 3 Phase, 60 Hz 120 V, 3 Phase, 60 Hz

6.03 Emergency Generator Engine

Quantity	One (1)
Type	Caterpillar or equal, high speed four-stroke, fresh water cooled with radiator, marine diesel generator engine set
Generator Output	900 ekW, 450 VAC, 60 Hz
Fuel Type	MGO including ULSD
Starting Type	Air or hydraulic

6.04 Step-Down Transformer for Emergency Switchboard

Quantity	Two (2)
Primary	450 V, 3 Phase, 60 Hz
Secondary	120 V, 3 Phase, 60 Hz

7. COMPRESSED AIR SYSTEMS

Compressed air systems shall be provided for the main generator engines' starting, for ship's service, and for control air.

The starting air system shall provide 30 bar(g) compressed air for engine starting and shall also be connected through a reducing valve with a relief valve to supply compressed air at 7 bar(g) to the service and control air systems. Two (2) main starting air compressors shall be provided in each engine room with one of them powered from the emergency generator and one powered by the generators in the engine room where it is located. A starting air receiver shall be provided in each engine room, and shall normally operate as an independent system, but shall be capable of cross connection with the other engine room in an emergency.

A ship's service compressed air system shall be provided with a dedicated compressor and receiver to supply compressed air to service outlets throughout the ship.

A control compressed air system shall be provided with a dedicated compressor, receiver, and a refrigerated air dryer in each engine room. The control air systems from each engine room shall normally be independent, but arranged to be cross connected in an emergency.

7.01 Starting Air System Equipment (in each engine room)

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Starting Air Compressor	2	Reciprocating, electric motor driven, water cooled. 1 unit connected to the emergency switchboard.	Volume as required by regulations, 30 bar(g)
Main Starting Air Receiver	1	Cylindrical, welded steel pressure vessel	Volume as required by regulations, 30 bar(g)

7.02 Ship's Service Air System Equipment (in one engine room)

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Ship's Service Air Compressor	1	Electric motor driven, screw type, air cooled	250 m ³ /h, 7.0 bar(g)
Ship's Service Air Receiver	1	Cylindrical, welded steel pressure vessel	2 m ³ , 8.0 bar(g) design pressure

7.03 Control Service Air System Equipment (in each engine room)

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Control Air Compressor	1	Electric motor driven, oil free, air cooled	100 m ³ /h, 7.0 bar(g)
Control Air Receiver	1	Cylindrical, welded steel pressure vessel	1 m ³ , 8.0 bar(g) design pressure
Control Air Dryer	1	Refrigerated type, air cooled	100 m ³ /h
Oil Removal Filter	1	To be installed in the air supply line from ship's service air system to the control air system	

8. SEA WATER SYSTEMS

The ship shall have a high sea chest on one side and a low sea chest on the opposite side connected by a seawater header in each engine room to provide seawater to all services in the engine rooms and to the ballast and fire systems described in Part II, Section 8 "Hull Piping". There shall also be a low suction sea chest and a high suction sea chest connected by a seawater header located in Auxiliary Machinery Room 2 and Auxiliary Machinery Room 3 to supply seawater for the air conditioning water chillers and the freshwater generators. Each sea chest shall have a sea connection (suction) valve at the sea chest, followed by a simplex basket strainer, and an isolating valve. All shutoff valves at the sea chest suction shall be remote operated gate valves.

Sea Water pumps shall have bronze casings, stainless steel impellers, and stainless steel shafts.

Sea chest gratings shall be suitable for underwater inspection and designed for easy opening by divers with gratings that can be easily secured open or closed underwater.

8.01 Main Sea Water Cooling Pumps

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Main Sea Water Cooling Pump	6 (3 per engine room)	Electric motor driven, vertical centrifugal	Each pump 50% of total required capacity per engine room, approx. 350 m ³ /h ea. @ 20 m

Note: One Main Sea Water Cooling pump per engine room shall be self-priming and have an emergency bilge suction connection, per regulations.

8.02 Auxiliary Sea Water Cooling Pumps

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Aux. Sea Water Cooling Pump	4 (2 per each of AMR 2 & AMR 3)	Electric motor driven, vertical centrifugal	Each pump 50% of total required capacity per system, approx. 350 m ³ /h ea. @ 20 m
Bilge / Aux. Sea Water Cooling Pump	2 (1 per each of AMR 1 & AMR 3)	Electric motor driven, vertical centrifugal, self-priming	Bilge: approx. 250 m ³ /h ea. @ 28 m SW Cooling: approx. 350 m ³ /h ea. @ 20 m

9. FRESH WATER COOLING SYSTEM

A low temperature (LT) fresh water cooling system shall be provided in each engine room for cooling the main generator engines, air compressors, MGO coolers, LO coolers, and other machinery or equipment that requires cooling. The system shall also supply cooling water to the propulsion motor rooms for cooling the propulsion motors and associated transformers, variable frequency drives, and other equipment that requires cooling. The LT fresh water cooling system shall circulate water at 36°C with 32°C maximum seawater temperature.

A high temperature (HT) fresh water cooling system shall be provided in each engine room for jacket water cooling for the main generator engines. The HT fresh water cooling system shall circulate water at approx. 59°C with approx. 42°C seawater inlet temperature (seawater exit temperature from the LT coolers). The HT fresh water system shall also be used to supply heat to the HVAC circulating water system for accommodation heating via a plate type heat exchanger.

Fresh water pumps shall have cast iron casings, bronze impellers, and stainless steel shafts. All plate heat exchangers to have a 10% fouling margin. Shell and tube heat exchangers to have a 15% fouling margin.

Makeup water for the LT and HT cooling systems will be provided by a fresh water distillation unit (evaporator type) located in Engine Room 1.

9.01 Main Fresh Water Cooling Pumps

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Main Fresh Water Cooling Pump	6 (3 per engine room)	Electric motor driven, vertical centrifugal	Each pump 50% of total required capacity per engine room, approx. 200 m ³ /h ea. @ 20 m

9.02 LT Fresh Water Coolers

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Low Temp Fresh Water Cooler	4 (2 per engine room)	Plate type with Titanium plates – 10% fouling margin (SW cooled)	Each cooler 60% of total required capacity per engine room

9.03 Main Generator Engine Jacket Water Preheating Pumps

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Pre heater Pump	2 (1 per engine room)	Electric motor driven, vertical centrifugal	As Recommended by engine manufacturer, approx. 50 m ³ /h ea. @ 20 m

9.04 Main Generator Engine Jacket Water (HT) Coolers

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Jacket Water Cooler	4 (2 per engine room)	Plate type with Titanium plates – 10% fouling margin (SW cooled)	Each cooler 60% of total required capacity per engine room

9.05 Main Engine Jacket Water Preheaters

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Jacket Water Heater	2 (1 per engine room)	Electric	As Recommended by engine manufacturer

9.06 HVAC Circulating Water Heater

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
HVAC Circulating Water Heater	2 (1 per engine room)	Plate type with 316 stainless steel plates	Same as Main G/E Jacket Water (HT) Coolers

A low temperature (LT) fresh water cooling system shall be provided for the bow thruster room to cool the Bow Thruster Hydraulic Power Unit Oil Cooler. The Bow Thruster Room Cooler shall be cooled by seawater from the Fire Main system.

9.07 Bow Thruster Room Fresh Water Cooling Pumps

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
BT Room Fresh Water Cooling Pump	2	Electric motor driven, vertical centrifugal	Approx. 2 m ³ /h ea. @ 20 m

9.08 Bow Thruster Room Fresh Water Cooler

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
BT Room Fresh Water Cooler	1	Plate type with Titanium plates – 10% fouling margin (SW cooled)	110% of total required capacity.

10. FUEL OIL SYSTEMS

The vessel shall have fuel oil filling, transferring, purification, and service systems for Marine Gas Oil (MGO).

10.01 Fuel Oil Tanks

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
MGO Storage Tanks	8	4 tanks located forward 4 tanks located aft	MGO Total volume including settling and service shall be min 2,200 m ³
MGO Settling Tank	2	Located Fr. 48-51 and Fr. 93-96	Min capacity is per Class requirements. Acts as backup Service Tank Est. capacity 40 m ³
MGO Service Tank	2	Located Fr. 48-51 and Fr. 90-93	Min capacity is per Class requirements Est. capacity 40 m ³

10.02 Fuel Pumps

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
MGO Transfer Pump	2 (1 per engine room)	Electric motor driven, screw or gear	30 m ³ /h @ 30 m
Purifier Feed Pump	4 (2 per engine room)	Electric motor driven, screw or gear	approx. 2 m ³ /h @ 30 m

Main G/E MGO Supply Pump	4 (2 per engine room)	Electric motor driven, screw or gear	Each pump 100% of recommended capacity for two main generator engines, approx. 6 m ³ /h @ 50 m
Incinerator MGO Supply Pump	1 (ER 2)	Electric motor driven, screw or gear	0.45 m ³ /h @ 30 m
10.03 Fuel Purifiers			
<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
MGO Purifier	4 (2 per engine room)	Automatic, self-cleaning, partial discharge	Each unit 1,900 l/hr of MGO

11. LUBE OIL SYSTEMS

The vessel shall have a lube oil filling, transferring, and purifying system to serve the main generator engines as recommended by the engine manufacturer. One storage tank and one settling tank shall be provided in each engine room, and service or sump tanks shall be provided for each generator engine. The main generator engines are to have engine-driven lube oil pumps. Each engine is to have its own pre-lube pump.

11.01 Lube Oil Pumps

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Main. Gen. Engine Pre-Lube Pump	4 (1 per engine)	Electric motor driven, screw or gear	Engine Maker's Recommendation
L O Transfer Pump	2 (1 per engine room)	Electric motor driven, vertical or horiz., rotary	10 m ³ /h @ 30 m
LO Purifier Feed Pump	2 (1 per engine room)	Electric motor driven, screw or gear	1 m ³ /h @ 30 m

11.02 Lube Oil Purifiers

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Main L O Purifiers	2	Automatic, self-cleaning, total discharge (identical to FO purifiers)	850 l/hr

11.03 Lube Oil Cooler

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	<u>Capacity</u>
Main Engine L O Cooler	2	FW cooled plate type with type 316 stainless steel plates	Engine Maker's Recommendation and based on 10% fouling allowance

12. VENTILATING FANS

- 2 - Supply fans, Engine Room 1, motor driven, axial flow, 1 fan reversible. Approximately 1,600 m³/min at 39 mmWG each
- 2 - Supply fans, Engine Room 2, motor driven, axial flow, 1 fan reversible. Approximately 1,250 m³/min at 36 mmWG each
- 2 - Supply fans, Motor Room 1, motor driven, axial flow, 1 fan reversible. Approximately 250 m³/min at 24 mmWG each
- 2 - Supply fans, Motor Room 2, motor driven, axial flow, 1 fan reversible. Approximately 250 m³/min at 24 mmWG each
- 2 - Supply fans, Auxiliary Machinery Room 1, motor driven, axial flow, 1 fan reversible. Approximately 90 m³/min at 35 mmWG each
- 2 - Supply fans, Auxiliary Machinery Room 2, motor driven, axial flow, 1 fan reversible. Approximately 90 m³/min at 35 mmWG each
- 2 - Supply fans, Auxiliary Machinery Room 3, motor driven, axial flow, 1 fan reversible. Approximately 95 m³/min at 37 mmWG each
- 2 - Supply fans, Auxiliary Machinery Room 4, motor driven, axial flow, 1 fan reversible. Approximately 130 m³/min at 36 mmWG each
- 3 - Supply fans, RoRo Space, motor driven, axial flow, 2 fans reversible. Approximately 325 m³/min at 37 mmWG each

Details of the ventilation systems for the accommodations and other non-machinery space areas are shown in drawing 2015-017-03-061 HVAC Layout Diagram and in design document 2015-017-03-15 HVAC System Design & Calculations.

13. FRESH WATER GENERATING PLANT

- 2 - Fresh water generators, Reverse Osmosis type, 65 mt/day, one located in AMR 2 (FZ 2), one located in AMR 3 (FZ 3)
- 4 - Sterilizers, ultraviolet type, 3 m³/hr ea., two located in AMR 2 (FZ 2), two located in AMR 3 (FZ 3)
- 4 - Mineralizers, 3 m³/hr ea., two located in AMR 2 (FZ 2), two located in AMR 3 (FZ 3)
- 1 - Distilled Water Generator, plate type vacuum evaporator, 10 mt/day, located in Engine Room 1, using jacket water as the heat source and with stainless steel casing.
- 1 - Distilled Water tank in Engine Room 1 double bottom, 50 m³ capacity.
- 1 - Distilled Water Hydrophore in Engine Room 1, 500 L capacity with 2 pumps, each rated 100 L/min x 40 m.

14. LIFTING DEVICE AND MACHINE TOOLS

- 2 - Engine Room overhead traveling crane, electric motor driven for hoisting, travel and traverse (capacity for heaviest ME part, abt 5 mt), 1 unit in each engine room
- 1 - Lifting Trolley in Engine Room 1 from Engine Room Stores Hatch landing area fwd to lifting area of Engine Room 1 crane and continuing to sliding water tight door at frame 90, (capacity for heaviest ME part)
- 1 - Lifting Trolley in Engine Room 2 from Engine Room Stores Hatch landing area aft via sliding water tight door to lifting area of Engine Room 2 crane, (capacity for heaviest ME part)
- 1 - Lifting Trolley at 4th deck from Engine Room 1 sliding water tight door at frame 90 to sliding water tight door at frame 159, also serving P/S Workshops and Engine Stores Room between frames 90 and 108, (capacity for heaviest ME part)
- 2 - Trolley Beam over the Purifiers (1 in each purifier area)
- 2 - Trolley Beams to Engine Work Shop and Engine Stores Room, 2 ton
- 1 - Lathe
- 1 - Drilling machine
- 1 - Fuel Valve Test Bench
- 2 - Electric welder
- 1 - Two wheel grinder
- 2 - Workbench, tool board and storage cabinet in each Engine Room at floor plate level, port side

Engine room Work Shop and Stores shall be located on 4th deck, forward of

Engine Room 1.

15. SHIP'S SERVICE AUXILIARIES IN ENGINE ROOMS AND AUXILIARY MACHINERY ROOMS

- Bilge Pumps and Fire Pumps – See Sections II.8.06 and II.8.08
- 4 - A/C Chilled water plants – Two (2) in AMR 1 and two (2) in AMR 4. Each plant approximately 300 tons of refrigeration, SW cooled with circulating system of treated (rust inhibited) fresh water including pumps and head tanks.
- Aux. SW service pumps – See Section IV.8.02
Primary purpose is to cool A/C Chillers in AMR 1 and AMR 4, 2 pumps running, 1 pump standby/for bilge pump per AMR.
- 2 - Bilge housekeeping pump – dual diaphragm, air driven type, 5 m³/hr @ 35 m, One (1) in each engine room.
- 2 - Sludge pump, motor driven type, 20 m³/hr @ 35 m, One (1) in each engine room.
- 1 - Oily water separator, automatic discharge type, not more than 15 ppm oil content in discharged water in compliance with IMO Resolution MEPC 107(49), 5 m³/hr.
- 4 - Marine Growth Prevention System (MGPS), Al and Cu anodes type for seawater cooling system with 2 year lifetime without spare, or chlorine type (Chloropac) - one in each engine room and one in each AMRs 2 and 3. The chosen system for the AMRs shall be suitable for use with the Reverse Osmosis type fresh water makers.
- 1 - Waste oil and garbage incinerator, IMO approved type, abt 1,500,000 kcal/hr.

16. MATERIAL FOR PIPING IN E/R

Piping system materials shall be in accordance with the Regulatory Bodies' requirements and the table below. Piping that is part of a packaged unit may be the manufacturer's standard, but in no case less than required by the Regulatory Bodies or this specification. U.S. standard piping materials are indicated in the below table, however, alternative, internationally recognized standard can be applied with equivalent thickness and material properties. Alternative standards shall be Owner and Class approved.

System	Size (NPS)	Material	Remarks
Seawater Cooling	2 & above	ASTM A53 Type E or S, Grade B steel, Sch 40	Polyethylene lined
	1½ & below	ASTM A53 Type S, Grade B steel, Sch 80 or A106 Grade B steel, Sch 80	galvanized
Lube Oil	All sizes	ASTM A53 Type E or S, Grade B steel, Sch 40	
Fuel Oil Service	All Sizes	ASTM A53 Type S, Grade B steel, Sch 40 or A106 Grade B steel, Sch 40	
Fuel Oil (other than service)	All Sizes	ASTM A53 Type E or S, Grade B steel, Sch 40	
Fresh Water Cooling	All sizes	ASTM A53 Type E or S, Grade B steel, Sch 40	
Engine Exhaust and drains from exhaust	650A & above	Welded Corten (or equivalent) Steel Plate 6mm	
	600A & below	ASTM A53 Type E or S, Grade B steel, Sch 40	
Compressed Air – 30 bar Starting Air System	All Sizes	ASTM A53 Type E or S, Grade B steel, Sch 40 or A106 Grade B steel Sch 40	galvanized
Compressed Air – Ship's Service & Control Air	All Sizes	ASTM A53 Type E or S, Grade B steel, Sch 40	galvanized
Potable Water (after mineralizer)	All Sizes	ASTM A53 Type E or S, Grade B steel, Sch 40	galvanized
Fresh Water (RO plant to mineralizer)	All Sizes	ASTM A312 Type 316L Stainless Steel, Sch 40	
Hot Potable Water	All Sizes	ASTM B88 Type K, Seamless Drawn Copper	
Heating Coils in Oil Tanks	All Sizes	ASTM A106 Grade B, Seamless Steel, Sch 40	
Heating Coils in Other Tanks	All Sizes	ASTM A312 Type 316L Stainless Steel, Sch 40	

V. ELECTRIC PART

1. ELECTRIC SUPPLY SYSTEM

Propulsion Generator	- AC 6,600V x 60 Hz x 3 phase
Propulsion Power system	- AC 6,600V x 60 Hz x 3 phase
Bow & Stern Thrusters	- AC 6,600V x 60 Hz x 3 phase
Air Con. Compressors	- AC 6,600V x 60 Hz x 3 phase
Ship's Service Power system	- AC 440V x 60 Hz x 3 phase
Reefer container	- AC 440V x 60 Hz x 3 phase
Lighting system	- AC 110V x 60 Hz x 1 phase
Battery light	- DC 24V

2. POWER EQUIPMENT

Details of the power generating and distribution system are shown on drawing 2015-017-03-30 Electric One Line Diagram, 2015-017-03-31 Electrical Design Basis, and 2015-017-03-34 Electrical Functional and Operating Philosophy.

Main diesel generator	AC 6,600V, 60Hz, 3 Phase, totally enclosed (IP44), fresh water cooled, Class F insulation. 4 sets x abt 3,775 ekW Generator rating to be based on Electric Load Analysis
Emergency diesel generator	Semi-enclosed, self-ventilated, Class F insulation. 1 set x Abt 900 kW (per Electric Load Analysis)
6.6 kV Main swbds	2 - Supplied directly from main generators at 6.6 kV, one per ER.
6.6 kV Substation swbds	4 - Supplied directly from main switchboards at 6.6 kV, one per each of 4 substations.
450 V ER swbds	2 - Supplied from 6.6 kV main switchboards via step-down transformers and also directly from 450 V Emergency switchboard, one per ER.
450 V Substation swbds	4 - Supplied from 6.6 kV Substation switchboards via step-down transformers, one per each of 4 substations. Interconnections provided between 450 V Substation swbds in adjoining fire zones for additional redundancy.

120 V ER swbds	4 - Supplied from 6.6 kV main switchboards via step-down transformers and also directly from 120 V Emergency switchboard, two per ER.
120 V Substation swbds	4 - Supplied from 6.6 kV Substation switchboards via step-down transformers and also directly from 120 V Emergency switchboard, one per each of 4 substations. Interconnections provided between 120 V Substation swbds in adjoining fire zones for additional redundancy.
450 V Emergency swbd	1 - Supplied directly from emergency generator at 450 V and also from 450 V ER sbwds.
120 V Emergency swbd	1 - Supplied from 450 V Emergency swbd via step-down transformers.
Motor & controller (Typ)	<p>Motor to have squirrel cage induction type, Class B or F insulation, generally self-ventilated with protection DP or W.T. according to the use.</p> <p>Motor controller to be group starter panel or individual type according to available space.</p>
Shore Power Supply	For shore power connection to supply electrical power from shore while vessel is moored at State Maritime Academy pier and during port stay (Cold Iron), provide two connection reels (Cavotec or similar), one port and one starboard, in designated spaces on the 2 nd deck level. Shore connection shall be suitable for harbor condition with full complement onboard or electric load of about 3,000 kW at 6.6 kV. Suitable connections to the main 6.6 kV switchboards with breakers shall be provided.
Shore Connection	A standard 440 V shore connection for use in drydock or during repair periods shall be fitted with an 800 amp breaker.

3. GENERATOR LOADING

An Electrical Load Analysis shall be prepared by the Builder and submitted to the Owner for approval. During normal operating conditions, the number of generators in operation should be approximately as shown in the following table.

Generator Service Condition	Main Generators	Emergency Generator
At normal sea going, full complement onboard:		
At design speed	4	
At 12 knots cruising speed	2	
At leaving and arriving:		
With full complement with bow & stern thruster	2	
At take home	2	
At port:		
With full complement	1	
With officers, crew and staff only	1	
At Emergency		1

Note:

1. Full complement for design purposes is based on 700 persons onboard.
2. Cruising mode of 12 knots is used during training ship "summer cruises" with full complement onboard.
3. Electric load shall be based on summer or winter conditions, whichever is higher.
4. Under normal operating conditions, no generator shall be loaded to more than 90% of its maximum rating, and a growth margin of 10% for the ship's service portion of the electrical load shall be included in all conditions.

4. LIGHTING SYSTEM

In general, LED type lighting fixtures to be provided for engine rooms, machinery spaces, and accommodation spaces, supplemented by incandescent lights as necessary. Incandescent type lighting fixtures to be provided for outer passages, store rooms, etc.

Explosion-proof lighting fixtures shall be provided for hazardous areas.

Electrical receptacles shall be provided throughout the vessel, with those exposed to the weather being watertight type.

400 W floodlights facing inboard, port and starboard, shall be provided between each container bay on deck for lashing purposes. Floodlights shall be protected against damage.

5. ELECTRIC CABLE

Electric cable shall meet IEC recommendations and be in compliance with the Regulatory Bodies' requirements.

6. ELECTRIC INSTALLATION IN HAZARDOUS AREAS

Electrical equipment and wiring installed in hazardous areas shall be certified safe in accordance with the regulations. Hazardous areas shall include RoRo spaces designated for carrying dangerous goods and motor vehicles with fuel in their tanks.

7. AUTOMATION AND REMOTE CONTROL SYSTEM FOR MACHINERY

The ship shall be provided with a Control, Alarm and Monitoring System (CAMS). This system shall monitor all machinery systems, tank levels and ship's draft, and shall provide the information to networked computers with two monitors in each of the machinery control rooms and one each in the ship's office, navigation bridge, training bridge and Chief Engineer's office. All data being monitored shall be available at any monitor, and control of systems shall be available on a selective basis depending on the location. The CAMS shall enable the ship to be classed for automated machinery spaces in compliance with the requirements of the Regulatory Bodies (Class notation ACC).

The primary CAMS control shall be from either machinery control room. A selector shall be provided in ER1 to select which control room has primary control. The CAMS shall provide the following functions.

- Alarm and monitoring of all points
- Remote start/stop of main and auxiliary generators
- Remote start/stop of automatic standby pumps
- Control of power management system
- Remote start/stop of MGO/LO pumps
- Control of the ballast system
- Tank level indication
- Mimic displays (15 pages)
- Running hours display for major machinery redundant pumps
- Call up display in the automation that shows which equipment is in standby
- Trend analysis
- Automatic data logging with a log printer and alarm printer
- Monitor size shall be at least 19"
- Two redundant CPU, one in each engine room.

The displays in the Chief Engineer's office, the ship's office, the navigation bridge and the training bridge shall be for monitoring without control function, except the CAMS system in the ship's office shall have control over the ship's ballast system and shall act as the main ballast control system.

Diesel Electric propulsion remote control shall be provided in the main control console in each of the two engine control rooms. Remote control shall also be provided in the wheelhouse, on the bridge wings and in the training bridge (as backup navigation control station in case of casualty to the navigation bridge).

The CAMS shall have provision for making specific fuel consumption calculations by taking input from the main generator fuel oil meters and 6,600 V system kW electric load meters and shaft kW meter to determine the instantaneous and average specific fuel consumption per electric kW and per shaft kW. Included in the specific fuel calculation output shall be provision for manually inputting vessel draft, trim, fuel type, engine room temperature, sea temperature and sea and wind condition.

The main generators shall be arranged for automatic starting.

The emergency generator shall be arranged for emergency starting.

8. REEFER CONTAINER & LIGHTING OUTLETS

8.01 Reefer Outlets

Main Deck	15 x 440 V, 30 amp reefer outlets shall be provided on the main deck at about Fr. 43 in gang boxes of 4 or 2 outlets.
RoRo Space	5 x 440 V, 30 amp reefer outlets shall be provided on the RoRo deck at about Fr. 57 in a gang box of 5 outlets. Reefer outlets shall be more than 450 mm above the deck.

8.02 Lighting Outlets for Modules

Main Deck & RoRo Deck	110 V water tight receptacles, 15 amp, shall be provided in the Module connection stands (see Module Connection Stand), 2 on the Main Deck and 4 on the RoRo Deck
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9. SHIP OPERATION INTERIOR COMMUNICATION SYSTEM

<u>Quantity</u>	<u>Description</u>
2 -	Common battery or sound powered telephone system (1-6 station)
1 -	Electric clock system
1 -	Engine order telegraph system (with receiver in each engine room)

- 1 - Shaft revolution indicating system
- 1 - Rudder angle indicator system
- 1 - General alarm and fire alarm system, which can be part of a separate safety announcement public address system
- 1 - Engineer's calling system
- 1 - Fire Fighting Medium release alarm (gas powered per USCG)
- 1 - Bridge alarm system
- 1 - Sound surveillance system
- 2 - Sliding Watertight door control and status monitoring system – primary system with backup system in alternate space
- 2 - Remote release system for all fire doors with primary and backup system in alternate space
- 2 - Flooding detection system with primary and backup system in alternate space

10. CADET & CREW INTERIOR COMMUNICATION

Interior communications to service cadet and non-cadet communications requirements onboard shall be provided as shown in drawing 2015-017-03-33 Ship Technology Plan and specification 2015-017-03-35 Ship Network Specifications. Below is an outline description of the system:

<u>Quantity</u>	<u>Description</u>
–	Automatic telephone system to each cabin and office, mess rooms, galley, class rooms, workshops, labs, training spaces, bridge, control rooms, high voltage rooms, multi-purpose space, communications space, conference rooms, library and other spaces regularly occupied. Telephone system shall have redundancy of controls and circuits so that remaining system will remain operable even if any section is damaged.
–	LAN with at least two independent loops in separate fire zones that are interconnected to create a ship wide network. Details of connection points and system layout are shown in the reference drawing.
2	Server rooms on the 05 level in separate compartments.
Abt 90	Wireless LAN access antennas suitable for steel hull vessels, to serve all parts of the vessel with accommodation or where normally manned during operation or training
Abt 22	Cell Phone remote antenna unit with repeaters on

accommodation decks.

- 1 Public Address System (separate from the safety related public address system) with loudspeakers in all cabins, public spaces, training spaces, machinery spaces, mooring spaces and other manned spaces. Public address system shall have at least 5 locations where broadcasts can be initiated and should be operable away from any damaged section.
- Min 14 CCTV cameras (Bridge, quarter deck P/S, stern/helideck, engine rooms (2 ea.), etc.), day/night capable, with central control system to allow display on monitors located throughout the vessel (Bridge, ECR, mess rooms, etc.)

11. NAUTICAL EQUIPMENT

An Integrated bridge system (IBS) shall be provided, including the following:

<u>Quantity</u>	<u>Description</u>
2 -	Auto pilot with course recorder (1x main bridge, 1x training bridge)
2 -	Gyro-compass
	Radar set with interswitch. Each radar shall have a display on the navigating bridge and on the training bridge:
2 -	"X" band radar with raster-scan type display of effective dia. 340mm
1 -	"S" band radar with raster-scan type display of effective dia. 340mm
2 -	ARPA for radar
1 -	Anemometer and anemoscope
1 -	Two axis doppler speed log
1 -	Echo sounder
4 -	ECDIS (2 x main bridge, 2 x training bridge)
4 -	DGPS navigator (including at least one set on training bridge)
1 -	VDR
1 -	AIS

- 1 - Bridge Navigation Watch Alarm System (BNWAS)

12. RADIO EQUIPMENT

<u>Quantity</u>	<u>Description</u>
2 -	GMDSS console with standard equipment for areas A1, A2 & A3, apply shore-based maintenance. Main system on the navigating bridge with backup system in the training bridge.
2 -	INMARSAT-F
6 -	Portable VHF transceiver with base station
1 -	Weather facsimile receiver
1 -	Ship security alert system
1 -	Broadband receiver system - Owner approved Ka Band System combined with Inmarsat F system complete with 1m aperture antenna, terminals, racks, installation and connection to the ship network. Owner will arrange subscription plan for the Broadband system (Inmarsat Fleet Xpress or similar))

13. NAVIGATION BRIDGE REDUNDANCY

The training bridge is to be arranged and outfitted such that it can function as the navigation bridge during an emergency, such as a fire in the navigation bridge, with controls as required by SOLAS Safe Return to Port requirements.

