TECHNICAL SPECIFICATIONS

For

22 m Survey Vessel

Project No. TEG-1451-A

Version 5

Date: 06 December 2019

BUILDER:

TESS Group Ltd.

Contents

1 INTRODUCTION

Work in Progress Specification for 22m Survey Catamaran to be built with composite materials.

2 GENERAL

2.1 Regulations and Standards

A. The Survey Vessel will be built to comply with the UK MCA under 24m workboat requirements, category II
B. The vessels hull construction has been designed using Lloyds Special Service software and in accordance with Lloyds Special Service Craft rules and regulations for category 'workboat' and area of operation 'G3' which will be well in excess of the likely operational and structural requirements of this vessel.
C. The Hull design has been approved by Lloyds, and the M.C.A.
D. The vessel will be built under survey and to the UK'S MCA workboat regulations category II, 60nm offshore and supplied with a MCA workboat certificate on delivery

2.2 Environmental Protection

A. The OPV will meet all IMO and International Rules and Regulations (MARPOL).

2.3 Certificates

The following certificates will be obtained at Builder's expenses and supplied to the Owner at the time of delivery of the Vessel:

A. Builder's Certificate
B. Class Certificate (Hull & Machinery) – Interim Provisional
C. Tonnage Measurement
D. Load Line Assignment
E. Certificate of Anchors, Cables and Hawsers

F. Certificate of Lights and Life Saving Appliances

G. Calibration Sheet of Magnetic Compass

H. De-rating Exemption Certificate, Fumigation Certificate

I. Radio Telephony Certificate

J. Safety Construction Certificate

K. Safety Equipment Certificate

L. Certificate for Fire Fighting Appliances

M. Certificate for Tank Pressure Test

3 TECHNICAL

TEG-1451-A-Weight Budget					Material:	FRP
			LCB:	9.08	Boat No.:	1.00
Full Load Condition			60522.95	8.66	-0.05	2.04
Lightship with Margin			47952.55	8.96	-0.06	2.18
Lightship			45193.49	8.96	-0.06	2.18

ITEM	Qty.	Unit	Total (kg)	LCG (m)	TCG (m) Port +	VCG (m)
Build Margin_ (%)	15.00		2759.07	8.96	-0.06	2.18
Full Load Additions (DWT)			**12570.40**	**7.50**	**0.00**	**1.49**
HULL STRUCTURE		**0.38**	**18393.78**	**9.66**	**-0.05**	**1.78**
PROPULSION		10.6%	**5068.71**	**4.767785**	**0.00**	**0.64**
ELECTRICAL		**12.4%**	**5968.90**	**7.917748**	**-0.04**	**2.60**
ELECTRONICS		1.4%	**682.20**	**15.34839**	**0.00**	**5.09**
SYSTEMS		7.8%	**3762.42**	**9.790186**	**0.08**	**2.20**
FITOUT & EQUIPMENT		12.8%	**6133.72**	**11.69434**	**0.00**	**2.67**
SAFETY		0.4%	**206.58**	**12.94343**	**-0.91**	**5.07**
DECK EQUIPMENT		10.4%	**4976.18**	**6.884748**	**-0.31**	**3.61**

3.1 Principle Particulars

Length overall	:	22.25 m
Length moulded	:	21.05 m
Length on WL	:	20.33 m
Breadth moulded	:	7.2 m
Depth moulded (Amidships)	:	2.78 m
Displacement	:	abt. 42 T *

3.2 Performance

Maximum Sustained Speed	:	15 knots
Cruising Speed	:	8-10 knots
Working Speed	:	1-5 Knots
Endurance	:	8 Days

3.3 Tank capacities

Fuel oil	:	12900 litres
Freshwater	:	500 litres
Blackwater	:	1000 litres
Oily Bilge tank	:	1500 Litres

3.4 Operating Environments

A. The Survey Vessel will be able to operate year-round, day and night, in European climate.
B. The Survey Vessel and its systems will be able to conduct operations as listed below:

Air Temperature & Humidity	Up to 45.0°C, high humidity
Water Temperature Range	Up 32 °C
Water Types	Salt water
Sea Conditions	Up to Sea State – 6

C. The exterior equipment and machinery, excluding securing arrangements, will be protected with secured waterproof covers. All machinery, structure, and outfit will be designed and built to withstand the resultant loads from the ship and sea interactions and the environmental conditions.

3.5 Control and Monitoring

The vessel will be controlled with a DP system supplied by NAVIS to keep the vessel on track while working at 1-5 Knots. The DP system will be integrated with the auto pilot and Bow thrusters to keep the vessel steady within +/- 0.3 m

3.6 Gauges

All information will be integrated and visualized in AMCS displays installed in the wheel house and research station.

3.7 Sensors

A. Calorifier Temperature and pressure sensors will be integrated into the alarm and monitoring system and will be displayed on a local control panel. Should the internal tank temperature reach 66.0°C or the tank pressure exceed the OEM's recommended pressure setting, power to the water heater will be cut off and an alarm will be activated.
B. Each tank will have tank level sensor alarm. The alarms will also be displayed on an AMCS displays. The potable water makers will be able to be started and stopped manually from a local control panel. Each water maker will be fitted with a salinity monitor and an automatic dump valve or shut down control.

3.8 Alarm detectors

A. Fire detection sensors will be located according requirements
B. Bilge level alarm detectors in each engine room bilge

4 CONSTRUCTION

The construction method will be Wet laminate Vacuum bagging.

4.1 Material

4.1.1 Resin System

A. The Vessel will be constructed with Vinyl ester Resin.
B. The level of catalyst and accelerator are to be as recommended by the manufacturer to ensure full polymerisation of the resin. In general, the rate of gelation is to be controlled by the amount of accelerator added to the resin. The amount of catalyst is not to be less than one per cent, by weight, of the base resin.

C. The gelation time is to be suitable for the proposed application such that full wet-out of the reinforcement can be obtained without unnecessary drainage on vertical surfaces or excessive loss of the monomer.

D. The gelation time may need to be varied to suit changing ambient workshop temperatures to be adjusted by variation of the accelerator and not by variation of the catalyst.

PROPERTIES OF CAST UNFILLED RESIN (TYPICAL VALUES)			
Property	Value	Unit	TM
Specific weight	1.08		
Hardness	40.00	Barcol	DIN EN 59
Tensile strength	78.00	MPa	ISO 527-2
Tensile E-modulus	3.00	GPa	ISO 527-2
Elongation at break	3.40	%	ISO 527-2
Flexural strength	150.00	MPa	ISO 178
Flexural E-Modulus	3.50	GPa	ISO 178
Heat Deflection Temp. (HDT)	107.00	°C	ISO 75-Ae
Impact res. - unnotched sp.	15.00	kJ/m²	ISP 179

4.1.2 Fillers

A. All fillers added by a Builder are to be of the dispersed type. The amount of filler that may be added to an approved resin is to be that recommended by the resin manufacturer and is not to alter significantly the viscosity of the resin nor is it to affect the overall strength properties of the laminate. Recommendations by the resin manufacturer to adopt amounts of fillers in excess of 13 per cent by weight of the base resin will be subject to individual approval and testing.

B. Fillers are to be carefully and thoroughly mixed into the base resin that is then to be allowed to stand to ensure that entrapped air is released. The resin manufacturer's recommendations regarding the method of mixing are to be followed.

C. Fillers are not to be used in the structural laminates forming the boundaries of fuel oil and water tanks.

4.1.3 Fibre Reinforcement

A. Fibre reinforcements will be E-Glass Stitched laminates.

B. The materials are to be free from imperfections, discolouration, foreign matter and other defects.

C. The fibres shall be aligned close to the direction(s) of the main load path(s).

E-Glass Fibre		
Property	Minimum Value (S.I.)	Maximum Value (S.I.)
Shear Modulus	30.00	36.00
Tensile Strength	1950.00	2050.00
Young's Modulus	72.00	85.00
Glass Temperature	820.00	850.00

4.1.4 Core Materials

A. Rigid expanded foam plastics are to:

B. be of closed-cell types and impervious to water, fuel and oils;

C. have good ageing stability;

D. be compatible with the resin system;

E. have good strength retention at 60°C;

F. if manufactured into formable sheets of small blocks, the open weave backing material and adhesive are to be compatible and soluble, respectively, with the laminating resin.

Airex C70		60 kg /m³	80 kg /m³	100 kg /m³	130 kg /m³
Nominal Density	kg/m³	60.00	80.00	100.00	130.00
Compressive Strength	MPa	0.90	1.45	2.00	3.00
Compressive Modulus	MPa	69.00	104.00	130.00	170.00
Shear Strength	MPa	0.85	1.20	1.70	2.40
Shear Modulus	MPa	22.00	30.00	40.00	54.00
Shear Elongation at break	%	16.00	18.00	23.00	30.00
Tensile strength	MPa	1.30	2.00	2.70	4.00
Tensile modulus	MPa	45.00	66.00	84.00	115.00

4.1.5 Adhesives and Core Bonding

A. Structural Bonds will be with Vinyl ester [CRYSTIC PA 590] or equivalent.

B. Core shall be primed with resin prior to bonding paste application. All kerfs in contour cut core shall be filled with resin. But joins shall be filled with low density resin filler.

Propety	Typical Value
Hardness	65 Shore D
Max Tens Strength	26 Mpa
Tensile Modulus	1400 Mpa
Elongation at break	1.00

4.1.6 Plywood

A. Plywood, for structural applications, is to be of a high-quality marine grade material.

B. Have good quality face and core veneers of a durable hardwood species.

C. The veneers are to be bonded with a WBP (water and boil proof) type adhesive.

D. Have a moisture content not exceeding 15 per cent.

E. The number of veneers is to be in accordance with Table:

Board thickness, mm	Min. number of plies
up to 9	3.00
10 to 19	5.00
20 and above	7.00

F. Butts and seams are to be scarfed or butt strapped where necessary. The length of the scarf is to be not less than eight times the plywood thickness. The scarf is to be glued and, if made in situ, fitted with a backing strap of width not less than 10 times the panel thickness.

4.1.7 Timber

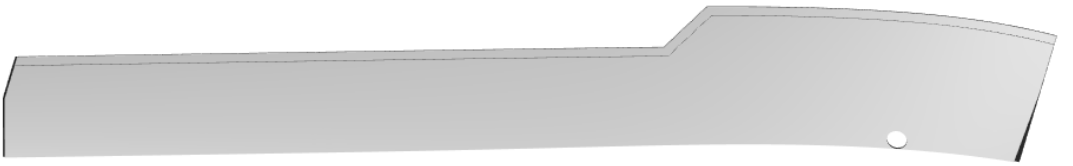
A. The timber is to be of good quality and properly seasoned. Timber is to be free from heart, sapwood, decay, insect attack, splits, shakes and other imperfections that would adversely affect the efficiency of the material. It is also to be generally free from knots, although an occasional sound intergrown knot would be acceptable.
B. The moisture content of timber for bonded or over laminated applications using resins is, in general, to be nominally 15 per cent. Contents slightly greater than this value are recommended when resorcinol glues are used, and contents slightly lower than this value are required when phenolic or urea-formaldehyde resins are used.

4.2 Hull

4.2.1 Hull Bottom

A. Panels: The Hull bottom panels are solid FRP tapering out on to the topsides above LWL.
B. Stiffeners: The hull bottom will be longitudinally stiffened and supported by bulkheads and/or web frames.

4.2.2 Hull Topsides

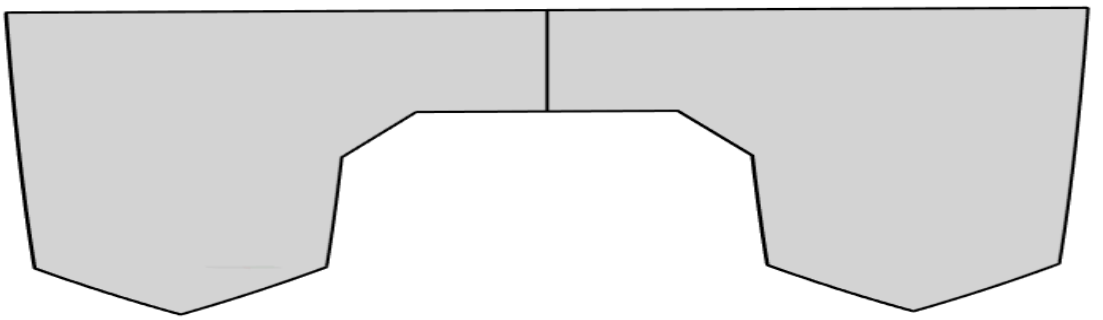


A. Panels: The Topside panels will be of Sandwich construction with closed cell PVC core.
B. Stiffeners: The hull bottom will be longitudinally stiffened and supported by bulkheads and/or web frames.

4.3 Weather Decks and Internal Decks

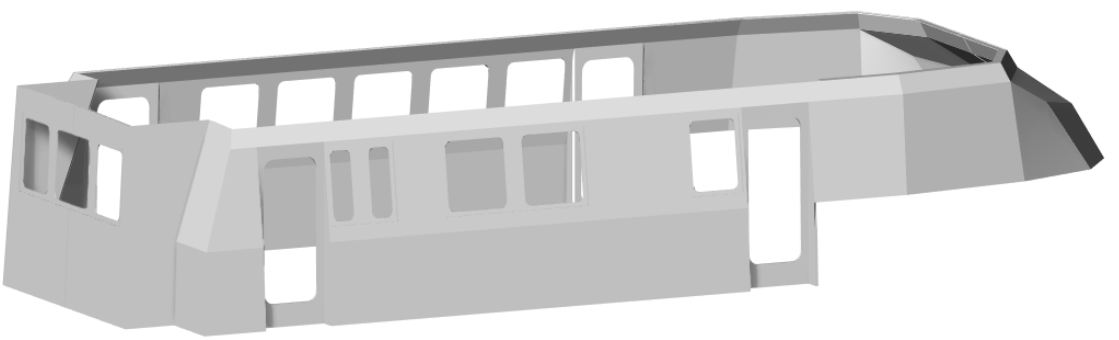
A. Panels: The Deck panels will be of Sandwich construction with closed cell PVC core.
B. Stiffeners: The Decks will be longitudinally stiffened and supported by bulkheads and/or web frames.
C. Openings: will be kept to a minimum in particular in the strength decks within the 3/5 length amidships.
D. Weather Deck Camber: All exposed decks will have a camber set of 25 mm at CL. No camber on accommodation decks.

4.4 Bulkheads



A. Panels: The BHD panels will be of Sandwich construction with closed cell PVC core.
B. Stiffeners: The BHDS will be vertically/horizontally stiffened.

4.5 Superstructure



A. Panels: The Structure panels will be of Sandwich construction with closed cell PVC core.
B. Stiffeners: The Structure will be longitudinally stiffened and supported by bulkheads and/or web frames.

4.6 Fendering

A. Fixed Fendering: A single run of fendering at the edges of the gunwale extends right around the craft. 150 x 100mm section. All fendering is through bolted with 10mm s/s bolts with large internal washers @ 200mm centres and a 12mm nylon backing plate is fitted inside the rubber. Black silkaflex 252 used as an adhesive to bond the fendering to the hull. Silkaflex is used inside the hull behind securing washers also.
B. Roving Fenders: Six (6) portable fenders with suitable storage will be supplied and installed onboard. The fenders supplied will be approximately 25 cm in diameter and 100 cm H.

4.7 Sound Insulation

The vessel will incorporate soundproofing throughout the under deck accommodation area above the engine room and the f/wd engine room b/heads to reduce noise levels to:

A. below 70dba at prolonged operational surveying speeds. (7-9kts) and
B. a maximum noise level of only 75-76db is achieved at transit speeds of 15kts

5 EQUIPMENT

5.1 Mast

A. Navigation Lights are arranged according to COLREGS 1972 for Vessels between 20m and 50m

B. The mast structure: and the associated platform s and overhangs will be designed and built to provide rigid foundations to support the electronic navigation equipment such as radar and antennae. The magnitudes of vibration will be designed so that the maximum vibration does not exceed the manufacturer's limitations for all pieces of equipment mounted on the mast or, if not stated by the manufacturer, that the vibration level in all operating condition does not adversely affect the performance of each piece of equipment.

C. Fitout: A mast will be fitted to carry radars, antennae, and navigating lights, and navigational aids, yardarms with signal flag hoisting attachment, signals and sirens. The mast and supporting structure will be designed and built to withstand wind loads up to and including eighty (50) kts, the weights of the structure and equipment and, the dynamic inertia loads due to ship motion.

D. Cleats: for signal halyards including masthead flag and gaff will be supplied and installed. Standing rigging will be reduced to a minimum.

E. Height: 5.1m in height placing navigation lights at a 2m separation, a central tube dia-100mm 316 g with tripod arrangement reinforcement tubes, fitted with navigation lights for:

   - Restricted ability to manoeuvre
   - Not under command (NUC)
   - And navigation underway

5.2 Mooring Arrangement

The Vessel will be equipped with:

A. Bow bollard,
B. 2x F/wd shoulder bollards,
C. 2 x midship cleats,
D. 2 x stern bollards

5.3 Anchor Arrangement

The Equipment Number according to Lloyds Special Service Craft :

EN = 120

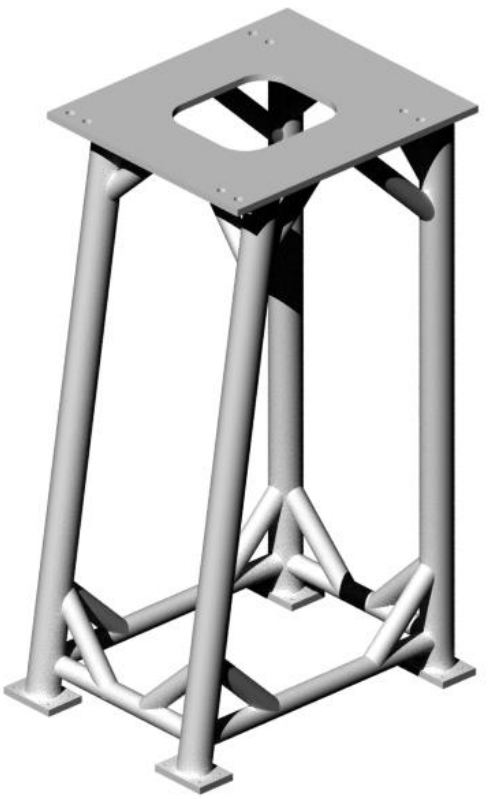
The following anchoring equipment is fitted to the vessel:

A. 75 kg Bruce anchor,
B. 88m of 13mm Chain
C. Chain, raised and lowered by a 3kW 380V capstan and S/S H/D bow roller (automatically stowing the anchor) fitted at the bow. Anchor windlass supplier Data Hirolik.
D. Anchor locker positioned in bow forward of collision bulkhead.

5.4 Slewing Crane

A. A hydraulic HIAB X-HIDUO 0720-3 360-degree telescopic knuckle crane which can lift 2,900kg at 2.2m reach and 580kg at 9.5m reach, and will be ideally suitable for lifting equipment from the dockside onto the vessels deck.

B. The crane will be supported by an Aluminium support frame. The support frame will be bolted to the bottom girders and through bolted through the deck to tie in with the FRP structure.



5.5 Deck Tie Downs

The upper deck will be provided with tie down points spaced 1000 mm apart.

5.6 Portlights and Windows

A. Windows and port lights will be constructed and installed to preserve the watertight and fire-rated integrity of bulkheads and the structure in which they are fitted. All glass will be heat treated safety glass.

B. All fixed Bridge windows will be electrically heated.
C. The Bridge front windows, non-drop type, will be fitted with straight- line wipers and a system to perm it potable water wash-down. A remote control panel will be installed in bridge console for speed controller and ON/OFF mode.
D. See-through window films that roll up will be supplied and installed to reduce sun glare and interior heating while still preserving full visibility.
E. Two side windows: one each port and starboard, will also be weather tight and drop-type opening.
F. To reduce reflections from internal lighting, all Bridge windows are to be inclined from the vertical plane top out, at an angle of not less than 10.0° and not more than 35.0°.

5.7 Protective Covers

A. *Protective covers:* will be supplied and installed for the anchor windlass, RHIB, searchlights, signal lights, floodlights, wire rope and tow rope reels, and other upper deck equipment or lockers requiring protection from the weather.
B. *Material*: All protective covers will be made of commercial, marine grade, waterproof coated nylon cloth with stainless steel lacing grommets.
C. *Fastenings:* Velcro® fastenings and chafing pieces of leather are to be fitted where there are pressure points on the cover.

5.8 Ladders and Railings

A. Railings will be constructed from 48mm tube and 6 mm flat bar – AW 5083 Aluminium. All railings in passenger area at 1000mm height with chain closure of all gaps where there is a gate.

B. An outboard type bow railing positioned on the gunwale top extends from the aft of the cabin, fwd and around the bow. A second outboard gunwale railing extends outboard around the aft cockpit area.
C. Twin transom gates inward opening give access to the water from the transom.
D. Twin stainless-steel dive platforms give access to the waterline. The aft deck and safety railings all around at the regulation height of 1m. All breaks in the railings should be close off with chain.

5.9 Name Plates, Notices and Markings

A. Label plates for compartments, warnings, ventilation, lifting appliances, exits, means of escape, lifesaving appliances, fire-fighting, dam age control, and safety Related item and equipment will be made using an aluminium metal photo process.
B. Self-adhesive safety labels and markings within compartments, warning signs, exits, lifesaving appliances, fire-fighting, dam age control, and other safety related items and equipment will be in accordance with International Maritime Organization (IMO) A 603(15) 7 Standard Symbols.

5.10Painting and Finishing

5.10.1 External Finishes

A. Hull above the WL White gel coat forming a boot line extending approx 100-200mm above the WL.
B. Dark 'Ocen Blue' gel coat extending from below the gunwale fendering to the lower white boot line.
C. Hull below the WL. White gel coat for osmosis protection. Antifouling Red Fendering Black rubber Deck Dark Grey

5.10.2 Name and Logo

RESEARCH (Will be agreed later) in large black vinyl letters on the superstructure

Vessels name on the transom and two either side at the bow.

5.10.3 Internal Finishes

Internal Finishes will be installed as shown in the table:

Interior covering	Honeycomb Aluminium Panels : Light Grey
Headlining	Removable Honeycomb aluminium panels: White
Forepeak	Painted: Grey
Wood Trim	Mahogany

5.11Deck Coverings

Deck coverings will be installed as shown in the table:

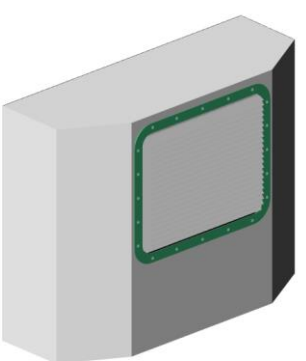
Bridge and command centre	Shock absorbing rubber: Black
Cabin and Mess	
Galley	Non-slip type Vinyl: Dark Grey
Exterior Deck	Non-slip high performance paints: Grey
Passageways	Vinyl flooring or tiles on underlay: Dark Grey

5.12Steering System

Electrical power steering system supplied by Poseidon using an engine driven pump to power the system, a reservoir and valve arrangement, helm pump and 2x steering cylinders.

6 HVAC

6.1 Engine Room Ventilation

A. The engine room ventilation Inlet is incorporated into the aft section of the superstructure.
B. The engine room ventilation Outlets are composite boxes on the aft deck forming part of the bulwarks.
C. 
D. Mechanical fans will be installed in the inlet ducts creating a positive pressure in the engine rooms.
E. The ventilation inlet and outlet are fitted with a mist eliminator (vertical 'hooked' vanes) type constructed of PVC. Both inlet and outlets have their lowest opening a minimum of 400mm above the weather deck. Fire proofing extends to the edge of the inlet outlet, and up to intersect the deck shell laminate.
F. The temperature in machinery spaces will not exceed 50.0ºC with all the machinery operated at full power or full load nor fall below 10.0ºC in all machinery states.

6.2 Heating

This means of heating the vessel are provided-

A. A Kabola diesel heater will be installed. Floor heating will be installed in research stations, settee, wheelhouse and crew accommodation rooms.
B. Additional to floor heating, each fancoil can be used for heating.
C. An engine supplied hot water fan blower heater / window demister will be fitted. This unit will supply hot air to the upper cabin's windows via four outlets and multi directional outlets positioned at the windscreen bases will effectively demist the windows.

6.3 Air Conditioning

A. Accommodation spaces and the Bridge will be supplied and installed with air conditioning cooling not more than 22.0°C under summer conditions;
B. Fresh air will be supplied to each accommodation space by central fresh air unit.
C. Air vents will be placed such that they do not blow directly on workstations or berths.
D. Air vent exit air velocity will as a minimum meet the specified air change rate will not exceed 2.5 m/s.
E. The 2.5 m /s air velocity maximum does not apply to unattended machinery spaces.
F. Ventilation trunking will be accessible and designed and built for efficient cleaning.

6.4 Natural Ventilation

Ventilation will be supplied for all watertight compartments.

7 PROPULSION

The vessel is equipped with a Diesel propulsion system configuration with two MAN D2676LE422 by 478 kW each. 2 Pieces propulsion systems designed for lowest hydroacoustic levels and various load conditions existing out off;

7.1 Engines

A. Twin MAN D2676LE422

B. Power rating, 478 kW / 650 PS

MAN

Technical data sheet

Marine diesel engine

D2676LE422 ()

29.04.2016
(Version 1)

Performance data [1]

Rated power	478	kW
Rated power	650	PS
Speed	2100	rpm
Bore	126	mm
Stroke	166	mm
Displacement	12,42	liter
Rated torque	2174	Nm
Maximum torque	2402	Nm
at speed	1200-1900	rpm
Compression ratio [ε]	16,5	:1
Mean effective pressure	21,99	bar
Mean piston speed	11,62	m/s

Consumption data [1]

Specific fuel consumption [2]	213	g/kWh
Absolute fuel consumption [2]	121	l/h
Lowest fuel consumption [3]	197	g/kWh

The engine illustrated may not entirely be identical to production standard engine

7.2 Exhaust System

A ‘Wet’ exhaust system is used utilising cooling water to cool exhaust gases, Halyard water traps / silencers are fitted, using 8” high temperature rubber reinforced flexible hose (Lloyds approved) with GRP transom outlets and S/S non return flaps.

A. The installation of the diesel exhaust system(s) will comply with both the OEM’s recommendations and the Class acoustic requirements for maximum noise reduction.
B. Each engine outlet will be supplied and installed with a stainless-steel expansion bellows which will be installed as recommended by the OEM.
C. Piping and silencers will be secured to accommodate thermal expansion and motion of the engines. The exhaust system s will be installed with supports to minimize loading of the flexible connections and expansion joints and be effectively isolated from the ship’s structure. Flexible sections will be installed at the engine exhaust outlets to facilitate engine maintenance including engine mounts and vibration isolators.
D. The exhaust gases from each engine will exit through a spark-arresting exhaust silencer, complete with clean-out ports, drain pot, drain line and valve.
E. The exhaust system will not run through habitable spaces and will be designed and built such that it does not interfere with the aft working deck area, specifically the boat launching and recovery operations, and be streamlined to reduce air drag. Arrangement will be supplied and installed to prevent spray and all water ingress into the exhaust system.
F. All portions of exhaust pipe surfaces and other hot surfaces which a hazard to personnel will could be properly insulated so that the surface temperature does not exceed 60.0°C or otherwise will be protected to prevent accidents or burns.

7.3 Drive Train

A. ORION 80 flexible Coupling
B. ORION 60 EVO2 thrust block
C. Duplex tailshaft 90*3000 mm

D. Pegasus seal deluxe 90 mm
E. Flanged GRP stern tube with bearings
F. 800 Diameter CU3 bronze rotor 7 blades DAR 100%
G. Aluminium stator 720 ID to be integrated in the GRP hull
H. Incl bracket bearing
I. Rudder installation with spade rudder
J. 400 V DC controlled Slew bearing for steering
K. Separated controlled or synchronized controlled mode
L. Bridge control panel for
M. Controls speed, steering etc. The console in the Bridge will be fitted with a steering wheel.
N. Control station will have rudder angle indicators which will be back lit with dimmers. Coupling bolts will be supplied and installed with locking devices.

8 AUXILIARY SYSTEMS

8.1 Pumps

A. All pumps will be supplied, installed and fitted with mechanical seals. The pump casings and impellers will be stainless steel or naval bronze or nodular cast iron, and all shafting will be constructed of stainless steel.
B. Pumps handling black and grey water, fuel, and lubricating oils will have drip trays or save-alls installed to contain possible leakage.
C. All pump configurations will be standardized where pumping requirements are the same or similar.
D. All instrumentation for machinery, pumps, piping and mechanical system s will display readings in the international system of units (SI). Instrumentation will be installed to ensure the safe and proper operation of equipment and systems.

8.2 Piping Systems

A. Piping systems will be designed and installed to afford access to valves, manifolds, strainers, filters and other item s incorporated in the systems requiring periodic servicing.

B. Duplex filters with changeovers will be fitted in critical systems for the purpose of enabling cleaning without disturbing the normal functioning of the systems. Where piping is attached to resiliently mounted machinery, rotating flange expansion joints or stainless steel braided flexible hoses with ridged m ale and swivel female couplings will be used.

C. Mechanical joints will be avoided and only used where absolutely necessary to allow for maintenance.

D. Pipe runs will be engineered to ensure no interference with equipment access for maintenance and operation.

E. All piping carrying potable water and raw water will be supplied and installed with drain plugs to allow complete drainage by gravity for maintenance. All piping arrangement will be designed and installed to avoid air pockets. W here piping systems are inherently prone to air pockets by design, piping will be fitted with threaded spigots or vent plugs.

F. After installation, all piping system s will be flushed and blown clear, to be proven free of oil, dirt, rust, weld splatter and all other foreign matter or contaminant prior to putting into service.

G. Valves will be suitable for the intended application and will be readily accessible for inspection, operation, maintenance and removal.

H. Sandwich-type, butterfly valves will not be used to provide watertight integrity between any system and the ship's hull. W here possible, all valves will be grouped in a manifold.

I. Piping systems will be identified in accordance with the Colour Coding Standard for Piping Systems.

J. All fuel oil, waste oil, lubrication oil, and black water connections will be fitted with a save-all.

8.3 Fuel Oil System

A. A transfer pump will be installed to allow transfer of diesel fuel to, or from, or between the diesel fuel oil storage tanks.
B. Two diesel filling stations will be located on the main deck one starboard and one port.
C. One simplex coarse strainer will be supplied and installed in the main fuel line at each filling station; and lockable closing caps and connections.
D. All fuel tanks will have access for internal examination and cleaning and will be fitted with sounding tubes on the main deck level.

8.4 Fresh Water System

A. The fresh water tank is filled via a deck filler on the weather deck. It is fitted with a breather vented to the hull side above the WL and a tank level gauge
B. A 230v pressurised water pump with accumulator tank supplies pressurised water to all sink taps and the shower.
C. It also supplies pressurised water to a 150-litre hot water calorifier that is feed hot water from one engine and, via a heat exchanger heats the cold fresh water, and supplies this hot water to all taps and the shower.
D. The calorifier will be equipped with temperature regulating devices to maintain the hot water temperature at 60.0°C.
E. All hot water piping and flanges will be insulated to minimize heat losses and ensure personnel safety.
F. All cold-water lines and flanges will be insulated to minimize heat gain and to prevent condensation.

G. Hot and cold-water piping in shower enclosures will be installed behind the panelling to ensure personnel safety. Isolating valves will be fitted at each hot and cold branch from the main system and at each fixture.

H. The fresh water system will be fitted with a) reverse-osmosis type potable water maker capable of producing a no less than 150.0 litres (l)/hour (hr) of potable water, from sea water and fresh water at a minimum temperature of 5.0°C .

    a. The cap on the fill connection will be padlocked and a bilingual label plate stating “Potable Water Only” will be installed at the fill valve and connection. Every outlet used for drinking and culinary purposes will be supplied and installed with a filter(s) capable of removing suspended solids down to one (1.0) micron and will have a bilingual plate affixed stating the water is safe for drinking and culinary purposes.

8.5 Black and Grey Water Systems

A. A 1000-litre black water tank receives waste from all toilets.

B. The tank is fitted with a gauge and light alarm that indicates when it is full.

C. The tank is fitted with a 230V pump that can be used to discharge the waste when offshore.

D. The tank can also be emptied via a vacuum fitting, that allows the tanks contents to be removed at suitable shore facilities.

E. Will be installed Sewage treatment system Hamman or similar.

8.6 5.5 HYDRAULIC OIL SYSTEMS

A. A central hydraulic station will be fitted on the aft deck to control the crane and Sonar antenna rigs.

B. A common HPU fitted in the Port side Steering compartment.

9 ELECTRICAL

9.1 AC System

A. Distribution Board consists modular switches rated at 63A. Individual MCB's as required. Housed in metal enclosure. The degree of protection of the switchgear enclosures corresponds to the spaces in which they are installed

B. 230-volt 3-pin sockets in the ship's premises according to the practice of the construction plant

9.1.1 House Generators

A. 2 x 80 kW Kohler 3-phase diesel generators sets are installed and linked.

B. Each generator is installed in a dedicated insulated housing situated in the port and st/bd ER each with its own dedicated fuel supply / filter from port & st/bd fuel tank. Raw water supply seacock and strainer, 2" exhaust water trap and silencer.

C. 230V circuits provided at the survey station with 10 outlets, a twin outlet at the galley. (also providing power for the cooker and microwave) Waterproof sockets x2 on the aft deck and one in each engine room.

D. The generators will be rated such that either one can continuously supply the peak cruising load at sea plus transient loads.

E. Each generator and its engine will be installed on a common rigid frame that is suitable for resilient mounting.

9.1.2 Shore Connections

A. Ashore power isolation transformer will be one – 3 phase, 380 V:

B. Shore power plug and socket rated at 100 Amps / IP56.

C. Watertight shore connection capability, located on the weather deck and readily accessible to shore power from both sides, will be supplied and installed.

D. The shore connection box(es) will be at least 0.5 m above the deck and will be located in weather protected area(s) to ensure the portable supply cable does not impede

weather deck walkways or interfere with deck activities on both the port and starboard sides.

E. Nameplate(s) will be supplied and installed to clearly identify the connection box(es). A warning plate instructing personnel to isolate all supplies prior to working within the enclosure will also be supplied and installed on every connection box.

9.1.3 Switchboards

A. The generator and distribution switchboards will be arranged for operation of generator circuit breakers and for distribution of power throughout the vessel
B. Main switchboard will be supplied and installed with fluorescent canopy lighting under the front, drip-shields. Front lighting will be individually switched.
C. Two of each type of distribution breaker used repeatedly will be supplied and installed within each switchboard and will act as spares.
D. In addition to manual paralleling capability, all generator combinations will be supplied and installed with automatic paralleling capabilities.

9.1.4 Distribution Panels

A. All distribution panel bus-bars and connectors will be made of copper.
B. Each distribution panel will also be supplied and installed with not less than four spare circuit breakers that are representative in amperage of what is installed in the panel.

9.1.5 Electrical Cables

A. All cable will be low smoke, zero halogen and, unless otherwise required, unarmoured. All cables will have an insulation rating of at least 85.0°C.
B. All cables will be designated by an identification number that will be permanently marked on tags, securely affixed to each end of the cable run.
C. Cableways and cables will be installed clear of machinery access routes and maintenance envelopes. The strength and watertight integrity of the decks and bulkheads will not be affected by the installation of the cable penetrations. Upon OPV

delivery, a minim um of 10% spare space will be available in all cableways and deck and bulkhead multi-cable penetrations.

D. All cables supplying power to equipment, fixtures and electrical apparatus exposed to the weather will be run internal to the ship's hull and superstructure as much as practicable. Where unavoidable, or where the length of the cables exposed to the weather exceeds one metre, the cable selected will be of a type that includes basket weave bronze braid armour covered with an external impervious non-metallic jacket.

9.1.6 Motors and Controllers

A. All motors will be totally enclosed fan cooled while those installed on deck exposed to weather will be watertight to NEMA 4X.

B. All motors greater than one HP will be suitable for 380 volt, 3-phase, 50 Hz operation, and rated for continuous duty, with Class F insulation, and equipped with anti-friction, factory sealed pre-lubricated ball bearings.

C. Grouping of motor controls in Motor Control Centres (MCC) centralized in proximity to the source of supply, the main or emergency switchboards, is a requirement and will be maximized. MCC bus bars and connectors will be made of copper. Starter units will include an incoming circuit breaker. Reduced voltage starters, where required, will be solid state type. Starter front covers will include shrouded start and stop pushbuttons and run indicating light.

D. Individual motor starters and controllers will be mounted within line of sight of the auxiliary they serve. They will be supplied and installed with local and indicating lights.

E. Local control will be mounted in drip proof enclosures. An overload/reset button will be supplied and installed on the enclosure door of each motor controller unless the operation of the auxiliary necessitates remote reset. Indicating lights mounted in the enclosure door will notify the operator of equipment status. A complete wiring diagram of each controller will be permanently attached, with a transparent, oil resistant protective covering, to the inside surface of the control cabinet door.

9.1.7 230V Receptacles

A. All receptacles will be “Specification Grade” duplex U-ground and, where used for general-purpose, rated for 15 am p, 230-volt, single phase, 50 Hz.
B. Cabins will be supplied and installed with a minim um of three (3) receptacles regardless of the presence of furniture. In addition, the mirror/medicine cabinet in each cabin will be supplied and installed with a shaver outlet, separate from the cabinet’s fluorescent lighting and integral switch.
C. Additional, non-duplex receptacles on dedicated circuits will be installed in the galley and mess for all countertop equipment and audio-visual equipment.
D. Additional, non-duplex receptacles will be installed elsewhere for all test equipment, portable tools, communication equipment, computers and other electrical equipment and appliances not specifically listed herein.
E. Internal work stations will have at least one non-duplex receptacle installed.
F. Single (non-duplex) watertight 230V receptacles will be installed in the steering gear compartment,
G. Ten exterior receptacles, two each side port and starboard located at the wheelhouse, and six on the aft wall of the super structure, will be installed for general utilities purposes. Each exterior receptacle will be on a separate branch circuit.

9.1.8 Lighting

A. Light for fore peak compartments, L.E.D. type
B. Port and s/wbd forward accommodation area, L.E.D. type
C. Toilet light, L.E.D. type
D. Four engine room lights, L.E.D. type, x2 per ER
E. Aft compartment lighting L.E.D. type
F. Midships crew compartment lighting x 2 L.E.D. type
G. 8 x overhead 4” L.E.D. lights in the main cabin
H. 2x overhead 4” L.E.D. lights in the upper cabin
I. Single Vetus round red night light at the helm

J. Electrical compartment light
K. Deck lighting consists of 4 x L.E.D. flood lights, one on each of the aft and f/wd quarters of the superstructure roof.
L. Boening navigation lights.

9.2 DC System

9.2.1 Battery Installation

A. The electrical system is 24V. A bank of sealed maintenance free batteries will be used. A remote operated solenoid isolator switch (operated from the helm) isolates the batteries.
B. The remote switched battery isolators for the banks of batteries, which are mounted in the battery link box, can be manually switched on or off in the link box in the event of a remote switch failure.
C. An emergency radio battery is fitted above the weather deck in the bridge.
D. The battery banks are rated as follows:
    - Starter Batteries: 140 Ah + 140 Ah +100 Ah + 100 Ah.
    - Emergency bank: 20 Ah.0
    - Emergency radio battery bank: 60Ah.
E. The batteries are of a sealed cell type
F. 1 charging alternator are fitted on each engine.
G. A DC distribution board fitted with 40 (or as required) SE two poles circuit breakers / switches, one for each of the main circuits rated at between 5 amps and 63 amps depending on electrical component draw. Each circuit is clearly labelled.
H. All cables are conduit run as required and all cables are securely clipped supported and protected for operation in rough weather.
I. 75x75mm Steel conduit is used in the engine compartment. Elsewhere 50x50mm PVC lidded trunking is used. Where cable is run outside the cable trays to individual

components, the cable is run in flexible convoluted conduit, which is resistant to oils and is self-extinguishing

J. All connections and junction boxes mounted as high in the vessel as practicable and are of an approved marine quality to IP55.

9.2.2 Charging System

A. The engine starts batteries –are charged from attached charging alternators.
B. The emergency batteries are charged from two AC to DC buffered converters.
C. isolation switches, to enable dedicated services to be used when the boat is in a dead ship condition

9.3 Emergency circuits

A. Emergency battery feeds to load sharing diodes
B. VHF DSC – mounted on helm console starboard side with voltage dropper mounted in electric compartment
C. Aft deck flood lights
D. Engine room lights (built-in rechargeable battery)
E. Wheelhouse lights
F. GPS Arial
G. Navigation lights
H. Aft deck floods
I. Integrated Alarm, Monitoring and Control System
J. Fire Alarm (feed off maintained supply off emergency bank)
K. Sounder beacon unit for fire alarm and fire extinguisher units – mounted in engine room and wheelhouse
L. All mast wiring connections are made in a junction box mounted in the aft of the wheelhouse.

10 NAVIGATION EQUIPMENT

A. Radar 48nm high definition radome type, displaying on its own 12.7”
B. colour display. Model: Raymarine C127
C. GPS / Plotter Separate 12/7” display for GPS chart plotter Model Raymarine
D. C127
E. Depth sounder Sonar information with graphic display displayed as split
F. screen on GPS display. Model Raymarine DSM 300
G. Radio Communication
H. VHF Radio Sailor RT6222 DSC VHF x1
I. Hand held VHF Icom M35 x2
J. Auto pilot Furno

11 SURVEY EQUIPMENT

A. A central moon pool is situated on the aft deck for a Sonar antenna. The antenna is lowered and raised with a Stainless Steel 316 rig. The rig is controlled via the central hydraulic control station. The Sonar is remotely controlled to rotate horizontally through an arc of 90°.
A. Two aft side mounted sonar antennas are mounted on the aft deck to Port and STB. The antenna is lowered and raised with a Stainless Steel 316 rig. The rig is controlled via the central hydraulic control station. The Sonar is remotely controlled to rotate horizontally through an arc of 90°.
B. Two fwd side mounted sonar antennas are mounted amidship to Port and STB. The antenna is lowered and raised manually around a pivot point on the deck.
C. Five drum winches are mounted on the aft working deck.
D. All the equipment electrical cables enter the research station through a common watertight fitting on the aft wheelhouse bulkhead.

12 FIRE AND SAFETY

12.1Fixed Fire Protection

A. In accordance with MCA requirements the following measures are taken to protect the vessels structure in the event of fire in the engine compartment.
B. NEOGEL FIRESTOP Fire retardant gel coat is used throughout the engine compartment on all exposed GRP surfaces above the waterline

12.2Safety Equipment

The vessel will be equipped with:

A. 1 no 16-person life raft SOLAS approved, fitted to superstructure roof on a launching cradle and fitted with a hydrostatic release system.
B. 2 x 30" dia orange life buoys one fitted with light and one fitted with 100m line.
C. 14 x Solas approved foam life jackets
D. 1 no Category C first aid kit
E. Offshore flares in poly bottle:
F. 4 red hand held flares
G. 4 red rocket flares
H. 2 smoke canisters

12.3Fixed Fire Fighting

12.3.1 Engine Room Extinguishing System

A. The type of fire extinguishing system to be used in this vessel is FirePro or similar, the aerosol produced upon activation of the FirePro extinguishing system suppresses fire by means of a chemical and physical system similar to Halon, but without any negative effect on the environment. The aerosol gas will not damage any mechanical / electrical

equipment and is nontoxic and does not give off any toxic by-products when mixed with fire or extreme heat. Unlike gaseous agents the aerosol does not decompose in the presence of fire nor does it extinguish by oxygen deprivation. The aerosol is considered non-toxic to humans.

B. Upon activation, the heat generated via the electrical activator within the fire extinguishing generator fitted in the engine room, set off by the activation system in the panel fitted at the helm position will rapidly transform the solid compound within the cylinder to generate the fire extinguishing aerosol gas. The fire extinguishing aerosol gas tackles the fire by inhibiting the chain chemical reaction present within combustion. The system is activated via a control panel for each engine room fitted at the vessels helm position, above the weather deck in the main accommodation cabin. The actual activation switch is positioned behind a door in plastic cabinet. To activate the system the door must be opened. On opening the door, a siren will sound and a strobe light will flash in the engine compartment to provide a visual and audible alarm in the engine compartment. As a further safety feature a protective guard must be peeled off to expose the switch. This safeguards against the system ever been set off accidentally.

C. In addition, on opening the activation panel door the engine room ventilation fan will be shut down. The power supply for this alarm is provide by two sources:
    - The service / boat supply battery.
    - The emergency battery.

12.3.2 Fire Mains

A. An electric pump of 14m3 hr capacity is situated in the aft compartment connected directly to a sea cock.

B. This sea cock is situated outside the engine compartment against the Super Structure aft wall.

C. Above deck a 10M fold46 flat fire hose is connected to the pump via a hydrant at the aft of the deck, capable of putting a spray of water on the source of fire. Note the fire pump can also be used as a deck wash pump The Port engine driven bilge pump can be used as a fire pump through a diverter valve in the bilge system.

12.3.3 Portable extinguishing system

A. One 5kg Co2 extinguishers are positioned in each cabin, and research station.
B. In addition, the galley is equipped with a fire blanket

13 INTERRIOR OUTFITTING

13.1 Bridge

The Wheelhouse is equipped with a console and suspension seats for the following:

A. One x Helmsman
B. One x Lookout
C. Steering wheel and controls are situated on the console
D. The main switch boards are situated in the wheelhouse
E. Stair case leading up to the upper deck.

13.2 Upper Accommodations

13.2.1 Server Room

A. Fitted with closing computer racks:
B. 1Pcs x PCR M2 42U, width 600mm, depth 1000mm, Fujitsu
C. 2Pcs x PCR M2 24U, width 600mm, depth 1000mm, Fujitsu
D. 1Pcs x 14U 600mm x 1075mm Advanced Shock Rack, HP
E. The server room is ventilated with standalone HVAC units.

F. A smoke alarm is fitted inside the room.
G. Independent firefighting system Novec installed in the room.

13.2.2 Research Stations

A. Desks of a single pedestal type and appropriately surfaced to reduce husbandry will be supplied and installed.
B. Cabin chairs of a lightweight design with an upholstered seat on a light metal frame will be supplied and stalled.
C. hydrographical / office work stations comprising:
D. seats on pedestals with footrests,
E. work tops with space for computer racking below,
F. multiple 230V AC sockets are provided along the top of the worktops

13.2.3 W/C

A. Vacuum toilets will be supplied and installed.
B. A toilet paper holder and grab rail will be supplied and installed in each toilet enclosure.
C. A toilet seat, open front type, will be supplied and installed for each toilet.

13.2.4 Settee's

A. Comfortable settee seating areas with 4" vinyl covered black cushions with tables in front of them.

13.3 Lower Accommodations

13.3.1 Galley

A. Situated in the port f/wd cabin accessed via stairs from the main cabin.
B. It features a work top, drawers and lockers, fridge / freezer, microwave, 230v HOB and cooker and compact tumble dryer.
C. The area is panelled in white Formica.

13.3.2 W/C

A. All trim pieces for fixtures and all accessories will be chrome plated cast, forged brass or stainless steel and will be of matching design for uniformity.
B. Grab rods will be supplied and installed at all showers and toilets.
C. Isolation valves will be supplied and installed as described at paragraph 7.12.8.
D. Washbasins, showers and service sinks will be supplied and installed with hot and cold potable water.
E. Vacuum toilets will be supplied and installed.
F. A toilet paper holder and grab rail will be supplied and installed in each toilet enclosure.
G. A toilet seat, open front type, will be supplied and installed for each toilet.

13.3.3 Port Crew Cabin

A. Berths will be single- or double-tier and will be installed in the fore and aft plane with the head position forward. Each berth will accommodate a mattress having dimensions of at least 1940 mm long, 640 mm wide and 150 mm thick. The underside of the bottom tier pan will be a minimum of 300 mm above the deck.
B. Each berth will be supplied and installed with one (1) reading light
C. Double-tier berths will be fitted with separate opaque privacy curtains with tie-backs.
D. One (1) kit locker per occupant will be supplied and installed within each cabin:
    - minimum of one (1) drawers; and
    - minimum of three (3) shelves; and
    - one (1) shoe stowage; and
    - one (1) hanging bar for clothes; and
    - one (1) outside towel rail; and
    - two (2) clothes hooks; and

E. Lockers will be designed, built and installed so that they perm it free air circulation within the locker and free unobstructed access within the compartments that they are situated in.

F. Drawers and lockers will not freely open due to the vessels motion.

...../end.