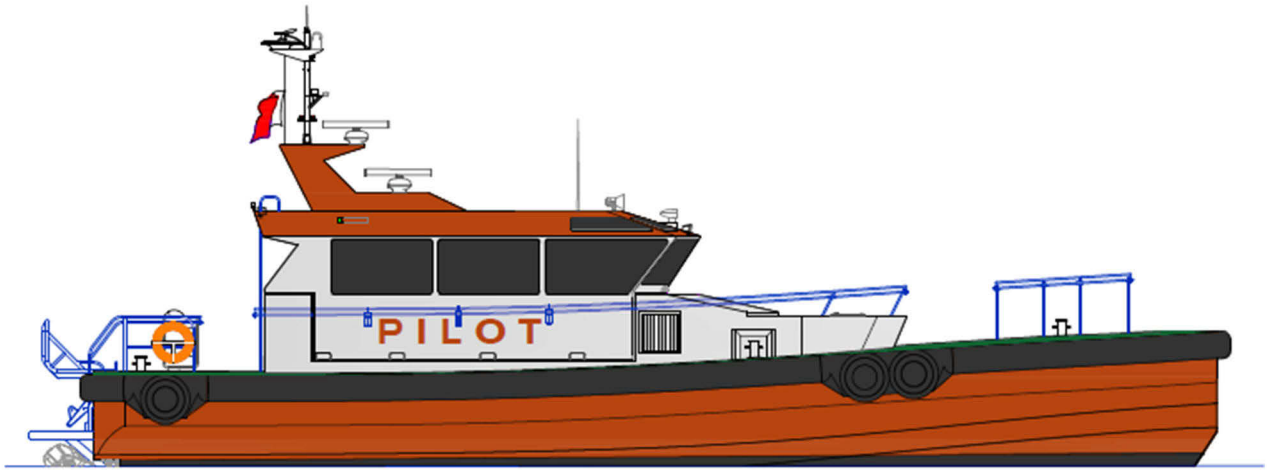
Technical Specification SFBP-011-001

For the Construction of a 67 ft Pilot Boat



Snow and Company | Seattle, Washington USA
Camarc Design | Argyll Scotland, UK
San Francisco Bar Pilots | San Francisco, California USA

Revisions

01	First Working Draft	05/14/2020
02	Second Working Draft	06/04/2020
03	Third Working Draft	06/28/2020
04	Fourth Working Draft	07/23/2020
05	Final Draft	08/06/2020
06	Update to:	08/10/2020

660 Seating model

07 Update to: 08/21/2020

all- replace Swagelok with Swagelok or equal
all update grammar and spelling throughout
150 revised seal description
167 correct frame 13 and frame 20 WT door mfg
247 clarified hydraulic interface
302 add exemption to OEM cables that cannot be severed
436 clarify WIF sensor monitoring
440 indicate TBD EPIRB is not provided but owner furnished
512 remove reference to dry zone
529 swap alarm vs pump order
625 revise adhesive description
640 replace Ayers with Ayers or equal

08 Update to: 10/16/2020

241 Transmission changed to TD MGX 6599SC

Table of Contents

000 | DESIGN AND GENERAL INFORMATION

This document describes the requirements and specification of systems and components for a 67 ft pilot transfer vessel for the San Francisco Bar Pilots.

The vessel is intended to be for a one-off custom designed, custom built vessel. At the writing of this specification the design of the vessel is in progress, as a result while some components and sizes are know at this time are and described specifically, in other cases where the design is not complete requirements for the sizing or selection of components are provided instead.

The vessel design is based upon previous vessel designs by the Designer built by various builders around the world, and shares many features included hull form, arrangement, and other details with those designs.

The hull will be sub-divided into the following compartments by main transverse watertight bulkheads (MTWB):

- Waterjet Compartment
- Engine Compartment
- Accommodations Compartment
- Void Compartment
- Collision Void

The superstructure will consist of the following spaces:

- Pilothouse
- The fixed area atop the superstructure main roof forming the bottom of the fixed mast will be considered the fiddley.
- The portion of the superstructure fixed to the hull above the main deck (not resiliently mounted) will consist of the cuddy, which is considered part of the Accommodations Compartment.

The main deck area will be divided into the following areas:

- Foredeck – area forward of the cuddy front
- Sidedecks – area outboard of the pilothouse and cuddy
- Aft deck – area aft of the pilothouse

010 DOCUMENTATIONS

This document is intended to accompany other documents to describe not only the vessel but the purchase of such vessel. In the event of inconsistencies, the order of precedence among the following documents will be observed:

1) Contract

2) Specification, this document

3) General Arrangement drawing

4) All others.

020 DEFINITIONS & ACRONYMS

Throughout this specification the following names/terms are defined to mean the following:

BUILDER: Snow and Company | Seattle WA USA

DESIGNER: Camarc Design | Argyll Scotland UK

OWNER: San Francisco Bar Pilots Benevolent and Protective Association | San Francisco CA USA

Throughout this specification the following acronyms are used to mean the following:

ANSI: American National Standards Institute

ASHRAE: American Society of Heating, Refrigeration and Air-Conditioning

ASTM: American Society of Testing and Materials

CARB: California Air Resources Board

CFR: United States Code of Federal Regulations

DEF: Diesel Exhaust Fluid (urea/water)

ELA: Electrical Load Analysis

EPA: Environmental Protection Agency

IACS: International Association of Classification Societies

MARPOL: International Convention for the Prevention of Marine Pollution from Ships

MTWB: Main Transverse Watertight Bulkhead

OSHA: Occupational Safety and Health Administration

SCR: Selective Catalyst Reactor

USCG: United States Coast Guard

030 VESSEL PARAMETERS

The below table describes the principle characteristics of the vessel:

CHARACTERISTIC	US Standard Units		SI UNITS	
LENGTH, OVERALL	73.3	ft	22.3	m
LENGTH, MOLDED	67.3	ft	20.5	m
BEAM, OVERALL	20.3	ft	6.2	m
BEAM, MOLDED	19.0	ft	5.8	m
DEPTH, MOLDED	9.8	ft	3.0	m
DRAFT, DESIGN	3.6	ft	1.1	m
AIR DRAFT, @ DESIGN DRAFT, LEVEL TRIM	27.9	ft	8.5	m
DISPLACEMENT, FULL LOAD	110,000	lbs	50,000	kg
FUEL TANK VOLUME	1,300	gal	5,000	liter
DEF TANK VOLUME	2x 50	gal	2x 200	liters
FRESH WATER TANK VOLUME	50	gal	190	liter
PERSONS	2 Crew, 12 Pilots			

040 OPERATING PARAMETERS

The vessel is to operate within the interior of San Francisco Bay and out through the Gate 11 nm to the station transfer vessel.

The vessel performs two typical runs throughout the day. One typical run consists of leaving the dock, transiting out to the station vessel for pilot transfer and return. This route has the following profile:

TYPICAL STATION VESSEL RUN				
DESCRIPTION	TIME	SPEED	POWER	FACTOR
IDLE-STAR UP	5 min	-	3%	0.15
MANEUVER-DOCKING	5 min	5 knots	15%	0.75
TRANSIT	27 min	25 knots	80%	21.6
MANEUVER-TRANSFER	5 min	10 knots	50%	2.50
TRANSIT	27 min	25 knots	80%	21.6
MANEUVER-DOCKING	5 min	5 knots	15%	0.75
IDLE-SHUTDOWN	10 min	-	3%	0.30
TOTAL	84 min		57%	47.65

The second typical route consists of leaving the dock, performing transfer(s) within the Bay to a vessel at an anchorage and return. This route can vary depending upon the number of transfers and the location of transfers, but an average run may have the following profile:

TYPICAL BAY RUN				
DESCRIPTION	TIME	SPEED	POWER	FACTOR
IDLE-STAR UP	5 min	-	3%	0.15
MANEUVER-DOCKING	5 min	5 knots	15%	0.75
TRANSIT	15 min	25 knots	80%	12.00
MANEUVER-TRANSFER	5 min	10 knots	50%	2.50
TRANSIT	15 min	25 knots	80%	12.00
MANEUVER-DOCKING	5 min	5 knots	15%	0.75
IDLE-SHUTDOWN	10 min	-	3%	0.30
TOTAL	60 min		47%	28.45

The vessel has expected annual hours of up to 4,000 per year. Based upon distribution of 1/3 station vessel runs and 2/3 bay runs, the vessel is expected to have an annual load profile of ~ **50%**.

050 SPEED AND RANGE

Speed estimated to be approximately 30 knots at 100% MCR at full load in flat water conditions.

Speed estimated to be approximately 25 knots at ~80% MCR at full load in flat water conditions

Fuel Consumption for the MAN 2862 LE 438 engine is taken from the graph below. From which the vessel will burn approximately 2x160 l/h (85 gph) at 80% MCR cruise and 2x 218 l/h (115 gph) at 100%.

With allowance for generator consumption, and less than engine manufacturer ideal conditions the vessel will have approximately 350 l/h (92 gph) consumption at cruise speed.

Based upon the usable portion (90%) the fuel tank, the vessel will have a cruise range of approximately 320 nm

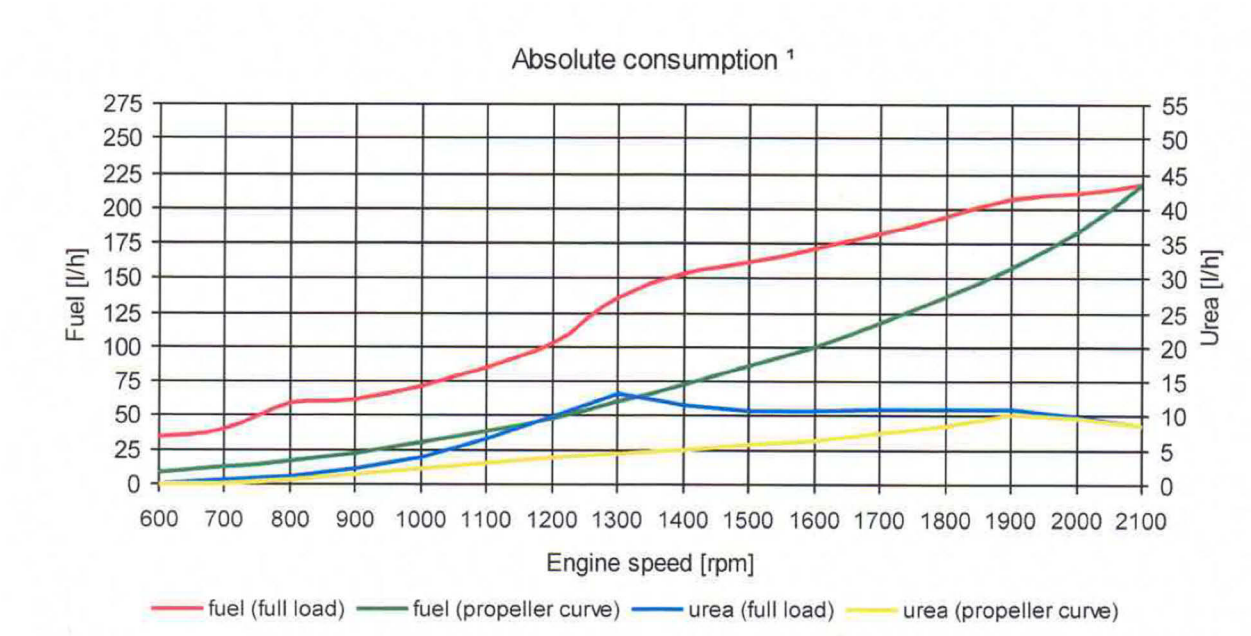


Image taken from MAN Tech Date Sheet 25.07.2019 (version 1)

NOTES:

1. Vessel speed is function of weight, installed power, propulsion efficiencies, hull efficiencies and environmental conditions.
2. Hull efficiencies are a product of the decisions of the selected hull by the Designer.
3. Propulsion efficiencies are a product of the decision for the selected waterjet propulsor.
4. Installed power is a product of the decision for the selected propulsion engine.
5. Environmental condition effects vary and not within the decision matrix.
6. Weight is a product of **ALL** decisions that comprise this specification. Increased weight will result in relatively lower top speeds or more fuel consumption for a given speed. The below speed and range estimates are based upon the selected propulsion components and anticipated weight of the vessel as describe within this specification. Changes to the specification that increase weight will negatively impact speed and range.

070 ENVIRONMENTAL CONDITIONS AND REQUIREMENTS

The vessel will meet the EPA requirements for emissions, for this vessel that requirement is EPA Tier4 Marine Propulsion Engine for Commercial Use.

The vessel will meet the MARPOL requirements for pollution discharge per current US ratification.

The vessel is intended to operate within the following range of environmental conditions based upon ASHRAE design conditions for San Francisco, CA USA.

- Mean maximum dry bulb air temperature 95 °F
- Extreme maximum wet bulb air temperature 72 °F
- Minimum 99% dew point for heating: 28 °F
- Maximum 0.4% dew point for cooling: 83 °F

The vessel is intended to operate within a range of water from Freshwater (0.999 spgr) through brackish to saltwater (1.025 spgr)

The vessel is intended to operate within San Francisco Bay and out to beyond the SF Bar.

Historic climate data summary is not immediately available for Scripps Data Buoy # 46237 – SF Bar (37.786 N 122.635 W). In its place historic wind and sea conditions based upon Climatic Summary of National Data Buoy # 46026 – 18 NM West of SF (37.754 N 122.839 W) is below.

- Wind Average Speed: up to 45 knots
- Wind Peak Gust: up to 58 knots
- Average Wave Period: 6 to 8 seconds (mean), 5 to 10 seconds (1 std)
- Dominant Wave Period: 9 to 13 seconds (mean), 6 to 16 seconds (1 std)
- Significant Wave Height: 1.5 m to 2.5m (mean), up to 3.5m (1std)
- Sea Water Temperature: 44 °F to 68 °F

080 NOISE REQUIREMENTS

The main propulsion diesel engines are the primary source of noise while the vessel is operating at full speed. In addition, the waterjet and wave induced hull noise provide secondary noise sources. The airborne noise from the engine is also transmitted to the structure and transferred as structural borne noise throughout the hull.

To mitigate the noise sources, the engine compartment and portions of the hull accommodation space will be outfitted with noise abating material adhered to the hull to limit the transmission of airborne to structural borne noise and damp the structure. The engines and reduction gears will be mounted to the hull via vibration isolating mounts to reduce structural borne noise.

To isolate the primary occupied space from the hull noise, the superstructure will be resiliently mounted to the hull on vibration isolators.

Based upon prior vessel builds of similar design (similar power, similar hull size, resiliently mounted pilothouse), the anticipated noise levels in the vessel are expected to be:

Pilothouse:

- Pilot Seats, middle row, seated head position height: 65-67 dBA (slow response) target.

Hull Accommodation Compartment:

- Noise levels in the hull accommodation compartments is expected to be less than 85 dB SPL (OSHA 8-hour exposure limit)

Hull forward voids:

- Due to wave interaction with the hull and structural borne noise from the engines and waterjets, the noise levels in the forward hull voids is expected to exceed 85 dB SPL. These spaces are un-occupied.

Engine Compartment, and Jet Compartment:

- Noise level in the engine compartment with the engines at full power are expected to exceed 115 dB SPL, and therefore entrances to the compartment will be labeled with Hearing Protection Required notice labels. Noise levels in the jet compartment with the engines at full power are expected to exceed 90 DB SPL, since the entry to the jet compartment is normally through the engine compartment, then same hearing protection will be recommended.

090 REGULATORY REQUIREMENTS

The vessel is intended to be documented with the US National Vessel Documentation Center by the OWNER to receive a Certificate of Documentation (COD) and Official Number. The vessel will be measured via the simplified system for domestic tonnage. The vessel will not have any endorsements with primary service to be UNCLASSIFIED VESSEL. The BUILDER will provide the OWNER with the necessary information for the OWNER to certify the vessel.

096 WEIGHT

Weight characteristics of the vessel will be provided by the Designer and reviewed by the Builder during the design phase based upon the vessel as described within this Specification. After the design phase is complete, the Builder will continually monitor weight and centers for any deviations from the design to as-built configuration. At the completion of the build, an in-water inclining experiment and deadweight survey will be performed by the builder, the results of which will be provided to the Designer for calculation of the As-Built Vessel's official lightship weight and center of gravity.

LIGHTSHIP:

The vessel ready for service with all gear and equipment installed, all systems with fluids at operating conditions.

FULL LOAD:

The vessel in the lightship condition plus deadweight per below.

DEAD WEIGHT:

In addition to the lightship condition, the vessel is intended to operate with the following deadweight:

- 2 crew – 225 lbs with personal kit, located in pilothouse
- 12 pilots – 225 lbs with personal kit, located in pilothouse
- Fuel, tank filled to 95% capacity
- DEF, tank filled to 95% capacity
- Potable water, tank 100% filled
- All other tanks at normal operating levels.
- Miscellaneous deadweight allowance of 600 lbs for tools, onboard spares, and other items; located at lightship LCG and a VCG of main deck amidships

097 STABILITY

The vessel is to be designed to meet the intact stability requirements of IMO A>749(18) Chapter 3 in all conditions of loading and operation.

The vessel is to be designed to meet the damaged stability requirements for single compartment flooding (remain upright without main deck immersion) in all conditions of loading and operation.

Based upon the results of the inclining experiment, the Designer will provide the Builder and Owner with a stability report (book) and guidance (equivalent to what would be required to achieve regulatory approval), for the vessel in the As-Built lightship weight and center and the loading conditions described within this report (see Section 096)

SERVICE LIFE MARGIN:

To account for future weight growth over the life of the vessel, a Service Life Margin of 1,000 lbs located 3 ft above the main deck at light ship LCG will be included in all stability calculations.

100 | STRUCTURE

The vessel's hull and superstructure are to be fabricated of marine grade welded aluminum.

101 STRUCTURAL MATERIALS

Structural marine grade aluminum will be used throughout the hull and superstructure.

Plating:

- 5086-H116 (ASTM B928)
- 5083-H116 (ASTM B928)

Extrusion in direct contact with sea water:

- 5086-H32 or 5086-H111 or -H112

Extrusion not in direct contact with sea water:

- 5086-H32 or 5086-H111 or -H112
- 6061-T6 (ASTM B221)
- 6063-T6 or -T52 (ASTM B221)

102 STRUCTURAL WELDING

The builder will maintain weld procedures approved by and IACS member (DNV or other) and the American Welding Society for aluminum for both FCAW and GMAW processes used in aluminum boat building.

110 HULL STRUCTURE

The hull will be fabricated welded marine aluminum.

Insert plates in the main deck should be positioned such that the thickness increase is to the interior of the vessel (downward)

Inserts plates, in the hull shell will be positioned such that the thickness increases to the interior of the vessel (inward)

The hull structure will be designed to the below scantling rules. The sides / topsides will be of increased strength for pilot boat boarding operations. Structure will be locally re-enforced in way of mooring bits, and other concentrated loads.

110 DESIGN REQUIREMENTS	
HULL SCANTLINGS	BV class standards, BV NR 396

114 HULL FENDERING

The vessel will be equipped with both primary and secondary fendering, appropriate for service as a pilot transfer vessel.

The primary fendering will consist of a custom pilotboat fender designed can fabricated by Fender Innovations, Westrak The Netherlands. The primary fender will be adhesive bonded to the hull with a capture key. The fender will have integral attachment points for the Secondary Tire. The bow radius will be additionally reinforced for abrasion against concrete piers while doing bow transfers.

The secondary fendering will consist of aircraft tires hung outside of the primary fendering as depicted on the General Arrangement Drawing. tire. Tires will be attached to the primary fender with lugs and chains. Where tires are in pairs, they will be located such that they are compressed together longitudinally so a rope or other item cannot pass between them. Tires will be located vertically such that the tire top is just below the deck edge.

114 EQUIPMENT LIST	
PRIMARY FENDERING	Fender Innovations, Custom Pilotboat fender 500 x 250mm Black
SECONDARY FENDERING	Aircraft Tires: PVGG 40x14.5-19 Approx. deflated dimensions: 36” dia x 14” width 18” rim opening

126 INTEGRAL FUEL TANK

A single structurally integral fuel tank will be located between the inboard engine girders. The fuel tank will provide fuel for both propulsion engines and generator(s).

The fuel tank will contain a single suction located at the aft end of the tank routed to a supply manifold. The tank suction will be located approximately 1 suction pipe diameter above the tank bottom. The suction will be isolated from the supply manifold with a single cable operated fuel shut off valve. The manual operator for the fuel shut off valve will be located on the main deck, aft of the pilothouse.

A fueling station with be located on the main deck, just aft of the pilothouse. The fueling station will contain a single fill connection and vent. A spill containment coaming with drain plug will surround the fill and vent. A high fuel alarm with audible and visual indication will be announced at the filling station. (see Section 440). The fill and vent are to be electrically connected to the fuel tank (bonded across any hose sections) to prevent the possibility of static build up and discharge.

The fuel tank will be fitted with a level indicator and high-level and low-level alarms per Section 436.

126 EQUIPMENT LIST	
ACCESS HATCHES	Tiona 20” with aluminum plate tops
FUEL SHUT-OFF VALVE	Full port valve, manual push-pull cable
FUEL LEVEL AND ALARMS	See Section 436

Piping for the fuel tank fill vent and sound will be per the below schedule.

126 FUEL FILL, VENT AND SOUND MATERIAL SCHEDULE	
FILL AND VENT PIPING	Piping: Aluminum Fill Size: 1 ½” Flanges: ANSI B16.5 Class 150, flat or raised face

The sizing of pipes and components for the fuel tank will be designed to meet the following requirements.

126 DESIGN REQUIREMENTS	
FUEL TANK SIZING	Based upon two 12-hour day operation at average of route profiles (see Section 040) plus 5%.
SUPPLY MANIFOLD VELOCITY	7 feet per second

150 SUPERSTRUCTURE

The hull will be fabricated welded marine aluminum.

The pilothouse will be resiliently mounted to the hull structure with vibration isolation mounts to reduce noise and vibration transmitted from the hull to the pilothouse. Bolted panels located around the perimeter of the house skirt will allow access to the vibration mounts. The access from the pilothouse to the hull accommodations apartment will be surrounded by a weathertight perimeter seal.

150 EQUIPMENT LIST	
RESILIENT MOUNTS	Trelleborg, Evolo 600 Series

All electrical connections between the hull and house will be made in the electoral junction space between the hull and house. The electrical junction space will be accessible through a hatch beneath the pilothouse console (see Section 168)

163 SEA CHEST

A pair of pipe sea chests for the main propulsion engines will be located on centerline between Frame 4 and Frame 6.

A pair of pipe sea chests for the generator engines will be located just outboard of the fuel tank at the forward end of the engine compartment. Each generator engine will be served by a dedicated, independent sea chest.

All sea chests for the above services will be fitted with tapered plate interceptor “scoops” and bar grates.

A pipe sea chest for the HVAC chillers will be located in the engine compartment.

A pipe sea chest for the fire pump will be located in the engine compartment.

Piping for the sea chests will be per the below schedule.

163 SEA CHEST MATERIAL SCHEDULE	
SUCTION PIPING	Piping: 5086 Sch 80 Flanges: ANSI B16.5 Class 150, flat or raised face

The sizing of pipes and components in the propulsion and generator sea water cooling systems will be designed to meet the following requirements.

163 DESIGN REQUIREMENTS	
INLET FREE AREA or	1.5x Suction pipe area
SUCTION PIPE VELOCITY	7 fps for aluminum piping

167 HULL DOOR, HATCHES AND MANHOLES

Watertight closures will be installed in the hull per the table below:

167 EQUIPMENT LIST	
WATERJET COMPARTMENT DECK HATCH	Make: Freeman Marine Coaming drain overboard Model: 2400 Series A-K, Hinged Clear Opening: 24” x 24”
ENGINE COMPARTMENT DECK HATCH	Make: Freeman Marine Coaming drain overboard Model: 2400 Series A-K, Hinged Clear Opening: 24” x 24”
ENGINE COMPARTMENT REMOVAL HATCH	Builder Fabricated aluminum Internally accessed bolted flange Gasketed seal
ACCOMMODATIONS COMPARTMENT ESCAPE HATCH (EXTERIOR CUDDY TOP)	Make: Freeman Marine Model: 2400 Series A-K, Hinged Clear Opening: 15” x 24”
ACCOMMODATION COMPARTMENT ACCESS HATCH (INTERIOR PILOTHOUSE)	Make: FabTek Hydraulic Assist Aluminum WT quick acting door Single lever Clear Opening: 24” x 36”
COLLISION VOID DECK HATCH	Make: Freeman Marine Coaming drain overboard Model: 2400 Series A-K, Hinged Clear Opening: 15” x 24”
MTWB No. 4 WATERTIGHT DOOR	Make: FabTek Single Lever View Port Aluminum WT quick acting door Clear Opening: 24” x 70”
MTWB No. 13 WATERTIGHT DOOR	Make: FabTek Single Lever View Port Aluminum WT quick acting door Clear Opening: 24” x 70”
MTWB No. 20 WATERTIGHT HATCH	Make: FabTek Aluminum WT quick acting door Clear Opening: 30” x 30”

Watertight doors through MTWBs will be fitted with open alarm sensors integrated into the Central monitoring system (see Section 436)

168 SUPERSTRUCTURE DOORS

Weather tight closures will be installed in the superstructure per the table below:

168 EQUIPMENT LIST	
PILOTHOUSE AFT DOOR	Make: FabTek Two dogs with handle Maximum size upper window Clear Opening: 30” x 70”
ELECTRICAL DISCONNECT ACCESS HATCH	Make: Freeman Marine Model: Series 2400 Vertical Series 2400 Vertical

170 MAST

The mast will be comprised of two parts, a lower fabricated box that is structurally part of the house top (aka fiddley), and an upper demountable pipe part. The lower part will support both radar array units. The upper part will support lights, antenna etc.

A halyard will be provided to fly an ensign aft off the upper mast.

200 | PROPULSION

The vessel will be powered by a pair of marine diesel engines providing power to a pair of waterjets for propulsion and steering. Each diesel engine and its support systems will be configured to allow a single engine to operate independent of the other.

233 PROPULSION ENGINES

Vessel power will be provided by a pair of marine diesel engines. The propulsion integrator will provide the engines close coupled to the reduction gears and outfitted for electrical, cooling and lube oil as described below.

233 EQUIPMENT LIST	
Propulsion Integrator	RDI Marine, Seattle WA
Propulsion engines	Make: MAN Model: D2862 LE 438 Rated Power: 1,200 HP Rated Speed: 2,100 rpm Emissions: EPA Tier4 Marine Commercial Rating: MAN Medium Duty
COOLING	Raw water heat exchanger
CHARGING – Primary alternators	24 VDC, OEM
SUMP CONNECTIONS	See Section 262

The propulsion integrator will perform a Torsional Vibration Analysis (TVA) to confirm the acceptability of the engine, engine mounts, gear, shafting and water jet.

The engine and reduction gear will be mounted on OEM vibration isolators to reduce noise and vibration from the engine to the ship's structure.

241 REDUCTION GEARS

Torque from the propulsion engines will be transmitted to the propulsion shafting (see Section 243) via a reducing, reversing marine transmission. The reduction gear will be cooled from the propulsion engine raw water-cooling loop (see Section 259). The installation of the torsional coupling and initial mating of the reduction gear to the propulsion engine will be performed by the propulsion integrator.

241 EQUIPMENT LIST	
PROPULSION INTEGRATOR	RDI Marine, Seattle WA
REDUCTION GEARS	Make: TwinDisc Model: MGX 6599 SC Gear Ratio: 1.8667 Rating: Medium Duty

The selection of the gear ratio will be performed by the waterjet supplier with designer approval based upon the commercially available ratio and impeller options. If no combination of impeller and reduction ratio is available, then and only then will a custom ratio be considered.

243 PROPULSION SHAFTING

A carbon fiber universal joint driveshaft will transmit torque from the reduction gears to the waterjets. The specification and sizing of the driveshaft and its components will be the responsibility of the shafting integrator.

The drive shaft will pass through the watertight bulkhead that separates the engine compartment from the waterjet compartment. A bulkhead seal will maintain watertight integrity.

The drive shaft configuration will allow for the servicing of the waterjet bearings and seals without removal of the main carbon driveshaft section from the vessel. This allowance will be attained by mounting the shaft seal in a bolt in plate in the Waterjet Compartment / Engine Compartment bulkhead of sufficient clearance such that with the plate removed, that the drive shaft can be lifted above or to the side of the required service area.

243 EQUIPMENT LIST	
SHAFTING INTEGRATOR	Driveline Service of Portland, Portland OR
DRIVE SHAFT	Make: EuroCardon Model: DLS 214519-00
BULKHEAD SEAL	Fully split non-contact, aluminum.

The sizing of the shafting will be designed to meet the following requirements.

243 DESIGN REQUIREMENTS	
ALL	Responsibility of Shafting Integrator

247 WATERJETS

Vessel forward and reverse thrust and steering will be provided by a pair of waterjet propulsion units. The waterjets will receive hydraulic pressure from the integrated HTX hydraulic system for steering cylinder and bucket cylinder actuation.

247 EQUIPMENT LIST	
WATERJETS	Make: Hamilton Jet Model: HTX 52

The sizing of the waterjets will be sized to meet the following requirements with agreement between the waterjet provider and Designer.

247 DESIGN REQUIREMENTS	
Top Speed @ available power	See Section 050
Reduction Ratio & Impeller Matching	See Section 243
Minimum cavitation speed	< 10 knots, appropriate for pilot boat service

Pad eyes or other consideration will be provided within the waterjet compartment and on the exterior transom to provide lifting points for waterjet removal and installation.

252 PROPULSION & STEERING CONTROL

Propulsion and steering control will be provided by an integrated control system. The primary operating station will be in the pilothouse. A secondary operating station will be on the aft deck for operation of the boat in conjunction with MOB recovery.

252 EQUIPMENT LIST	
CONTROL SYSTEM	Hamilton Jet AVX with Jet Anchor with AP interface
PRIMARY CONTROL STATION - PILOTHOUSE	Steering: Helm Tiller Unit Throttle: Dual Lever Unit Bucket: Dual Lever Unit Docking: Mouseboat Unit
SECONDARY CONTROL STATION – AFT DECK	Steering: Helm Tiller Unit Throttle: Dual Lever Unit Bucket: Dual Lever Unit
DATA RECORDER	Hamilton Jet VDRIU

The control system will be powered from an independent, isolated power system. (see Section 321)

Alarm and monitoring of the propulsion engines and the waterjets will be integrated with the centralized alarm and monitoring systems (see Section 436) to the extent possible by the existing I/O provided the OEM equipment.

256 PROPULSION ENGINE COOLING

The propulsion engines will be sea water / heat exchanger cooled. The engine supplied raw water pump will take suction through the sea chest (See Section 163) and sea water suction piping.

Each sea chest will be separated from a simplex strainer by a sea valve. Strainers outlets will be fitted with discharge valves to allow for strainer isolation during basket cleaning. The discharge of each strainer will be connected in an "H" with cross over valve to connect both engine suctions to a single sea chest.

Raw water will be diverted to the reduction gear cooler (See Section 241) and be discharged to the wet exhaust injection ring (see Section 259). To meet engine manufacture's requirements for exhaust back pressure, a raw water overboard by-pass with orifice plate will be installed in the discharge line between the engine and the exhaust connection. An anti-siphon loop will be installed between the raw water pump suction and wet-exhaust injection point.

OEM Block heaters will be proved for each propulsion engine.

256 EQUIPMENT LIST	
SEA STRAINERS	Style: Simplex Make and Model: Miller Leaman, Thompson SeaStrainer Material: CuNi
BLOCK HEATER	Make: MAN (factory equipped) Size: 2x 1100 Watts Power: VAC shore power only

Seawater piping for the propulsion engine cooling system will be per the below schedule.

256 SEAWATER PIPING MATERIAL SCHEDULE	
SHELL TO ISOLATION VALVE PIPING	Piping: 5086 Sch80 Flanges: ANSI B16.5 Class 150, flat or raised face Propress
ISOLATION VALVE	Butterfly, lugged body, epoxy coated iron body Bronze or CRES stem and disk, isolation kit
ISOLATION VALVE TO ENGINE PIPING	Piping: ASTM B466 90/10 CuNi Class 200 Flanges: ANSI B16.5 Class 150, flat or raised faced
OVERBOARD FLANGE TO SHELL PIPING	Piping: 5086 Sch80 Flanges: ANSI B16.5 Class 150, flat or raised face
OTHER PIPING	Piping: ASTM B466 90/10 CuNi Class 200 Flanges: ANSI B16.5 Class 150, flat or raised faced Hose: USCG w/barb or weld bead, 2x 316 stainless clamps
FLEXIBLE CONNECTION	Flanged Bellows or USCG Hose w/barb or weld bead, 2x 316 stainless clamps

The sizing of pipes and components in the propulsion sea water cooling system will be designed to meet the following requirements.

256 DESIGN REQUIREMENTS	
Strainer sizing	Both engines running combined on only one strainer at 80% MCR
SUCTION LOSS	Per raw water pump requirements
DISCHARGE PRESSURE	Per exhaust back pressure requirements Adjusted with orifice plate sizing
FLOW VELOCITY LIMITS	Alum: 9 fps suction, 12 fps discharge CuNi: 12 fps

259 PROPULSION ENGINE EXHAUST

Exhaust from the propulsion engines will pass through dry pipe sections to the MAN provided Dosing unit and SCR. Exhaust discharge from the SCR will route to a water injection ring that receives raw water discharged from the propulsion engines sea water cooling system. Wet, mixed exhaust combine in a surge tube and pass through the watertight bulkhead and then travel through a water lift muffler and discharge at the transom corners.

259 EQUIPMENT LIST	
SCR and Dosing Units	Make: MAN
INJECTION RING	Material: 316L stainless
MUFFLER	Make: Marine Exhaust Systems FRP waterlift

The dosing units will consume DEF at a % of diesel fuel use (see Sect 265).

MAN SCR and dosing units are supplied with sheathed insulation. Other dry piping section will be insulated with removable exhaust lagging. Exhaust lagging will be pre-sewn and removable, laced preferably with spring fasteners

The dry exhaust piping and the SCR components will be mounted to account for working thermal expansion and to minimize thermal sound and vibration transmission.

Exhaust piping will be per the below schedule.

259 EXHAUST PIPING MATERIAL SCHEDULE	
DRY PIPING	316L Sch 10s
WET PIPING	FRP marine exhaust
SHELL CONNECTION	Piping: 5086 Sch80 See Section 631 for coating of faying surfaces
DRY PIPING, FLEX CONNECTION	Marine Exhaust
WET PIPING, FLEX CONNECTION	Silicone, single or double hump, 2x 316 clamps

The sizing of pipes and components in the exhaust system will be designed to meet the following requirements.

259 DESIGN REQUIREMENTS	
BACK PRESSURE	Per engine mfg requirements
TURBO FLANGE LOADING	Per engine mfg requirements
INSULATION LEVELS	Limit of 150°F surface temperature
FUTURE CARB FILTER	Provide a pipe spool piece between the turbo expansion joint and the input to the Dosing Box to allow for a 36” long by 18” diameter future Diesel Particulate Filter.

261 PROPULSION ENGINE FUEL

The propulsion engines will draw fuel from the integral fuel tank (see Section 123) via the fuel supply manifold. Each engine will have an independently run full supply line from the manifold to its primary fuel filter. An isolation valve will connect each supply run to the manifold. The primary fuel filter will be fitted with isolation valves at each side of the filter and will be positioned above a drip pan to catch fuel spillage during element transfer.

Each engine will have an independently run fuel return directly back to the fuel tank without any valves. Fuel return piping will penetration the tank top and extend and extend to within 6 inches of the tank bottom. The fuel return pipe will have anti-siphon holes just below the tank top to prevent siphoning.

261 EQUIPMENT LIST	
PRIMARY FUEL FILTERS	Racor, Marine Duplex Turbine Series, Poly bowl, WIF sensor, Micron Rating per engine mfg., vacuum gauge

Fuel piping for the propulsion engine fuel system will be per the below schedule. Piping will be primarily tube with flexible hose lengths and connections minimized.

261 DIESEL FUEL PIPING MATERIAL SCHEDULE	
SUPPLY AND RETURN PIPING	Tube: 316 (min 0.035 wall) Hose: USCG approved
FITTINGS	Tube: 316 Swagelock or equal Hose: JIC 37° flare Other: NPT or flanged Flanges: ANSI B16.5
VALVES	Full port ball, 316

The sizing of pipes and components in the fuel system will be designed to meet the following requirements.

261 DESIGN REQUIREMENTS	
SUCTION LOSS	Per engine requirements
SUCTION VELOCITY	7 fps
DISCHARGE VELOCITY	12 fps

262 PROPULSION ENGINE LUBE OIL

The propulsion engine oil pan and the lower reduction gear casing discharge ports will be fitted with remote suctions. A section of hose will be run from the isolation valve to above the floor plating. The hose ends will be fitted with quick disconnect fittings and caps.

If allowed by the respective OEMs, the propulsion engines, generator engines and transmission will be filled with the same lube oil.

262 LUBE OIL PIPING MATERIAL SCHEDULE	
SUPPLY AND RETURN PIPING	Hose, engine: OEM Hose, gear: USCG approved
FITTINGS	Engine: OEM gear: JIC 37° flare, Q/D: Bronze

The sizing of pipes and components in the fuel system will be designed to meet the following requirements.

262 DESIGN REQUIREMENTS	
PRESSURE AND VELOCITY	No requirement, size at ¾”

A lube oil storage rack will be fitted in the Waterjet Compartment. The lube oil storage rack will allow secure storage of four 5-gal buckets and four 1-gal bottles.

265 DEF SYSTEM

Each exhaust system will be supplied with Diesel Exhaust Fluid (DEF) as required by the SCR. The exhaust system dosing units will take DEF supply from the DEF tank. Each propulsion engine will be served by an independent DEF tank. DEF tanks will be polyethylene, sized per the requirements below. Tanks will be isolated from the aluminum structure by high durometer neoprene to prevent chaffing. All penetrations through the DEF tank will be through the tank top to minimize the potential of leaks. Each DEF tank will be fitted with a high-level alarm, low level alarm, and tank level indication.

265 DEF PIPING MATERIAL SCHEDULE	
SYSTEM PIPING	Tube: 316 (min 0.035 wall) Hose: USCG approved
SYSTEM FITTINGS	Tube: 316 Swagelock or Equal Hose: JIC 37° flare Other: NPT or flanged Flanges: ANSI B16.5
VALVES	Full port ball, 316
FILL AND VENT PIPING	Pipe: 5086 Sch 40 Aluminum Hose: SAE J1942A1 w/double hose clamp

265 DESIGN REQUIREMENTS	
DEF TANK CAPACITY	% of fuel tank capacity per MAN

300 | ELECTRICAL

The vessel will utilize both an AC power system and a DC power system to supply electrical power to required loads.

AC power will be arranged as 3-phase Wye, 120/208 VAC, 4-pole, 5-wire (A-B-C-N-G).

The AC system will be configured as an ungrounded system with a single point hull safety ground. Electrical components will not be grounded to the hull. Were required, safety grounds should be returned to the distribution power panel provided power to the piece of equipment. The AC neutral and the AC safety ground will be made common within the main AC switchboard and a ground fault indicator and test functionality will be provided. An AC ground will be connected to the hull at a single point to serve as a hull safety ground. The single point hull safety ground will be made in an easy to access location and be labeled as such.

The single point hull ground will also serve as the location of the AC ground – DC neutral single point common connection.

DC power will be arranged as a 24V system (28.8 VDC).

The DC system will be configured as an ungrounded system. DC branch circuit positive and negative conductors will be returned to their source or panel.

Equipment that is case grounded will be isolated from the aluminum hull.

The sizing of power wiring we be designed to meet the following requirements for ampacity and allowable voltage drop.

300 DESIGN REQUIREMENTS	
Power wiring ampacity and voltage drop	ABYC E-11

301 POWER AND CONTROL WIRING

Wire for all powering circuits will be UL listed 1426 boat cable or IEEE-45/1580 shipboard cable.

Wiring for non-powering circuits will be multi-strand conductor type and UL listed for its intended purpose.

Unless required otherwise for OEM compatibility, crimp connectors will be ring type. A maximum of two ring connectors will be landed on any single terminal. If more conductors are needed to be landed, a terminal board with jumpers or a bus bar will be used.

Deutch DTM series style connectors may be installed between OEM pigtails and Builder supplied cable to allow for assembly, removal, and maintenance.

Wago Splicing connectors (Type 222-###) may be used for multi-conductor connection of low amperage DC LED lighting.

Where heat shrink is used it will be of the cross-linked polyolefin type.

DC wiring will be Red (positive), Black or Yellow (negative), Green or Green/ Yellow (safety ground).

AC wiring will be Red, Black, Orange (Phase), White (neutral), Green (safety ground)

Wire cables will be labeled at entry to each panel or junction box. Conductors will be labeled at each termination. Wire labels will be printed (not handwritten).

Watertight wire multi transits will utilize the Rise FIWA sealing system.

Watertight singe cable transits will utilize Rise or a welded threading coupling and a watertight cord grip.

302 HULL – SUPERSTRUCTURE-HULL ELECTRICAL DISCONNECT

Wires passing from the hull to the superstructure will have disconnect plugs to allow for complete removal of the superstructure from the hull. Wire that are not allowed to be severed by OEM will pass through mechanical WT glands or penetrations.

Plugs connecting AC, DC equipment will be a minimum IP 67 rated. (Deutch DTM or SMS)

Plugs connection navigation, control, alarm or communication equipment will be at a minimum IP 68 rated. (LEMO T series or SMS)

Were possible multi conductor plugs will be utilized to reduce the number of plugs. Multi-conductor plugs will be grouped by function. AC power, DC power and other sources will not be combined into a single plug to minimize possible interference and line noise.

Plugs will be arranged or mechanically keyed to prevent incorrect assembly.

303 ELECTRICAL LOAD ANALYSIS

An AC and DC electrical loads analysis will be created during the design of the vessel. The ELA will be maintained through the design and construction of the vessel and updated with actual purchased equipment as the information becomes available.

304 ELECTRICAL MOTORS

Unless only available otherwise from OEM, AC motors ¾ HP and larger will be 3-phase VAC (A-B-C). AC motors ½ HP and smaller will be 1-phase 120 VAC (A-N) or 1-phase 240 VAC (A-B).

310 ELECTRICAL POWER GENERATION – AC

AC power will be provided from marine generator sets while underway and shore power connection while dockside.

Generators will be located transversely in the engine compartment. Generator sets will be fitted with sound enclosures.

310 AC POWER GENERATION EQUIPMENT LIST	
AC GENERATOR QTY 2	Make: Northern Lights Model: M944T3F 38 kW 60 Hz @ 1,800 rpm 120 / 208 VAC 3-phase 0.8 pf 24 VDC electrical system No charging alternators

The shore power connection will be located on the aft deck in the aft control station, recessed and downward angled. The shore power connection will be isolated from the hull. Shore power will be fed from the shore power connection point to a main shore power disconnect breaker. NOTE: due to the use of 100A 120/208 3ph Shore power, an ELCI shore power breaker will not be used due to lack of commercially available product. A Delta:Wye isolation transformer will be located between the main shore power disconnect breaker and the AC switchboard. The transformer will provide isolation and create the Neutral for the 120 VAC service.

Transfer from shore power to generator will be provided by remote switching located in the pilothouse.

Starting of generators will be proved by both a local start panel and a remote started located in the pilothouse.

311 ELECTRICAL POWER GENERATION - DC

DC power will be provided by the engine alternators and AC powered battery chargers.

Each propulsion engine will be equipped with a primary alternator. This alternator will provide charging for the propulsion engine battery. The propulsion engine battery will provide power only to the respective propulsion engine E-Box and starter under normal operation. Start batteries will be cross connected with a manual emergency cross over battery switch.

An emergency battery will be located pilothouse to supply emergency power for minimal navigation and lighting for 6-hour duration. The emergency battery will be maintained via an ACR between the emergency and house battery.

Propulsion engine batteries and the house battery will be charged/maintained by a multi-output battery charger while underway (via generator) or on shore power (shore bus).

Each generator will be provided with dedicated start battery that will be charged by the generator's on engine alternator. A multi-outlet battery charger will charge/maintain voltage while on shore power. Start batteries will be cross connected with a manual emergency cross over battery switch.

The waterjet control system will be powered by two dedicated control batteries providing primary and secondary control power to each waterjet. These batteries will be charged by a dedicated Isolated DC-DC converter/charger with input from the propulsion batteries to allow continuous operation in the event of AC power system failure.

311 DC POWER GENERATION EQUIPMENT LIST	
PROPULSION / HOUSE BATTERY CHARGER	Make: TBD
GENERATOR BATTERY CHARGER	Make: TBD
WATERJET CONVERTER / CHARGER	Make: Newmar Model: 48-24-18I

320 ELECTRICAL DISTRIBUTION – AC

AC power will be distributed from the AC switchboard in the hull accommodations compartment. The AC Switchboard will receive power from either the generator(s) or shore power. Power transfer between the generator(s) and shore power will of the dead bus type. Power transfer will be accomplished either locally at the AC switchboard, or remotely from the pilothouse console.

The AC switchboard will have a local metering for frequency, current and voltage and remote metering from the pilothouse console

The AC switchboard will have circuit breakers for the pilothouse sub-panel and all AC power circuits in the hull.

The AC switchboard will have a separate shore power bus that will only be powered while the vessel is connected to shore power. The shore power bus will be connected to the same mechanical interlock for shore power vs generator source selection. The breaker to the HVAC engine panel will be able to load-shed in case too high load demand.

The pilothouse AC sub-panel will have a main disconnect breaker and circuits for all AC power circuits in the superstructure.

Panel circuits will be labeled and back lit.

120 VAC receptacles will be located throughout the vessel per the following schedule

320 AC RECEPTACLE SCHEDULE	
PILOTHOUSE – outboard of pilot seats	6 x 120VAC duplex receptacles with USB
PILOTHOUSE - console	2 x 120VAC duplex receptacles with USB
PILOTHOUSE – under console	1 x 120VAC duplex receptacles
ACCOMMODATIONS	2 x 120VAC duplex receptacles
HEAD	1 x 120VAC duplex receptacles
ENGINE COMPARTMENT	4 x 120VAC duplex receptacles with hinged cover plates
WATERJET COMPARTMENT	1 x 120VAC duplex receptacles with hinged cover plates

321 ELECTRICAL DISTRIBUTION – DC

24 VDC power will be distributed from the main DC panel in the hull for hull connected loads, or from the Pilothouse DC panel for superstructure connected loads. If the 12VDC supply is required in the hull or superstructure, the respective main panel will have a 12 VDC sub panel fed by a dedicated 24 VDC to 12 VDC convertor. DC power panels will have a multi-function meter to display voltage and current. DC breakers will be single pole.

Panel circuits will be labeled and back lit.

12 VDC receptacles will be located throughout the vessel per the following schedule

321 DC RECEPTACLE SCHEDULE	
Console (qty 1)	12VDC 15A socket
Aft Pilothouse cabinet (qty 1)	12VDC 15A socket

331 LIGHTING – INTERIOR

Lighting throughout the interior of the vessel will be LED.

Pilothouse:

- Red / white dimmable overhead space lighting, three-way switched from the console and aft bulkhead near pilothouse door.
- Red / white dimmable overhead reading (spot) lights centered above each pair of pilot seats, locally switched from the overhead.

Waterjet Compartment:

- Overhead space lighting switched at the Frame 3 watertight door.

Engine compartment:

- Overhead space lighting, three-way switched from within engine compartment near aft watertight door / ladder and switched within hull accommodations space near watertight door. Lights located within the overhead of the soft patch will be fitted with Deutch DTM connectors for removal.

Hull accommodations compartment:

- Step lighting, switched at console
- Overhead space lighting, switch at the base of the stairwell.

Head:

- Overhead light, switch within the space.

Forward Void:

- Overhead space lighting switched at the Frame 19 watertight hatch within accommodations space.

331 INTERIOR LIGHTING EQUIPMENT LIST	
PILOTHOUSE OVERHEAD LIGHTS (QTY 12)	Imtra, Red/White LED, DC
PILOTHOUSE PILOT READING LIGHTS (6)	Imtra, White, TBD, LED, DC
WATERJET COMPARTMENT LIGHTS (QTY 4)	Imtra Linear High output LED, AC 24”
ENGINE COMPARTMENT LIGHTS (QTY 10)	Imtra Linear High output LED, AC 24”
ACCOMMODATIONS COMPARTMENT LIGHTS (QTY 4)	Imtra Linear High output LED, AC 24”
STEP LIGHTS (1 per step)	Imtra, LED
HEAD LIGHT (1)	Imtra, White LED
FWD VOID LIGHT (2)	Imtra Linear High output LED
COLLISION VOID LIGHT	none

Emergency lighting will be provided by a reduced quantity of the normally used space lights. The reduced quantity of emergency lighting will allow egress and passage through the space. Emergency lights will be switched as the primary light switch but will turn on if loss of main power via relay switch. AC emergency lighting in the hull will be powered via DC:AC invertor off the house batteries.

332 LIGHTING – EXTERIOR

Lighting throughout the exterior of the vessel will be LED.

All exterior lighting will be switchable from the control console in the pilothouse.

The searchlight controls will be located on the console such that either the helm or navigator can operate. The searchlight IR camera will display on the integrated bridge system displays (see Section 436)

332 EXTERIOR LIGHTING EQUIPMENT LIST	
SEARCHLIGHT	Luminell CLITE2 IR LED with AIS and 121.5 tracking from Rhotheta RT 500
MAIN DECK LOW LEVEL DECK LIGHTING (house and cuddy perimeter, aft console (1 lot)	Imtra, Livewell, DC
BOARDING (2 on cuddy front)	Imtra, Lo Pro Bar, 32” 60deg flood
APPROACH / DISEMBARKING (1 port, 1 stbd, House front visor)	Imtra, Offshore 20 40deg flood
SIDE DECK FLOOD LIGHTS (1 port, 1 stbd) Pilothouse top	Imtra, Offshore 20 60deg wideflood
AFT DECK FLOOD LIGHTS (2)	Imtra, Offshore 20 60deg wideflood
MOB TRANSOM FLOOD LIGHTS (2)	Imtra, Offshore 12 60deg wideflood
BOW BOARDING LOW LEVEL DECK LIGHTING (between and around bow handrails)	Imtra, Livewell, DC

341 GENERATOR COOLING

The generator engines will be sea water / heat exchanger cooled. The engine supplied raw water pump will take suction through the sea chest (See Section 163) and sea water suction piping. Raw water will be discharged to the wet exhaust injection elbow. An anti-siphon loop will be installed between the raw water pump suction and wet-exhaust injection point.

Each generator engine will have an independent sea water cooling loop.

341 EQUIPMENT LIST	
SEA STRAINERS	Style: Simplex Groco, Bronze, poly bowl
BLOCK HEATER	Make: MAN (factory equipped) Power: VAC shore power only

Seawater piping for the generator engine cooling system will be per the below schedule.

341 SEAWATER PIPING MATERIAL SCHEDULE	
SHELL TO ISOLATION VALVE PIPING	Piping: 5086 Sch80 Flanges: ANSI B16.5 Class 150, flat or raised face Propress
ISOLATION VALVE	Bronze, full port ball, flanged
ISOLATION VALVE TO ENGINE PIPING	Piping: ASTM B466 90/10 CuNi Class 200 Flanges: ANSI B16.5 Class 150, flat or raised faced
OVERBOARD FLANGE TO SHELL PIPING	Piping: 5086 Sch80 Flanges: ANSI B16.5 Class 150, flat or raised face
OTHER PIPING	Piping: ASTM B466 90/10 CuNi Class 200 Flanges: ANSI B16.5 Class 150, flat or raised faced Hose: USCG w/barb or weld bead, 2x 316 stainless clamps
FLEXIBLE CONNECTION	Flanged Bellows or USCG Hose w/barb or weld bead, 2x 316 stainless clamps

342 GENERATOR EXHAUST

Each generator will be fitted with a wet exhaust system. Exhaust hose will run from a on generator engine, OEM, wet exhaust elbow to FRP water lift muffler. The outlet of the muffler will discharge via FRP pipe riser and then exit the hull side above the full load waterline in a downward sloping run.

342 EXHAUST MATERIAL SCHEDULE	
DRY PIPING	None
WET PIPING	FRP exhaust Marine exhaust hose
FLEXIBLE CONNECTIONS	High temperature silicone w/ double hose clamps

343 GENERATOR FUEL

The generator engines will draw fuel from the fuel tank (see Section 123) via the fuel supply manifold. Each engine will have an independently run full supply line from the manifold to its primary fuel filter. An isolation valve will connect each supply run to the manifold. The primary fuel filter will be fitted with isolation valves at each side of the filter and will be positioned above a drip pan to catch fuel spillage during element transfer.

Each engine will have an independently run fuel return directly back to the fuel tank without any valves. Fuel return piping will penetration the tank top and extend and extend to within 6 inches of the tank bottom. The fuel return pipe will have anti-siphon holes just below the tank top to prevent siphoning.

343 EQUIPMENT LIST	
PRIMARY FUEL FILTERS	Racor, Marine Duplex Turbine Series, Poly bowl, WIF sensor, Micron Rating per engine mfg., vacuum gauge

Fuel piping for the propulsion engine fuel system will be per the below schedule. Piping will be primarily tube with flexible hose lengths and connections minimized.

343 DIESEL FUEL PIPING MATERIAL SCHEDULE	
SUPPLY AND RETURN PIPING	Tube: 316 (min 0.035 wall) Hose: USCG approved
FITTINGS	Tube: 316 Swagelock or Equal Hose: JIC 37° flare Other: NPT or flanged Flanges: ANSI B16.5
VALVES	Full port ball, 316

400 | COMMAND AND CONTROL

421 COMPASS

A magnetic compass will be installed on CL directly in front of the helm position on top of the console. The Compass will be illuminated with a dimmable light.

421 COMPASS EQUIPMENT LIST	
MAGNETIC COMPASS	Make: Ritchie Model: SuperSport 1002

422 NAVIGATION LIGHTS

Navigation lights will be provided for a vessel < 50m for operation as a power-driven vessel underway, a vessel at anchor and a pilot vessel underway.

Red and white all-around lights located on the mast will comprise of two lights, mounted back to back against the mast.

The navigation lights will be controlled via the integrated control system (see Section 436)

422 NAVIGATION LIGHTING EQUIPMENT LIST	
NAVIGATION LIGHTS	Imtra DHR60
MASTHEAD LIGHT	225 deg white, 5nm
SIDE LIGHTS	112.5 deg red/green, 2nm
STERN LIGHT	135 deg white, 2nm
ANCHOR/PILOT LIGHT	2x 360 deg white, 2nm
PILOT LIGHT	2x 360 deg red, 2nm

423 ELECTRONIC NAVIGATION SYSTEMS

The following electronic navigation equipment will be installed and interconnection to work together and work with the Integrated bridge system (See Section 436)

Installation, Testing, Termination and commissioning will be performed by the electronics integrator.

Antenna will be located upon the pilothouse top and mast and arranged to minimize induced vibrations in interference.

423 ELECTRONIC NAVIGATION SYSTEM EQUIPMENT LIST	
Electronics Integrator	Mackay Marine
RADAR (Qty 2)	FURUNO FAR2228BB/NXT Processor Unit Keyboard with trackball
RADAR ARRAY (Qty 2)	FURUNO XN12CF/4 X-band, 4ft open array
NAVIGATION COMPUTER	Marinized DC computer, solid state drives Rose Point ECS Commercial Grade Navigation
SAT (GPS) COMPASS	FURUNO SC70
AUTOPILOT	FURUNO 711C
RDF	Rhotheta RT-500-M
AIS	FURUNO FA170 Dedicated GPS and VHF
ANEMOMETER	RM Young Ultrasonic
RADIO RECEIVER	FUSION, AM/FM, SiriusXM ready SIRIUSXM SCV3000 Receiver SIRIUSXM Low profile marine antenna Speakers (qty 4 pair)

424 DEPTH SOUNDER

A thru-hull transducer to measure depth/speed/water temperature will be mounted through the hull bottom. The transducer will communicate to the electronic navigation system (see Section 423)

421 COMPASS EQUIPMENT LIST	
Depth Transducer	Make: Airmar Model: DST800 (stainless)

435 FIRE DETECTION AND ALARM SYSTEM

The vessel will be fitted with a central fire detection and alarm system. While the alarm system will be fully independent, it will also announce to the Integrated bridge system (see Section 436)

All compartments with a detector will be equipped with a manual pull station near the primary exit and an overhead horn/strobe.

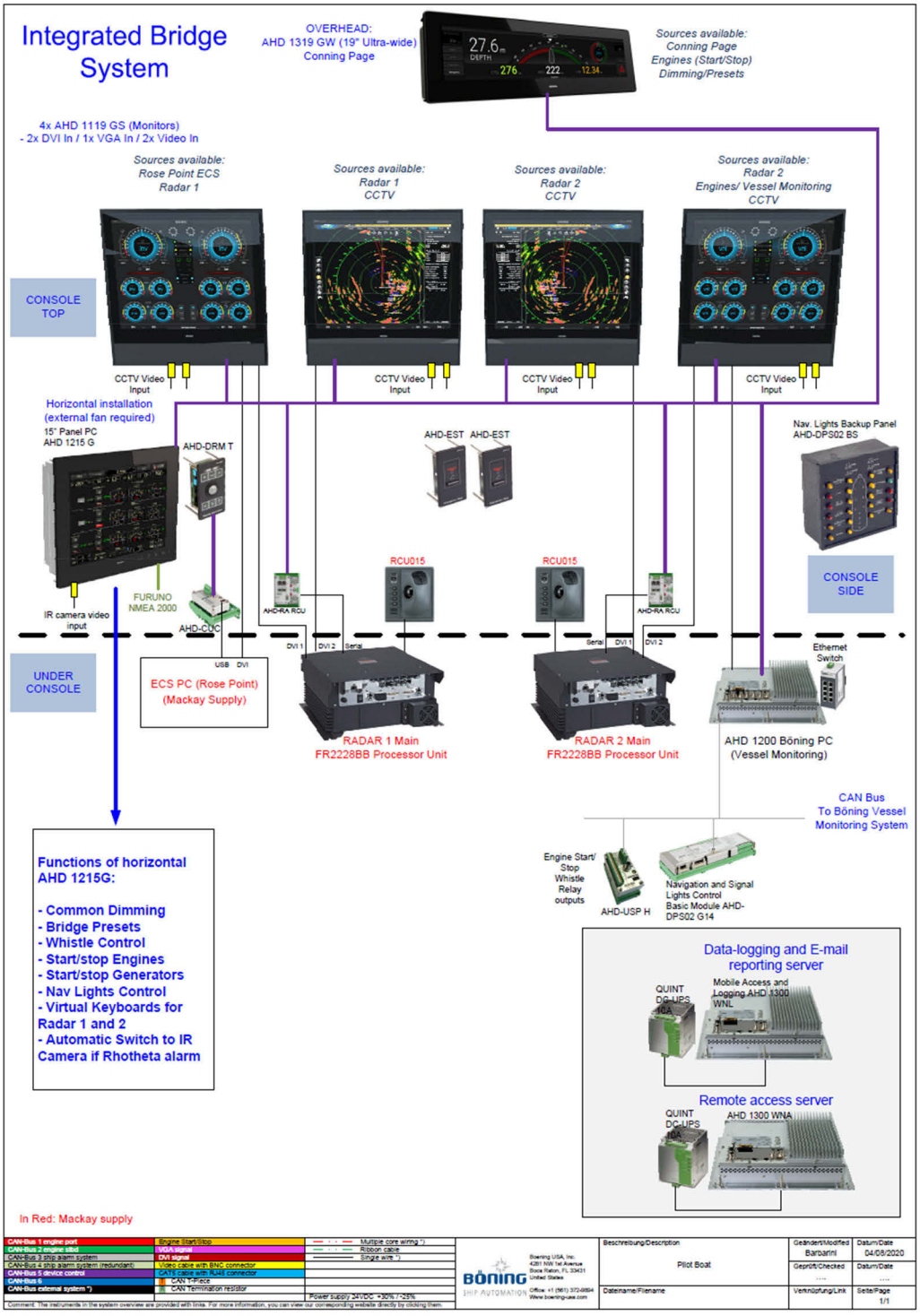
435 FIRE DETECTION AND ALARM SYSTEM EQUIPMENT LIST	
ALARM SYSTEM	Kidde Fire
WATERJET COMPARTMENT	Rate of Rise detector
ENGINE COMPARTMENT	2 x Rate of rise detector
HULL ACCOMMODATION	PhotoElectric detector
PILOTHOUSE	PhotoElectric detector

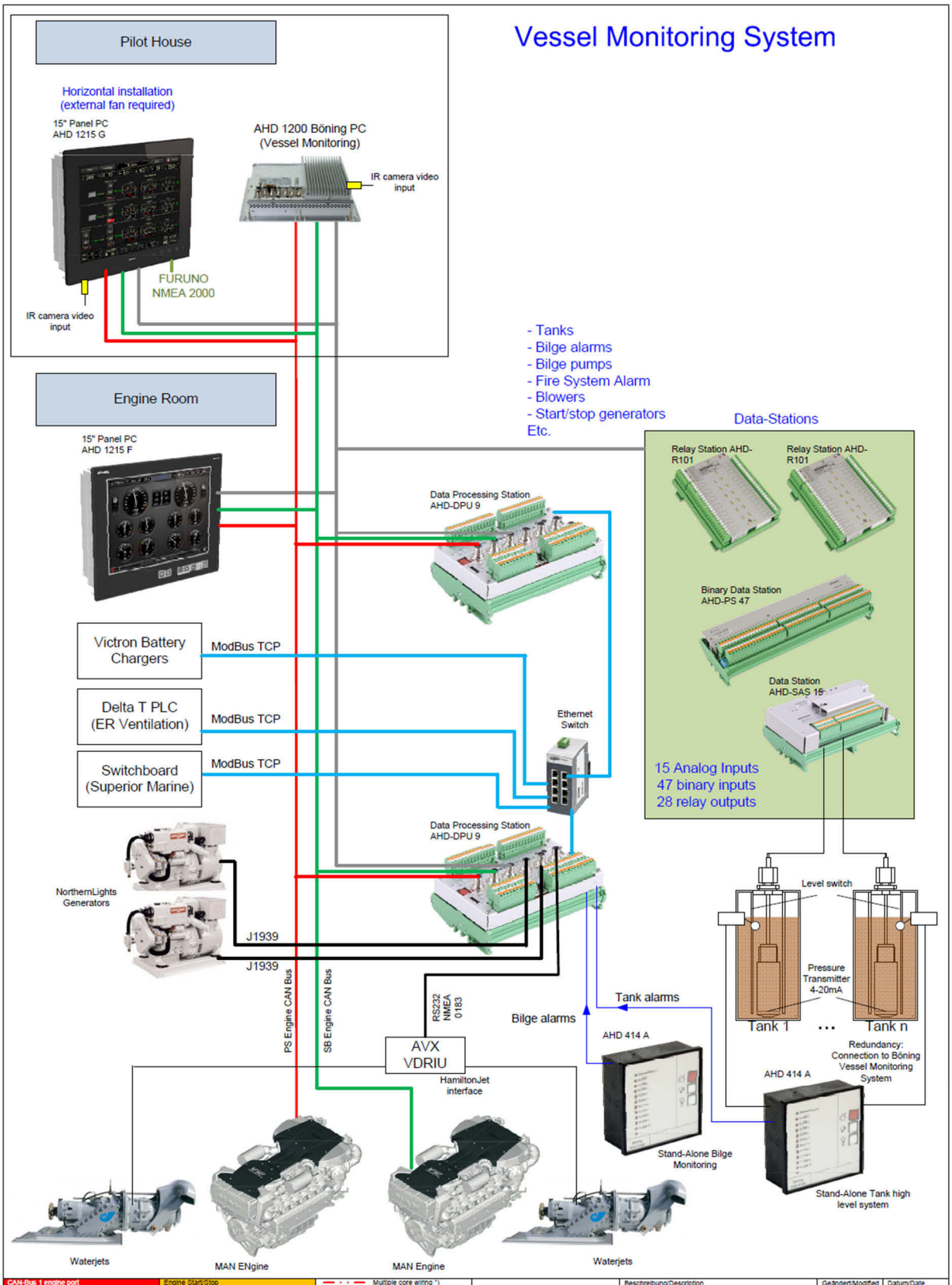
436 INTEGRATED BRIDGE ALARM, CONTROL AND MONITORING

The vessel will be fitted with a Boning integrated bridge control and monitoring. The Boning system will integrate with the following WBS, providing centralized control and monitoring.

WBS	ITEM INTERFACED / FUNCTIONALITY
126	Fuel tank level indication and hi/low alarm
167	Watertight door alarm
233	Propulsion engine Start-Stop, display and alarm monitoring
247	Waterjet alarm monitoring
256	DEF tank level indication and hi/low alarm
310	Generator engine Start-Stop, display and alarm monitoring Battery charger monitoring
320	DC power switching, display and monitoring
321	AC power switching, display and monitoring
332	Searchlight IR camera display
350	WIF sensor
423	Electronic navigation system display and control integration
422	Navigation light monitoring and control
435	Fire detection and alarm
443	Fog signal control
450	CCTV System display
513	Engine compartment ventilation monitoring and control
529	Bilge alarm monitoring
533	Potable water low level alarm
555	Engine compartment fire extinguishing system alarm monitoring

The following diagrams depict the system and interconnections are currently established and understood.


Integrated Bridge System
OVERHEAD:
AHD 1319 GW (19" Ultra-wide)
Conning Page
Sources available:
Conning Page
Engines (Start/Stop)
Dimming/Presets
4x AHD 1119 GS (Monitors)
- 2x DVI In / 1x VGA In / 2x Video In
Sources available:
Rose Point ECS
Radar 1
Sources available:
Radar 1
CCTV
Sources available:
Radar 2
CCTV
Sources available:
Radar 2
Engines/ Vessel Monitoring
CCTV
CONSOLE TOP
CCTV Video Input
CCTV Video Input
CCTV Video Input
CCTV Video Input
Horizontal installation
(external fan required)
15" Panel PC
AHD 1215 G
AHD-DRM T
AHD-EST
AHD-EST
Nav. Lights Backup Panel
AHD-DPS02 BS
CONSOLE SIDE
IR camera video input
FURUNO NMEA 2000
AHD-CUC
AHD-RA RCU
RCU015
RCU015
AHD-RA RCU
UNDER CONSOLE
ECS PC (Rose Point)
(Mackay Supply)
RADAR 1 Main
FR2228BB Processor Unit
RADAR 2 Main
FR2228BB Processor Unit
Ethernet Switch
AHD 1200 Böning PC
(Vessel Monitoring)
CAN Bus
To Böning Vessel
Monitoring System
Functions of horizontal AHD 1215G:
- Common Dimming
- Bridge Presets
- Whistle Control
- Start/stop Engines
- Start/stop Generators
- Nav Lights Control
- Virtual Keyboards for Radar 1 and 2
- Automatic Switch to IR Camera if Rhotheta alarm
Engine Start/ Stop Whistle Relay outputs
AHD-USP H
Navigation and Signal Lights Control Basic Module AHD-DPS02 G14
Data-logging and E-mail reporting server
QUINT DC-UPS 10A
Mobile Access and Logging AHD 1300 WNL
Remote access server
QUINT DC-UPS 10A
AHD 1300 WNA
In Red: Mackay supply
Pilot Boat


Vessel Monitoring System
Pilot House
Horizontal installation
(external fan required)
15" Panel PC
AHD 1215 G
AHD 1200 Böning PC
(Vessel Monitoring)
IR camera video input
FURUNO
NMEA 2000
IR camera video input
- Tanks
- Bilge alarms
- Bilge pumps
- Fire System Alarm
- Blowers
- Start/stop generators
Etc.
Data-Stations
Engine Room
15" Panel PC
AHD 1215 F
Relay Station AHD-R101
Relay Station AHD-R101
Data Processing Station AHD-DPU 9
Binary Data Station AHD-PS 47
Data Station AHD-SAS 15
Victron Battery Chargers
ModBus TCP
Delta T PLC (ER Ventilation)
ModBus TCP
Switchboard (Superior Marine)
ModBus TCP
Ethernet Switch
15 Analog Inputs
47 binary inputs
28 relay outputs
Data Processing Station AHD-DPU 9
NorthernLights Generators
J1939
J1939
PS Engine CAN Bus
SB Engine CAN Bus
RS232 NMEA 0183
AVX VDRIU
HamiltonJet interface
Level switch
Pressure Transmitter 4-20mA
Tank 1
Tank n
Redundancy: Connection to Böning Vessel Monitoring System
Tank alarms
Bilge alarms
AHD 414 A
AHD 414 A
Stand-Alone Bilge Monitoring
Stand-Alone Tank high level system
Waterjets
MAN ENgine
MAN Engine
Waterjets
CAN-Bus 1 engine port
CAN-Bus 2 engine stbd
CAN-Bus 3 ship alarm system
CAN-Bus 4 ship alarm system (redundant)
CAN-Bus 5 device control
CAN-Bus 6
CAN-Bus external system *)
Engine Start/Stop
DVI-I signal
DVI signal
Video cable with BNC connector
CAT5 cable with RJ45 connector
CAN T-Piece
CAN Termination resistor
Multiple core wiring *)
Ribbon cable
Single wire *)
*) Customer supply
*) Optional equipment
Power supply 24VDC +30% / -25%
Comment: The instruments in the system overview are provided with links. For more information, you can view our corresponding website directly by clicking them.
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Beschreibung/Description
Pilot Boat
Dateiname/Filename
Geändert/Modified
Barbarini
Datum/Date
04/08/2020
Geprüft/Checked
Datum/Date
Verknüpfung/Link
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440 EXTERIOR COMMUNICATION SYSTEMS

The vessel will be outfitted with the external communications systems per the below equipment list.

440 EXTERIOR COMMUNICATIONS EQUIPMENT LIST	
VHF #1	Furuno FM8900S Furuno RB8900 remote handset Remote Speaker in overhead
VHF #2	Furuno FM8900S Furuno RB8900 remote handset Remote Speaker in overhead
VHF #3	Furuno FM8900S Furuno RB8900 remote handset Remote Speaker in overhead
Hailer	Furuno LH5000 Exterior talkback horns fwd and aft
Boom Microphone	Shure
VHF Antenna	MORAD 6db gain hot rod, black
EPIRB	TBD, float free, mounted to aft house overhang Owner furnished; builder installed

Each VHF radio and the hailer will have the ability to transmit through the boom microphone by pressing a button at boom mike's base.

VHF antenna will be located on the mast. VHF antenna cables will be provided with service loops to allow replacement of faulty end connectors without replacing the entire length of cable.

EPIRB?

443 HORN

An air powered signaling horn / foghorn will be mounted to the superstructure top for a vessel less then 50M in length. The horn will be controlled by a horn control panel located on the console. The horn control panel will provide signaling options for fog.

The horn compressor will be in the fiddley / mast base.

The horn controller will integrate with the central control system. (see Section 436)

443 HORN EQUIPMENT LIST	
HORN	Make: Kahlenberg Model: S-330
COMPRESSOR	Make: Kahlenberg Model: P449-25
HORN CONTROL	Make: Kahlenberg Model: Signal Controller M-512

450 CCTV SYSTEM

The vessel will be equipped with CCTV system with interior and exterior cameras throughout the boat per the below schedule. Images will be displayed on the Integrated bridge system (see Section 436) displays.

450 CCTV SYSTEM LIST	
Waterjet Compartment	1, aft facing CL
Engine Compartment	1 fwd facing CL, 2 aft facing outboard
Aft Deck	1, aft facing
Port Side Deck	1 fwd facing, 1 aft facing
Stbd Side Deck	1 fwd facing, 1 aft facing
Boarding areas	1 port, 1 stbd

500 | AUXILIARY MECHANICAL

511 COMPARTMENT HEATING

Hull compartments and the pilothouse will be provided electric heat as described in the table below.

The waterjet compartment heater is intended to provide minimal temperature elevation to minimize condensation. The waterjet compartment heater will be connected to the shore power bus.

The engine compartment will be heated by radiant heat from the propulsion engine and generator engine block heaters. Engine block heaters will be connected to the shore power bus.

The hull accommodations compartment and the pilothouse will be heated from the HVAC system. Other compartments will not be heated.4

511 COMPARTMENT HEATING LIST	
WATERJET COMPARTMENT SPACE HEATER	Make: King Model: Pic-A-Watt Output: 1000 W
ENGINE COMPARTMENT	See Section 256 See Section 341
HULL ACCOMMODATIONS	See Section 514
FORWARD VOID	None
COLLISION VOID	None
PILOTHOUSE	See Section 514

512 COMPARTMENT VENTILATION - EXCEPT ENGINE COMPARTMENT

All hull compartments will be ventilated.

Compartments with non-powered ventilation will be fitted with two vent pipe connections, one connection will be deck connected with no interior tube, the other connection will have an internal tube led down to promote thermal circulation. All vent pipes will be of the inverted ball check type. Vents will be located near CL to further mitigate water ingestion. If possible, vent risers will be integrated into railing stanchions to minimize deck penetrations and clutter.

The hull accommodations compartment will be provided with natural inlet with a forced air exhaust. An exhaust fan will be in the head overhead to provide air exchanges. The head door will have a lower louver to allow air to pass.

The pilothouse will take air from the fiddley directly into one of the HVAC unit to provide heating, cooling and/or de-humidification of the makeup air as required. See Section 514. Pilothouse air will exhaust via a dedicated exhaust fan located in the aft bulkhead.

512 COMPARTMENT VENTILATION LIST	
WATERJET COMPARTMENT	Natural
ENGINE COMPARTMENT	See Section 513
HULL ACCOMMODATIONS COMPARTMENT	Exhaust Fan, 24 VDC
FORWARD VOID	Natural
COLLISION VOID	Natural
PILOTHOUSE	Exhaust Fan, 24 VDC

Sizing of ventilation fans for air exchanges will be based upon the following requirements.

512 DESIGN REQUIREMENTS	
HULL ACCOMMODATIONS COMPARTMENT FORCED AIR EXCHANGES	2 persons x 6 changes per hour
PILOTHOUSE HOUSE FORCE AIR EXCHANGES	14 persons x 6 changes per hour

513 HULL COMPARTMENT VENTILATION – ENGINE COMPARTMENT

The engine compartment will be ventilated with inlet supply fans that positively pressurize the space, providing combustion air to the propulsion engines and to the generator engines and allow for exhaust air and heat to naturally exhaust. The supply fans will be VFD controlled by a fan temperature controller.

Air inlets and air outlets will be fitted with water rejecting de-misters

Ducting at the engine compartment entry and exit will be fitted with automatic fire dampers.

513 ENGINE COMPARTMENT VENTILATION LIST	
DEMISTERS	Delta-T Systems
INLET FANS	Delta-T Systems 21 inch 3 HP 208 VAC, Frequency drive control
FIRE DAMPERS	Delta-T Systems
FAN CONTROLLER	Delta-T Systems T6

514 HEATING VENTILATION AND COOLING

The HVAC system will provide heated, cooled, de-humidified air to the pilothouse and hull accommodations space. The HVAC will be of the chilled water type, with the chiller(s) located within the engine compartment, serving air handler units located in the individual spaces.

The chillers will have a dedicated, independent raw water loop that will circulate sea water from a sea chest, through the chiller and discharge overboard. Sea water piping will be per Section 256.

The chillers will have a chilled water loop that will circulate water/glycol mixture to the air handlers and back. Chilled water piping will be insulated. Chilled water piping to the pilothouse will have a double valve arrangement with a removable hose section to allow closing of the system and removal of the pilothouse with minimal chilled water loss. Chilled water piping will be fitted with air bleaders at all high spots. Chilled water disconnect for house removal will be accomplished by two isolation valves with a short removable jumper hose between. To remove the house, the isolation valves will be closed, and the house jumper removed. Re-installation will introduce a small amount of air into the system and must be bled.

HVAC chiller(s), raw water pump(s) and chilled water pump(s) will be powered from a localized HVAC power panel located in proximity to the chillers and pumps in the engine compartment.

All air handlers will be fitted with condensate drip pans. The drains for the drip pans will be aft to allow draining while underway with bow up running trim. Air handlers in the pilothouse will drain onto the main deck. The air handler in the accommodates space will drain into the sink sump (see Section 593)

The pilothouse will be divided into two zones. A pair of air handlers will provide air to above the pilot seats in one zone. Air from these units will be distributed in linear slow drop registers to minimize air velocity and cold “spikes”. A third air handler will provide air the above the helm / navigator seats in a second zone.

The hull accommodations compartment will be provided air to a centralized overhead duct by a single air handler.

515 WINDOW DEFROST

The forward-facing windows and the forward most side windows in the pilothouse will be installed with force hot air defrosters. A single VFD will control all three fan motors which will supply forced air, heated via inline duct heaters, delivered to each window via directional slots below each window.

The side windows in the pilothouse will be installed with forced hot air defrosters. A single VFD will control both fam motors which will supply forced air, heated via inline duct heaters, delivered to each window via directional slots below each window.

All window defrost will be controlled from the console. Defrost heaters will be thermostatically controlled and interlocked to their respective fans.

515 WINDOW DEFROST EQUIPMENT LIST	
FORWARD WINDOW FANS (QTY 3)	208VAC, 1 ½ HP
FORWARD WINDOW HEATER (QTY 3)	2kW
SIDE WINDOW FANS (QTY 2)	208VAC, 1 ½ HP
SIDE WINDOW HEATERS (QTY 2)	2kW

521 FIRE MAIN

The vessel will be fitted with a general service / fire pump. The general service / fire pump will take suction from either a suction box located within the engine compartment for dewatering or from a dedicated sea chest. Pump discharge will be either to an overboard discharge or to the fire hydrant on the aft deck.

The pump motor will have both local start/stop and remote start/stop from the console.

The fire hose will be stored in an FRP box.

521 FIRE MAIN EQUIPMENT LIST	
Fire / General Service Pump	TBD Self-priming 208VAC
Fire Hose	1 ½" 50' fire hose

Seawater piping for the fire main system will be per the below schedule.

521 SEAWATER PIPING MATERIAL SCHEDULE	
SHELL TO ISOLATION VALVE PIPING	Piping: 5086 Sch80 Flanges: ANSI B16.5 Class 150, flat or raised face Propress
ISOLATION VALVE	Bronze, full port ball, flanged
SUCTION PIPING	Piping: ASTM B466 90/10 CuNi Class 200 Flanges: ANSI B16.5 Class 150, flat or raised faced
OVERBOARD FLANGE TO SHELL PIPING	Piping: 5086 Sch80 Flanges: ANSI B16.5 Class 150, flat or raised face
DISCHARGE PIPING	Piping: ASTM B466 90/10 CuNi Class 200 Flanges: ANSI B16.5 Class 150, flat or raised faced Hose: USCG w/barb or weld bead, 2x 316 stainless clamps
FLEXIBLE CONNECTION	Flanged Bellows

The fire pump will be selected to meet the following requirements.

521 DESIGN REQUIREMENTS	
Pump sizing	50 gpm at 60 psi at the pump outlet

526 SCUPPERS AND DECK DRAIN

The superstructure top is not fitted with deck drains. The after end of the roof panels will have a flat bar upstand to prevent rain/sea water from dripping off the aft edge of the pilothouse overhang.

The main deck is cambered and completely self-bailing without bulwarks. The main deck does not have deck drains. The recesses for the deck matting will drain over the sheer.

529 BILGE SYSTEM

All hull compartments, with the exception of the collision void, will be fitted with dedicated, submersible DC bilge pump(s).

Bilge pumps in the hull accommodations and forward void with automatic bilge switches located below the level of the bilge alarm.

If the bilge pumps located such that the screen of the pump is out of reach, the pump will be mounted to a bolted riser to allow temporary lifting of the pump to within reach without disconnecting the system.

The bilge control panel will be located off the main DC panel in the hull. The bilge panel will allow switching from automatic to manual in addition to bilge pump run indication. Bilge alarms will be connected to the integrated bridge system (see Section 436)

Bilge discharge hoses will be routed as high as possible in the space with a high loop that is downward sloped to the bilge discharge below the fender strake / topside seam.

529 EQUIPMENT LIST	
BILGE PUMPS • WATERJET COMPARTMENT (1) • ENGINE COMPARTMENT (2) • HULL ACCOMMODATIONS COMPARTMENT (1) • FORWARD VOID (1) • COLLISION VOID (NONE)	Rule 24VDC
MANUAL BILGE PUMP	Whale Gusher 30 mounted on foot board 25 ft 1.5” suction hose 25 ft 1.5” discharge hose

Bilge will be per the below schedule. Piping will be primarily tube with flexible hose lengths and connections minimized.

529 BILGE SYSTEM PIPING MATERIAL SCHEDULE	
HOSE	TBD
PIPING	Piping: 5086 Sch80 Flanges: ANSI B16.5 Class 150, flat or raised face
VALVES	Swing Check: TBD

The bilge system will be sized to the following design requirements:

529 DESIGN REQUIREMENTS	
Bilge pump and discharge size	IACS High speed craft

533 POTABLE WATER SYSTEM

A potable freshwater system will supply hot and cold water to the galley sink faucet and head sink faucet. An expansion tank (accumulator) will be fitted after the pump discharge.

An inline water filter will be installed in the cold-water service to the galley faucet.

Potable water will be stored in a polyethylene water tank. Only the tank top will be penetrated for tank connections. Tank fill will be atop the cuddy roof and the tank vent will be in the cuddy side,

The water tank will not be fitted with tank level indication but will be fitted with a low-level alarm connected to the integrated bridge monitoring system (see Section 436)

533 EQUIPMENT LIST	
PRESSURE PUMP	Jabsco Par-Max 6 gpm 24 VDC
WATER FILTER	3M Aqua Pure Under Sink
WATER HEATER	Raritan 1700 series 6 gal 120 VAC

Piping for the potable water system will be per the below schedule. Piping will be primarily tube with flexible hose lengths and connections minimized.

533 POTABLE WATER SYSTEM PIPING MATERIAL SCHEDULE	
HOSE	PVC
TUBE	PEX
VALVES AND FITTINGS	All: Brass, NSF approved for potable water

555 FIRE EXTINGUISHING SYSTEM

The engine compartment will be outfitted with a manual marine fixed gas fire suppression system. The fire system will consist of an agent cylinder plumbed to two overhead discharge nozzles located within the engine compartment

Activation of the fire system will trigger a 30 second delay with siren via a nitrogen pilot bottle.

Activation of the fire system will be by manual pull boxes adjacent to the watertight doors in the adjacent spaces.

Activation of the fire system will shut down the propulsion engines, generator engines and engine compartment ventilation system.

555 FIRE EXTINGUISHING EQUIPMENT LIST	
Engineered fixed fire extinguishing system	Alexander Gow Fire Equipment – Kiddie Fire Systems.
Fire Agent	FM-200

556 HYDRAULIC SYSTEM

The rescue basket will be articulated by hydraulic power, provided by a hydraulic power pack. The hydraulic power pack will be configured with two (one redundant) variable displacement load sensing pumps.

A power on switch with run indication, stop switch and E-Stop switch will be located on the aft console. Rescue basket articulation will be via momentary up and momentary down buttons located on the aft console.

The system will be plumbed with an emergency manual valve located in the waterjet compartment that will allow the basket (rams) to freely move without hydraulic pressure, in case of total hydraulic failure in the down position.

System plumbing will be primarily in tube, with hose used where articulation requires flexibility.

556 HYDRAULIC SYSTEM EQUIPMENT LIST	
Hydraulic power pack	Parker V-pack 5 HP 208 VAC
Hydraulic Cylinders	TBD 316 stainless

Piping for the hydraulic system will be per the below schedule.

565 HYDRAULIC SYSTEM PIPING MATERIAL SCHEDULE	
HOSE	Parker 451TC JIC 37° flare or NPT, 316 stainless
TUBE	316 stainless tube Swagelok or Equal, 316 stainless

The hydraulic system will be sized to meet the stern rescue platform requirements.

565 TRIM AND RIDE CONTROL SYSTEM

Adjustable interceptors will be equipped on the transom to provide both trim and ride control. Interceptor controls will be located on the console.

565 TRIM AND RIDE CONTROL EQUIPMENT LIST	
INTERCEPTORS	Make: Humphrees Model: TBD by Humphrees during design phase Size: TBD by Humphrees during design phase
CONTROL SYSTEM	Make: Humphrees: Package: Active+ • Auto Trim • Auto List • Coordinated Turn • Roll and Pitch Stabilization

573 MOB RESCUE BASKET

An articulating MOB rescue platform will be installed on the transom of the vessel to provide man overboard recovery. The MOB rescue basket will be controlled from the aft control station (see Section 556).

The basket frame and arm will be fabricated of aluminum. The basket will be woven netting.

A pair of cam-locking detents will secure the basket in the up position. The hydraulic force will be sufficient to overcome and release the detents to lower the basket.

The rescue basket to the following design requirements:

557 DESIGN REQUIREMENTS	
Weight of MOB	350 lbs
Lower Time	12 seconds or less (to be compared to prior designs and adjusted accordingly)
Raise Time, loaded, vessel at rest	12 seconds or less (to be compared to prior designs and adjusted accordingly)
Raise empty @ speed	5 knots in reverse

581 ANCHORING

An emergency anchor and rode will be provided. The anchor will be stored on the cuddy roof and secured by quick release pins. The anchor is intended to be used only in an emergency and no means of anchor recovery is provided. It is intended that the anchor line will be tied off to one of the two bow bollards.

The bitter end of the anchor rode will be secured to the boat's internal structure. The anchor rode will be stored loose flaked in a polyethylene tank with the end cut off, within the collision void. The anchor rode will run through a spurling pipe that penetrates the deck within one of the bow railing "hoops" and attached to an eye bolt secured through the spurling pipe cam lock end.

581 ANCHORING EQUIPMENT LIST	
ANCHOR	Fortress FX-85
Rode	1" Nylon brait, 250 ft ½" proof coil galvanize chain, 65 ft (~1 boat length)
Hardware	316 stainless

582 MOORING

Bow, midship and stern mooring bitts will be installed on each side of the vessel. The mooring bitts will be fabricated of welded aluminum pipe and consist of a single vertical bollard, cross bar, and top cap. Cross bars will extend 6-inches from each side and have rounded ends. The top cap will overhang the bollard pipe and have a bull nose rounded over edge.

The bow bitts will be set inboard and under the bow railings. The midship bitts will be recessed in the house cuddy sides. The aft bitts will be located on the aft stern corners but set in from the sheer such that contact between the bitt top and an alongside vessel is not possible.

583 LIFE SAVING

The below list of rescue and lifesaving equipment will be installed on the vessel.

The MOD marker pylon will be deployed via a remote switch located at the helm station.

Life raft cradles will be provided for Owner supplied Subscription life raft service.

583 LIFE SAVING EQUIPMENT LIST	
Personal Floatation Devices x 14	Mustang 4-0ne or similar USCG Type I, with personal light and whistle
Type IV Ring Buoy x4 (bow rail, house side p/s, aft console)	LSS 244 or similar 24 inch Reflective markings
MOB marker light x3 (house side p/s, aft console)	LSS 314 or similar With tether and clip
Rescue Throw Bag x2 (aft rails p/s)	LSS 237-P or similar
MOB marker pylon (transom)	Switlik MOM 8-A
Boat hook x2 (house side p/s)	TBD
Life Rafts (aft console p/s)	Cradle only provided for OWNER furnished rafts

593 MARINE SANITATION

The vessel head will be fitted with a marine toilet that will be plumed to a marine MSD system. The toilet will be fresh water flushed.

Sink drains will be plumbed to a sump collection box with automatic float switch and discharge bilge pump. Discharge hose will be per Section 529.

593 MARINE SANITATION EQUIPMENT LIST	
Toilet	Headhunter Royal Flush Commercial
MSD	Red Fox Environmental Services Fox Pac Marine Sanitation Device MSD Type II RF 50-FP-FG 50 gallons per day, fiberglass or aluminum housing
SINK SUMPS	Rule, 98-24

600 | OUTFIT

602 HULL MARKINGS

All hull and house markings s (see Section 603) will be painted. See Section 631 for paint specification.

The vessel will be marked as per the table below.

602 HULL MARKING LIST	
VESSEL NAME	Hull sides, bow (p/s) below fender Black with white boarder
PILOT	House side (p/s) Cuddy top Orange with black border
VESSEL NAME SAN FRANCISCO	Transom Black with white border

603 DRAFT MARKS

Forward and aft draft marks will be welded to the bow and stern port and stbd side. Draft marks will be 6 inches in height and 0.190” thick.

Draft marks will be painted a contrasting color to the hull / topsides.

612 RAILINGS

The vessel will be fitted with both handrails and a safety rail system as depicted on the General Arrangement drawing. The handrails will consist of fabricated aluminum pipe and will be continuous for each section of railing. Handrails will have grip clearance along their entire length and handrail to stanchion attachment will not require releasing of the hand to pass by.

Hadrian Marine Safety Rail System will run beneath the handrails. Safety Rails will be equipped with roller harness carriages or CARS per below list.

612 RAILING SAFETY TETHER CAR LIST	
PILOTHOUSE PERIMETER SAFETY CARS	4 total, stored 2 port aft, 2 stbd aft
AFT CONSOLE PERIMETER SAFETY CARS	2 cars
FWD RAIL SAFETY CARS	1 car port, 1 car stbd

The transom on main deck will be fitted with a single course rail with a span approximately the length of the rescue basket. This rail will not be fitted with a Hadrian system.

The interior of the vessel will be fitted with handrails as required for safe navigation throughout the vessel in a seaway.

622 FLOOR PLATES

The Waterjet Compartment, Engine Compartment and Void Compartment will have aluminum diamond tread floor plates. Floor plates will have upturned edges. Floorplates will be bolted, if access for routine maintenance is required, floorplates in the area will be hinged.

623 LADDERS AND STAIRS

Access from the aft main deck to the superstructure top will be via a fabricated aluminum pipe ladder. Compartment ladders will be fabricated of aluminum pipe / tube. Ladder rungs will be fitted with 3M safety walk tape.

Two SFBP specified ladders will be stored on the main deck, attached to the superstructure top ladder. Ladder #1 is 12'-4" long and ladder #2 is 7'-7" long. The ladders will have similar spacing and width as the house top ladder such that as lashed together, they can still be climbed.

625 WINDOWS

Pilot house windows will be of the bonded. Adhesive will follow manufactures requirements for UV protection. If required interior fritting will be applied to the inner glass surface to protect the window adhesive per the adhesive manufacturer's recommendations. Pilothouse windows will be recess set into the house side such that the outer window surface and outer house surface are flush. Overhead windows will be recess set into the house top such that the outer window surface and the outer roof surface are flush.

625 WINDOW EQUIPMENT LIST	
FORWARD WINDSHIELD	Non-tinted, heated
FORWARD SIDE WINDOWS	Non-tinted, heated
MID SIDE WINDOWS	Tinted
AFT SIDE WINDOWS	Tinted
AFT WINDOWS	Tinted
OVERHEAD	Tinted

Windows will be monolithic glass. Where windows are fitted with heating elements an additional bonded glass layer for distortion control, only the primary window will be structurally considered.

625 DESIGN REQUIREMENTS	
WINDOW STRENGTH	Based upon minimum of IACS rules

All pilothouse non-tinted windows will be fitted with solar shades, with the exception of the overhead windows which will be fitted with removable covers

626 WINDOW WIPERS AND WASH SYSTEM

The forward windshields and forward most side windows will be fitted with wipers. Wiper arm and blade size will be arranged to maximize wiper coverage area. Forward windshield will have Pantograph arms. Side windows will have radial arms. Wiper motors and wash fittings will be mounted through aluminum shell below the windows.

Wiper wash water will be provided via the freshwater system (See Section 533). Each wiper arm will have a dedicated solenoid valve.

626 WIPER AND WASH EQUIPMENT LIST	
WIPERS	Make: Exalto HD2
WIPER CONTROL	Exalto Wiper Control-5

631 PAINTING

The vessel will be painted by a paint sub-contractor to the following paint specification:

631 PAINT SCHEDULE	
HULL BOTTOM	Intersleek 1100 system Color: Black TBD
HULL SIDES	Awl Grip 545 / Topcoat Color: International Orange
MAIN DECK	Awl Grip 545 / Topcoat Non-skid additive with drain paths Color: Grey TBD
SUPER STRUCTURE SIDES	Awl Grip 545 / Topcoat Color: Snow White
SUPER STRUCTURE TOPS	Awl Grip 545 / Topcoat Color: International Orange Non-skid additive on walking surfaces
MAST	Awl Grip 545 / Topcoat Color: Super Jet Black
RAILINGS	Awl Grip 545 / Topcoat Color: Snow White
RESCUE BASKET AND STERN GUARD	Awl Grip 545 / Topcoat Color: Snow White
MOORING BITTS	Awl Grip 545 / Topcoat Color: Snow White
FAYING SURFACES • Behind Fender • Sea valve flange faces • Exhaust hose	Awl Grip 545 Epoxy Primer
WATERJETS	TBD

The surfaces within the void between the superstructure and hull, including the hull soft patch will not be painted.

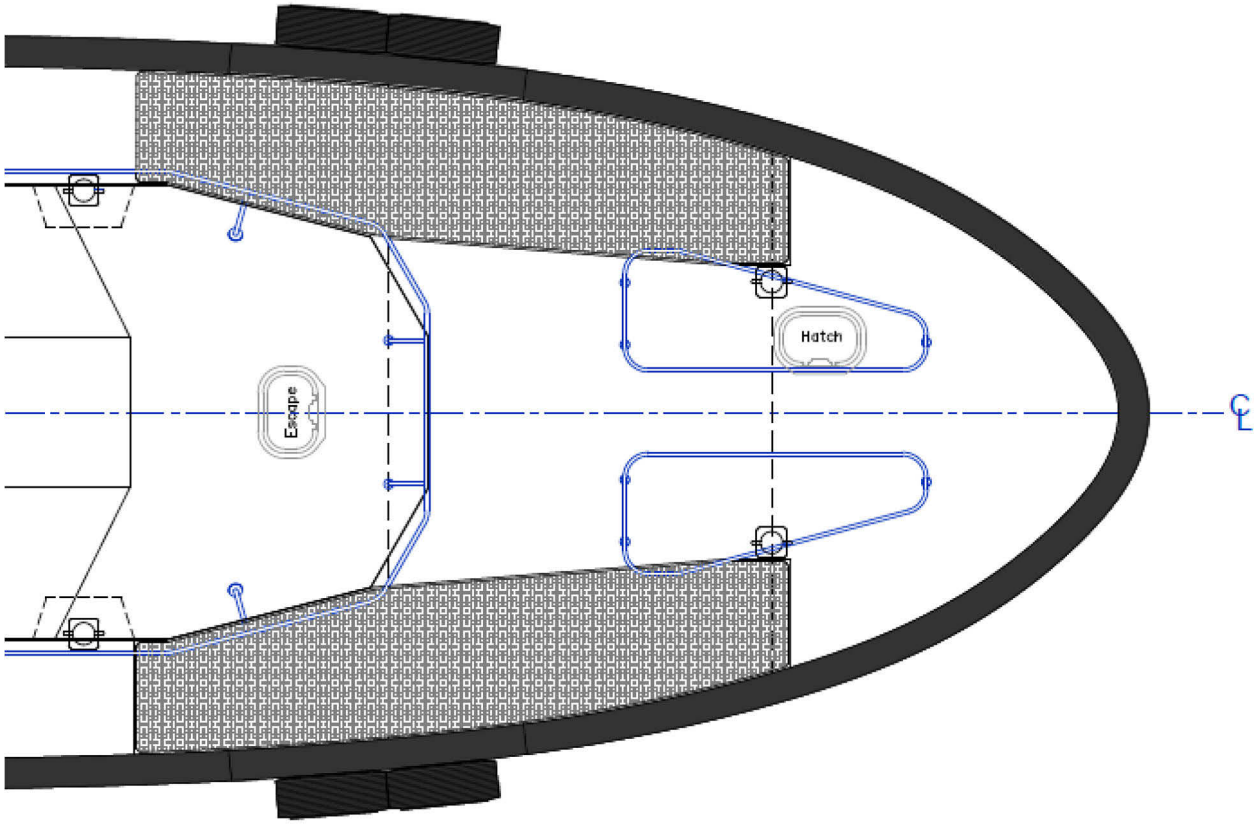
633 CATHODIC PROTECTION

The hull will be fitted with pockets for flush mounted hull anodes. The transom will be fitted with non-flush mounted anodes. Hull anode size and location will be determined during the detailed design process.

Seachests will be fitted with pencil anodes.

634 EXTERIOR DECK COVERINGS

The main deck area in way of the boarding area will be covered with deck matting per the following schedule and area diagram. Deck matting will be recessed into the deck such that the top of the rubber mat and the nominal deck top are at the same level.



634 DECK COVERING SCHEDULE	
PILOT BOARDING AREAS	Crown SafeWalk or San-Eze No Trak 7/8” rubber food service mat

635 INSULATION

Unless indicated otherwise, insulation will be glass mineral wool, density and thickness per the below schedule. Insulation will wrap around stiffeners and frames/girders. Hull side insulation will extend from the overhead and terminate at the lowest longitudinal stiffener above the lower chine flat to prevent wicking. Insulation will be taped and pinned.

635 INSULATION SCHEDULE	
Hull Insulation	Isover Ultimate U SeaProtect Thickness: 30,50,70 mm Density: 24,36,56,66 kg/m³ Facing: per below
ENGINE COMPARTMENT OVERHEAD	Facing: alum foil/glass cloth
ENGINE COMPARTMENT SIDES AND BULKHEAD	Facing: alum foil/glass cloth
HULL ACCOMMODATIONS COMPARTMENT OVERHEAD	Facing: alum foil/glass cloth
HULL ACCOMMODATIONS COMPARTMENT JOINER EXTERIOR PARTITIONS	Facing: glass cloth
PILOTHOUSE OVERHEAD	Facing: alum foil/glass cloth
PILOTHOUSE SIDES AND ENDS	Facing: alum foil/glass cloth
PILOTHOUSE UNDERSIDE	Facing: alum foil/glass cloth

635 DESIGN REQUIREMENTS	
Thickness and density	Thickness and density to be sized to match performance on past Pilot boat projects.

640 INTERIOR OUTFIT

The pilothouse and hull accommodation spaces use an Ayers or equal aluminum skinned, aluminum honeycomb panel joiner system. Panels will be vinyl covered, color TBD. Panels will be finished with brushed aluminum trim. Where possible panels will be mounted with blind fasteners.

Interior aluminum railings and aluminum console/radio bar will be powder coated, color.

Wood and wood trim will not be used in the interior.

Structural members neither covered by the joiner system nor powder coated will be wrapped in foam and covered with sewn edge Naugahyde covering.

Flooring throughout the interior will be per the below schedule.

640 INTERIOR FLOORING SCHEDULE	
PILOT HOUSE	Roppe raised circle profile or similar Color: Dark Grey
STAIRWAY	Aluminum treads, 3M safety walk
HULL ACCOMMODATIONS MAIN AREA	Identical to pilothouse
HEAD	Identical to pilothouse

650 EXTERIOR OUTFIT

Welded “U’s” will be positioned above the forward side windows port and starboard. Clamp on style bus/truck mirrors will be attached to the provide the helmsperson with a view of the side decks looking aft.

660 SEATING

Fixed marine seating will be provided per the equipment list below. Pilot seats to be

660 SEATING EQUIPMENT LIST	
HELM SEAT	Make: Imtra Model: NorSap 1600 Adjustable linear base
NAVIGATOR SEAT	Make: Imtra Model: NorSap 1600
PILOT SEATS (12)	Make: UES Model: Luxform Journey