24065-002-832-1
Electronics Specification

Specification Addendum developed for the Alaska Department of Public Safety (DPS), Division of Alaska Wildlife Troopers (AWT).

11-2-2026

24065-002-832-1 Electronics Specification
Navigation and Communications Equipment Technical Specification

1. Purpose

The Department of Public Safety (DPS), Division of Alaska Wildlife Troopers (AWT) is working with Elliott Bay Design Group (EBDG) for design, engineering, and project management services related to efforts to replace a large class vessel utilized to provide resource protection and public safety services primarily on the inside and outside ocean waters of Southeast Alaska.

The vessel will be a steel construction, single displacement hull patrol vessel of less than 95-feet in length and no more than a 27-foot beam. This vessel must be capable of stowing up to two patrol skiffs aboard the main exterior deck or elsewhere onboard; have the capacity to launch and retrieve crab fishing pots, skiffs, and other apparatus to and from the vessel deck; be equipped with a proven diesel or hybrid powered propulsion system; and be able to support 24/7 public safety operations up to seven crew members to include berthing, hygiene, interior workspace, and galley accommodations for extended patrols.

This section supplements selected portions of Section 400-Command and Monitoring of EBDG Specification 24065-200-832-0. This addendum was prepared in consultation with the Alaska Department of Public Safety, Division of Alaska Wildlife Troopers (DPS/AWT), hereinafter referred to as “Owner” and Elliott Bay Design Group (EBDG).

This is intended to provide clarity regarding the equipment selection and performance expectations to ensure the vessel can meet its operational objectives while promoting long-term cost effectiveness. The guidance herein is not intended to discourage alternative equipment, configurations, or technical approaches that may better serve the Owner’s intended needs. Suppliers and design professionals are encouraged to identify and discuss potential improvements or alternatives with the Owner for consideration and approval.

The suggested technical representative is:

> Mr. David Pratt, President, OptimERA Marine, Seattle, WA, (206)-776-3456, marine.service@optimerainc.com

In the event of a conflict between this specification and applicable laws, regulations, or other mandated standards, the applicable legal or regulatory requirements shall take precedence. In the event of a conflict between this addendum and corresponding provisions of EBDG Specification 24065-200-832-0, the discrepancy shall be referred to the Owner and EBDG for clarification prior to implementation.

2. Pre-Installation
   2.1. System Drawings
      2.1.1. The supplier shall provide preliminary system drawings showing all powered components, circuit identifiers and cable types.
      2.1.2. Drawings shall be supplied in AutoCAD and PDF formats.
      2.1.3. Drawing set shall include basic block diagrams and will include installation details for each system installed. These details shall include:
   2.2. Console Mockup
      2.2.1. Console supplier is to arrange and coordinate for a 1:1 console mockup arrangement to aid owner in decisions on placement of components and displays.
      2.2.2. Electronics integrator is expected to support this effort by providing sizing and mounting requirements for each component being integrated on top of and within the console.
3. Installation and Commissioning
   3.1. System Documentation
      3.1.1. The supplier shall provide any and all publicly available installation and operations manuals for systems provided.
      3.1.2. Documents shall be provided in PDF format and where practical, paper.
   3.2. All newly installed cables should have a label attached at each end, indicating start and end points OR a circuit designator relating to provided drawings. The following exceptions apply:
      3.2.1. Local or factory provided cables of less than 15 feet, such as mice and keyboards plugged into a Processor will not need to be labelled.
      3.2.2. Existing cables that are reused for installation of new equipment do not have to have labels on both ends (these should incorporate a label on the "new" end).
   3.3. The supplier shall provide start-up and commissioning service of all systems listed in this specification.
      3.3.1. Each radar shall be calibrated by a technician holding an FCC License that carries a Radar Endorsement.
      3.3.2. Communications to be tested in accordance with the FCC Bridge to Bridge Inspection Checklist by a technician holding a suitable FCC license. Checklist can be found here: https://www.fcc.gov/sites/default/files/bridge2bridgeinsp_new.pdf
         3.3.2.1. FCC Form 827 (Vessel Bridge to Bridge Radiotelephony Certificate) to be issued with a 5-year expiry.
   3.4. Training and Sea Trials
      3.4.1. The supplier shall provide up to one day of dockside testing and training for the crew.

3.4.2. The supplier shall provide up to one day of sea trials for calibration, testing, and crew training on the final electronics suite. In particular, the following systems shall have offsets, settings, and calibration results annotated and provided to the vessel.

3.4.3. Final “As-Built” drawings to be provided within 6 weeks of sea trials.

Section 400

400. Command and Monitoring

400.1. The Navigation and Electronics Systems shall consist of the following:

400.2. Introduction

400.2.1. This section describes requirements for the vessel’s command and monitoring systems. The Contractor shall provide a system of command, communication, control, and navigation electronics and equipment which is complete and functional in all respects. Components which are not explicitly identified in this specification, but which would typically be required for a complete system shall be provided as part of the Contract. See section 638.8 of Specification 24065-200-832-0 for description of Pilot House console cabinetry.

401. Navigation Equipment covered in EBDG Specification 24065-200-832-0

402. Navigation Lights covered in EBDG Specification 24065-200-832-0

403. Searchlight

403.1. One The Carlisle & Finch Co. 12LNH-DE-1IR-ANCH1 or equal to be installed.

403.1.1. The search light shall feature LED light sources, 12-inch diameter, anti-icing heater, 3.5-degree beam optics, an infrared pod, and auxiliary wide beam flood light modules. Main beam light output shall be 3.5 million candle power. The housing shall be powder coated.

403.1.2. Three (3) electronic joysticks at port, starboard, and center helm station. The modules allow control of main and wide-beam light sources, as well as pan and tilt aiming. Mount the control modules in Owner approved locations at the helm stations.

403.1.3. An anti-icing thermostatically controlled heater shall be included to prevent ice build-up from affecting the motorized base in cold climates.

403.1.4. Supply the searchlight system with 120V AC. Provide power supplies, controllers, wiring components, cabling, and other hardware to create a complete and functional system. Mount the searchlight on a steel pedestal at least 12 inches tall on the Pilot House roof. The pedestal shall feature a mounting flange so that searchlight mounting bolts do not penetrate to the vessel interior.

404. Navigation electronics

404.1. General Requirements

404.1.1. All navigation, communication, monitoring, and electronic equipment included in this section shall be installed in accordance with the manufacturer's installation requirements and applicable requirements of 46 CFR Subchapter T, 33 CFR Parts 26, 83 and 164, 47 CFR Part 80, SOLAS Chapter V, and other applicable USCG, SOLAS Chapter, and FCC requirements.

404.1.2. All equipment should be of commercial and/or marine quality, where available and appropriate.

404.1.3. The supplier shall obtain AWT's prior approval of any “equivalently” selected equipment.

404.1.4. All graphics displays provided for Navigation Electronics in the following sections shall meet the following minimum requirements (unless factory provided as part of a commercially packaged system):

404.1.4.1. Displays must be sufficient size for performance of functions and be compatible with space availability and ergonomic viewing.

404.1.4.2. Displays shall incorporate Quarter-Wave Plate (QWP) technology or an equivalent solution to maintain screen visibility when viewed through polarized eyewear, regardless of eyewear orientation (anti-blackout).

404.1.4.3. Displays should be mounted using a suitable marine rated system to ensure displays stay rigid. This can include factory-provided brackets or another VESA compatible rigid mounting system.

404.1.4.4. Interface selection shall consider compatibility with connected equipment, supported resolution, cable length, and signal integrity. The preferred video interface types, in descending order of preference, shall be:

404.1.4.4.1. 1. HDMI

404.1.4.4.2. 2. DVI

404.1.4.4.3. 3. VGA

404.1.4.4.4. 4. Others

404.1.5. Unless impractical, all displays and common components in a given system should be fed from same power source (i.e. do not feed Processor from one UPS and related display from a different one)

404.1.6. Where manufacturers’ installation requirements exceed regulatory requirements, the more stringent requirement shall apply unless otherwise approved by the Owner, provided that such approval does not result in noncompliance with applicable regulations.

404.1.6.1. Due to space available, strict adherence to all manufacturer-recommended separation distances and placement guidelines for RF antennas and other top-side electronic equipment is unlikely. The Supplier shall coordinate with the Owner to evaluate installation constraints, minimize electromagnetic interference, and optimize equipment performance.

404.1.6.2. The Supplier shall identify and document anticipated deviations from manufacturer installation requirements and recommendations, including potential interference concerns and proposed mitigation measures. A list of these deviations and limitations shall be submitted to the Owner for review and approval prior to fabrication of the topside support structures.

404.1.7. Pre-Installation

404.1.7.1. System Drawings

404.1.7.1.1. The supplier shall provide preliminary system drawings showing all powered components, circuit identifiers and interconnections.

404.1.7.1.2. Drawings shall be supplied in AutoCAD and PDF formats.

404.1.7.1.3. Drawing set shall include basic block diagrams and will include installation details for each component installed. These details shall include:

404.1.7.1.3.1. Make/Model/Unique ID

404.1.7.1.3.2. Component location

404.1.7.1.3.3. Power input requirements should be indicated by starting at the recommended circuit protection.

404.1.7.1.3.4. Interconnecting cable details should include manufacturer (or generic), part number, manufacturer designator (where applicable), or conductors and gauge requirements where relevant.

404.1.7.1.3.5. Enclosures, terminal strips, and buses that are not powered should be identified and shown.

404.1.7.1.3.6. Where cabling has limitations on length or routing, such as factory-provided cables with modular plugs, available options showing alternate and/or maximum lengths should be included.

404.1.7.2. Console Mockup

404.1.7.2.1. Console supplier is to arrange and coordinate for a 1:1 console mockup arrangement to aid owner in decisions on placement of components and displays.

404.1.7.2.2. Electronics integrator is expected to support this effort by providing sizing and mounting requirements for each component being integrated on top of and within the console.

404.1.7.3. Installation and Commissioning

404.1.7.3.1. System Documentation

404.1.7.3.1.1. The supplier shall provide any and all publicly available installation and operations manuals for systems provided.

404.1.7.3.1.2. Documents shall be provided in PDF format and where practical, paper.

404.1.7.3.2. All newly installed cables should have a label attached at each end, indicating start and end points OR a circuit designator relating to provided drawings. The following exceptions apply:

404.1.7.3.2.1. Local or factory provided cables of less than 15 feet, such as mice and keyboards plugged into a Processor will not need to be labelled (though mice and keyboards should be labelled to identify which system they control).

404.1.7.3.2.2. Existing cables that are reused for installation of new equipment do not have to have labels on both ends (these should incorporate a label on the “new” end).

404.1.7.3.3. The supplier shall provide start-up and commissioning service of all systems listed in this specification.

404.1.7.3.3.1. Each radar shall be calibrated by a technician holding an FCC License that carries a Radar Endorsement.

404.1.7.3.3.2. Communications to be tested in accordance with the FCC Bridge to Bridge Inspection Checklist by a technician holding a suitable FCC license. Checklist can be found here: https://www.fcc.gov/sites/default/files/bridge2bridgeinsp_new.pdf

404.1.7.3.3.3. FCC Form 827 (Vessel Bridge to Bridge Radiotelephony Certificate) to be issued with a 5-year expiry.

404.1.7.4. Training and Sea Trials

404.1.7.4.1.1. The supplier shall provide up to one day of dockside testing and training for the crew.

404.1.7.4.1.2. The supplier shall provide up to one day of sea trials for calibration, testing, and crew training on the final electronics suite. In particular, the following systems shall have offsets, settings, and calibration results annotated and provided to the vessel.

404.1.7.4.1.3. Final “As-Built” drawings to be provided within 6 weeks of sea trials.

404.2. Radar and GPS System

404.2.1. Primary Radar

404.2.1.1. One (1) Furuno FAR2228NXTBB 96 NM Solid-State Black Box Radar (or equivalent) shall be provided.

404.2.1.1.1. Supplied with

404.2.1.1.1.1. 6.5 Foot Open Scanner Array (Upper)

404.2.1.1.1.2. One (1) Display that meets guidelines in Section 404.4.1.
404.2.1.1.1.3. 115VAC Input Source fed via UPS distribution A
404.2.1.1.2. Interfacing Requirements
404.2.1.1.2.1. GPS (Input) from switched source
404.2.1.1.2.2. Heading (Input) from switched source
404.2.1.1.2.3. AIS (Input)
404.2.1.1.2.4. NMEA 0183 Data Distribution Network (For Target Tracking information)
404.2.1.1.2.5. TimeZero Network for Radar Overlay Functionality
404.2.2. Secondary Radar
404.2.2.1. One (1) Furuno FAR2228NXTBB 96 NM Solid-State Black Box Radar (or equivalent) shall be provided.
404.2.2.1.1. Supplied with
404.2.2.1.1.1. 6.5 Foot Open Scanner Array (Lower)
404.2.2.1.1.2. One (1) Display that meets guidelines in Section 404.4.1.
404.2.2.1.1.3. 115VAC Input Source fed via UPS distribution B
404.2.2.1.2. Interfacing Requirements
404.2.2.1.2.1. GPS (Input) from switched source
404.2.2.1.2.2. Heading (Input) from switched source
404.2.2.1.2.3. AIS (Input)
404.2.2.1.2.4. NMEA 0183 Data Distribution Network (For Target Tracking information)
404.2.2.1.2.5. TimeZero Network for Radar Overlay Functionality
404.3. GPS Units
404.3.1. Two (2) GPS Units, GP170 or equal will be provided.
404.3.1.1. One unit shall operate on Emergency 12VDC power.
404.3.1.2. One unit shall operate on 24VDC power.
404.3.1.3. These units to output information to the vessel data distribution system, with the outputs of these GPS navigators being switchable, so that all navigation equipment can be fed simultaneously from either GPS unit. Selection can be either automatic or manually activated.
404.4. Electronic Compass
404.4.1. One (1) GPS Satellite Compass SC130 or equal will be provided.
404.4.1.1. Unit shall operate on 12VDC power.
404.4.1.2. This unit will output heading and GPS information to the vessel data distribution system, as well as to the GC80 as an external source.
404.4.2. One (1) SIMRAD GC-80 Compact or equal shall be provided.
404.4.2.1. System shall be provided power from 24VDC battery bank, as well as 24vdc from a separately provided 115VAC to 24VDC converter.

404.4.2.2. Gyrocompass system will interconnect bidirectionally with the SC130 to provide digital heading information that will go to NMEA0183 and NMEA2000 distribution, ultimately feeding all relevant navigation systems and relevant Digital Data Repeaters.

404.4.3. All repeaters and interfaces to navigation equipment shall be via NMEA 0183 or NMEA 2000 protocol based on best practices.

404.5. Chart Plotters

404.5.1. ALL THREE WORKSTATIONS WILL UTILIZE OWNER PROVIDED NAVIGATION SOFTWARE

404.5.2. Timezero Professional Workstation #1 (Center Helm)

404.5.2.1. One (1) Marine Grade Processor workstation (Must be certified IEC 60945)

404.5.2.1.1. Minimum Specifications

404.5.2.1.1.1. Operating System: Windows 11 (64-bit) or higher

404.5.2.1.1.2. Processor (CPU): Intel Core i7 or newer

404.5.2.1.1.3. Memory (RAM): 16GB Minimum

404.5.2.1.1.4. Graphics (GPU)

404.5.2.1.1.5. • Minimum: Intel Iris Xe, AMD Radeon, or any DirectX 12 compatible integrated graphics card

404.5.2.1.1.6. • Recommended: Dedicated Video Card (NVIDIA RTX or AMD Radeon) with 4GB VRAM

404.5.2.1.1.7. Display Resolution: Minimum: 1920 x 1080 (Full HD)

404.5.2.1.1.8. Storage: Minimum: 150 GB of free space on a Solid State Drive (SSD) after installation of all software and charts.

404.5.2.1.1.9. Connectivity & Instrument Integration

404.5.2.1.1.10. At least 2 (two) RS-232 or RS-422 serial ports for NMEA 0183 data integration (If using USB adapters, chipsets must be FTDI):

404.5.2.1.1.11. Network: at least 3 (three) Gigabit Ethernet Adapters (1000 Base-T) for sensor networks, internet access, and NAVNET integration.

404.5.2.1.2. Processor, Keyboard, and Display Must be certified IEC/EN 60945, unless a compatible all-in-one unit is utilized.

404.5.2.1.3. 115VAC Input Source fed via UPS distribution or 24VDC source as required by selected Processor.

404.5.2.1.4. Interfacing Requirements

404.5.2.1.4.1. GPS (Input) from switched source

404.5.2.1.4.2. Heading (Input) from switched source

404.5.2.1.4.3. Depth (Input) from Depth Sounder

404.5.2.1.4.4. AIS (Input)

404.5.2.1.4.5. NMEA 0183 Data Distribution Network (For Target Tracking information and other available information)

404.5.2.1.4.6. TimeZero Network for Radar Overlay/FCV1150 Connection

404.5.3. Timezero Professional Workstation #2 (Center Helm)

404.5.3.1. One (1) Processor workstation

404.5.3.1.1. Minimum Specifications

404.5.3.1.1.1. Operating System: Windows 11 (64-bit) or higher

404.5.3.1.1.2. Processor (CPU): Intel Core i7 or newer

404.5.3.1.1.3. Memory (RAM): 16GB Minimum

404.5.3.1.1.4. Graphics (GPU)

404.5.3.1.1.4.1. Minimum: Intel Iris Xe, AMD Radeon, or any DirectX 12 compatible integrated graphics card

404.5.3.1.1.4.2. Recommended: Dedicated Video Card (NVIDIA RTX or AMD Radeon) with 4GB VRAM

404.5.3.1.1.5. Display Resolution: Minimum: 1920 x 1080 (Full HD)

404.5.3.1.1.6. Storage: Minimum: 150 GB of free space on a Solid State Drive (SSD) after installation of all software and charts.

404.5.3.1.1.7. Connectivity & Instrument Integration

404.5.3.1.1.7.1. At least 2 (two) RS-232 or RS-422 serial ports for NMEA 0183 data integration (If using USB adapters, chipsets must be FTDI):

404.5.3.1.1.7.2. Network: at least 4 (four) Gigabit Ethernet Adapters (1000 Base-T) for sensor networks, internet access, WASSP, and NAVNET integration.

404.5.3.1.2. 115VAC Input Source fed via UPS distribution or 24VDC source as required by selected Processor.

404.5.3.1.3. Two (2) displays that meet guidelines in Section 404.4.1

404.5.3.1.4. Interfacing Requirements

404.5.3.1.4.1. GPS (Input) from switched source

404.5.3.1.4.2. Heading (Input) from switched source

404.5.3.1.4.3. AIS (Input)

404.5.3.1.4.4. NMEA 0183 Data Distribution Network (For Target Tracking information)

404.5.3.1.4.5. TimeZero Network for Radar Overlay AND FCV1150

404.5.3.1.4.6. WASSP Network for Sonar Control

404.5.4. Timezero Professional Workstation #3 (Captain's S/R)

404.5.4.1. One (1) Laptop Processor workstation

404.5.4.1.1. Minimum Specifications

404.5.4.1.1.1. Operating System: Windows 11 (64-bit) or higher

404.5.4.1.1.2. Processor (CPU): Intel Core i7 or newer

404.5.4.1.1.3. Memory (RAM): 16GB Minimum

404.5.4.1.1.4. Graphics (GPU)

404.5.4.1.1.5. Minimum: Intel Iris Xe, AMD Radeon, or any DirectX 12 compatible integrated graphics card

404.5.4.1.1.6. Display Resolution: Minimum: 1920 x 1080 (Full HD)
404.5.4.1.1.7. Storage: Minimum: 150 GB of free space on a Solid State Drive (SSD) after installation of all software and charts.
404.5.4.1.2. Connectivity & Instrument Integration
404.5.4.1.2.1. Network: at least 2 (two) Gigabit Ethernet Adapters (1000 Base-T) for sensor networks and internet access.
404.5.4.1.2.2. Unless internal battery backup exists (i.e. Laptop), a 115VAC Input Source fed via UPS distribution or 24VDC source as required by selected Processor.
404.5.4.1.3. Docking station provided, with a standard LCD Display, 23" widescreen to be integrated.
404.5.4.1.3.1. Must be mounted using VESA wall mount.
404.5.4.1.4. Interfacing Requirements
404.5.4.1.4.1. All Interfaced Navigational Data to be received over UDP on an ethernet port.

404.6. Depth Sounder
404.6.1. One (1) FCV1150
404.6.1.1. 12.1 Inch Color LCD Sounder, 1-3kW output power
404.6.1.2. Transducer
404.6.1.2.1. One (1) CA28BL-12HR 3kW 28kHz Transducer or other as approved.
404.6.1.2.1.1. Transducer must come with appropriate thru-hull fitting.
404.6.1.2.1.2. The transducer must be professionally installed using accepted practices. The pocket must be strong and watertight to reduce the risk of property damage, personal injury, and/or death.
404.6.1.2.1.3. Routing of the cable to the echosounder should consider electrical interference; where possible, it should be separated from high power electrical wiring and the engine(s).
404.6.1.2.2. One (1) CA200B-8B 200kHz 2kW Transducer or other as approved.
404.6.1.2.2.1. Transducer must come with appropriate thru-hull fitting.
404.6.1.2.2.2. The transducer must be professionally installed using accepted practices. The pocket must be strong and watertight to reduce the risk of property damage, personal injury, and/or death.
404.6.1.2.2.3. Routing of the cable to the echosounder should consider electrical interference; where possible, it should be separated from high power electrical wiring and the engine(s).
404.6.2. One (1) WASSP F3/160 Multibeam Sonar or other as approved.
404.6.2.1. Includes

404.6.2.1.1. One (1) Transducer WSP502/160/10 or other as approved.
404.6.2.1.2. One (1) WSP002-082 Steel thru-hull tube for WASSP or other as approved.
404.6.2.1.3. One (1) WSP002-120 IMU-038 Inertial Measurement Unit or other as approved.
404.6.2.1.4. Following licenses to be included where needed:
404.6.2.1.4.1. WSP002-219 Pro License Bundle
404.6.2.1.4.1.1. WASSP Timezero Interface license
404.6.2.1.4.1.2. WASSP Backscatter License
404.6.2.1.4.1.3. WASSP Water Column License
404.6.2.1.4.1.4. WASSP Sidescan License

404.7. Automated Identification System (AIS)
404.7.1. One (1) AIS, model Furuno FA-170 to be installed.
404.7.1.1. AIS shall be equipped with Comrod AV51P or equivalent VHF antenna and mounting hardware as necessary, and mounted as high as practical to extend range.
404.7.1.2. Coaxial cable used for interconnection shall be RG-214 or better and must have a nominal attenuation of not more than 2.8dB per 100 feet.
404.7.2. AIS shall be provided with GPS antenna, mounts, and cable as necessary.
404.7.3. The AIS shall operate on 24VDC power.
404.7.3.1. Interfacing Requirements
404.7.3.1.1. GPS (Input) from switched source
404.7.3.1.2. Heading (Input) from switched source
404.7.3.1.3. Radar 1 (Output)
404.7.3.1.4. Radar 2 (Output)
404.7.3.1.5. Pilot Plug located in console (Output)
404.7.3.1.6. Electronic Chart System 1 (Output)
404.7.3.1.7. Electronic Chart System 2 (Output)

404.8. Bridge Navigational Watch Alarm System
404.8.1. One (1) Furuno BR500 BNWAS to be installed.
404.8.1.1. One (1) BR510 to be installed at main operating station.
404.8.1.2. Three (3) BR540 Cabin Alarm Panels installed in Captain S/R, Galley, and One other location TBD.
404.8.1.3. Two (2) BR560 Motion Detectors located in wheelhouse at primary operating stations.
404.8.1.4. One (1) BR570 Flash Beacon located in wheelhouse.
404.8.2. BNWAS shall be interfaced with the autopilot system for automatic activation whenever autopilot system is in AUTO mode.

404.9. Weather Station
404.9.1. One (1) Airmar 300WX or equivalent, capable of the following:
404.9.1.1. Ultrasonic measurement of apparent and Dynamic true wind speed and direction with accuracy of 1.5 knots RMS at 20 knots.

404.9.1.2. Barometric pressure
404.9.1.3. Air temperature
404.9.1.4. Unnecessary outputs (i.e. Heading, GPS) can interfere with commercial sensors on board, so should be isolated from the data distribution network to prevent.
404.9.2. To the extent possible, the Instrument must be mounted in “clear air”, away from obstructions in any direction that will interfere with air flowing through the unit. If there is an obstruction, mount the Instrument at least 2m (6') away.
404.10. Autopilot
404.10.1. One (1) Simrad AP70Mk2 System to be installed
404.10.1.1.1. To be integrated with the vessel’s hydraulic steering system.
404.10.1.1.2. System shall consist of:
404.10.1.1.2.1. One (1) AP70 Display forward
404.10.1.1.2.2. Three (3) FU80 Follow up levers (one at each wing and one at the primary steering station)
404.10.1.1.2.3. One AC85 Autopilot Computer with SI80 Board
404.10.1.1.2.4. One (1) SD80 Interface board to integrate with existing steering solenoids.
404.10.1.1.3. Integrated with Timezero for Route Navigation
404.10.1.2. System to incorporate isolation relays on the output of the SD80, Crydom CWD2425 or equivalent.
404.10.2. Rudder Angle Indicators
404.10.2.1. A total of three (3) RAI’s to be installed.
404.10.2.1.1. One (1) Panorama Rudder Indicator RI85-45 mounted above the forward console
404.10.2.1.1.1. Power and signal must be fed independent of the Autopilot for the Panoramic RAI only.
404.10.2.1.2. One (1) Wheelhouse Port Wing IS42 or Equivalent
404.10.2.1.3. One (1) Wheelhouse Stbd Wing IS42 or Equivalent
404.11. NMEA Data Distribution System
404.11.1. One (1) centralized data distribution system is required to effectively integrate navigation equipment in a suitable manner.
404.11.2. NMEA0183 Distribution
404.11.2.1. NMEA 0183 Distribution should be at a centralized location with respect to primary navigational electronics and should include appropriate multiplexing and buffering of signals to avoid doubling up on outputs or inputs to distribute NMEA0183 signals.
404.11.2.2. Redundancy of heading and position is necessary. Automatic switching may be used to provide redundancy in Position and Heading sources exists.

404.11.2.3. No single point of failure, including power sources, should prevent the Electronic Charting Systems from having position information.

404.11.2.4. One (1) Actisense PRO-Mux2 Multiplexer

404.11.2.5. Two (2) Actisense PRO-Buf2 data splitters

404.11.3. NMEA2000 Distribution System

404.11.3.1. Backbone - Mid-size cabling shall be provided to go from between spaces in accordance with NMEA2000 installation guidelines, and will provide for drops in the following locations:

404.11.3.1.1. Engine Room

404.11.3.1.2. Thruster and Bosun's Room (Transducer Area)

404.11.3.1.3. Foredeck (Bosun's Locker)

404.11.3.1.4. Mud Room

404.11.3.1.5. Stores

404.11.3.1.6. Mess

404.11.3.1.7. Captain Stateroom

404.11.3.1.8. Pilot House (Port, Mid, and Stbd Consoles)

404.11.3.1.9. NMEA 0183 Distribution Location (if not in wheelhouse)

404.11.3.1.10. Nav Mast

404.11.3.2. Where necessary, A Maretron NBE100 or similar (Network Bus Extender) should be used to isolate the backbone to mitigate the risk of losing the entire backbone in the event of catastrophic failure. At a minimum, this should include:

404.11.3.2.1. One (1) Maretron NBE100 or similar (Network Bus Extender) isolating the pilot house from any exterior NMEA 2000 connection points

404.11.3.2.2. One (1) Maretron NBE100 or similar (Network Bus Extender) isolating pilot hours from the rest of the interior NMEA 2000 connection points

404.11.3.2.3.

404.11.3.3. One (1) IS42 NMEA2k digital display repeater on foredeck for crew information

404.11.3.4. Four (4) IS42 NMEA2k digital display repeaters, two on each wing console

404.11.3.5. The AP70 NMEA2000 backbone should be kept isolated from this distribution backbone.

405. Alarm and Monitoring Systems covered in EBDG Specification 24065-200-832-0

406. CCTV and Thermal Imaging Systems

406.1. One (1) Network Video Recording system shall be provided for safety and training. System to be comprised of:

406.1.1. One Network Video Recorder, 2 TB Storage, 16 Licenses

406.1.2. For indoor cameras, supplier shall provide Indoor Rated Dome Cameras, Axis M6085 or equivalent (Wide Angle Lens, 2MP or better).

406.1.3. A sufficient quantity of indoor cameras to cover the following locations:
406.1.3.1.1. Doors with access to the exterior,
406.1.3.1.2. machinery spaces
406.1.3.1.3. shop/stores
406.1.3.1.4. Bos'n Locker
406.1.3.1.5. Galley
406.1.4. For outdoor cameras, supplier shall provide Outdoor Rated (IP-67 or better) Cameras (Wide Angle Lens, 2MP or better). The use of indoor cameras and enclosures to meet this requirement is acceptable (i.e. Axis M6085 installed in a Dotworkz BASH enclosure).
406.1.5. A sufficient quantity of outdoor cameras viewing the following locations:
406.1.5.1.1. Working Deck
406.1.5.1.2. Crab Block
406.1.5.1.3. Skiff Launch
406.1.6. One (1) Display that meets guidelines in Section 404.4.1.
406.1.7. Thermal Imaging System to be incorporated into the NVR.
406.2. Thermal Imaging Systems
406.2.1. One (1) Flir Night Vision Camera; M364C LR or equivalent
406.2.1.1. Must include Active Gyro-Stabilization; 640 x 512 Pixel Camera Resolution
406.2.2. One (1) Display that meets guidelines in Section 404.4.1.
406.2.3. Output to TZ
406.2.4. Output to Camera System NVR
407. Communications
407.1. Internal Communications
407.1.1. One (1) LH5000 Loudhailer to be provided
407.1.1.1. Hailer horns to be located on exterior of vessel in the following locations:
407.1.1.1.1. One talkback speaker located at Pot Launcher by crab pot controls.
407.1.1.1.2. One talkback speaker located by exterior crane controls.
407.1.1.1.3. 4 each ISP-5000 Intercom speakers to be included, to be wired to the following locations:
407.1.1.1.3.1. Galley
407.1.1.1.3.2. Mud Room
407.1.1.1.3.3. Stores/Workshop
407.1.1.1.3.4. Bos'n Locker
407.1.2. General Alarm
407.1.2.1. The public address system should be used to serve as the general alarm signal and must meet all requirements.
407.1.3. Public Address (PA) / General Alarm (GA)

407.1.3.1. One (1) approved Zenitel Public address system (SPA-V2 or equivalent) will contribute to fulfilling the requirements of the General Alarm, redundant per requirements and interfaced with the shipboard telephone system as a backup.

407.1.3.2. PA be a fixed installation and be audible during normal operating conditions throughout the accommodation spaces and all other spaces normally manned by crew members.

407.1.3.3. The PA must be operable from the primary bridge operating station.

407.1.3.4. PA System must be powered from more than one source of electricity.

407.1.3.5. General Alarm Lights to be provided in noisy locations and machinery spaces.

407.1.4. Telephone System

407.1.4.1. One (1) Zenitel IC-Edge Phone System or equivalent will complement the PA/GA system.

407.1.4.2. A suitable marine telephone system to be installed and operable throughout common areas and staterooms. Suggested locations include:

407.1.4.2.1. Upper Deck

407.1.4.2.1.1. Pilothouse

407.1.4.2.1.2. Stateroom 1

407.1.4.2.1.3. Stateroom 2

407.1.4.2.1.4. Stateroom 3

407.1.4.2.1.5. Stateroom 4

407.1.4.2.1.6. Foc'Sle Deck

407.1.4.2.2. Main Deck

407.1.4.2.2.1. Stateroom 5

407.1.4.2.2.2. Galley

407.1.4.2.2.3. Mess

407.1.4.2.2.4. Mud Room

407.1.4.2.3. Hold

407.1.4.2.3.1. Engine Room

407.1.4.2.3.2. Stores/Workshop

407.1.4.2.3.3. Thruster Room

407.1.4.2.3.4. Steering Gear Room

407.1.4.3. Lights and Headsets to be provided in noisy locations and machinery spaces.

407.1.4.4. Phones should be Power-Over-Ethernet (POE) or equivalent.

407.1.4.5. The Owner will select phone stations that should have access to outgoing voice over the vessel Iridium satellite system.

407.2. External Communications

407.2.1. Three (3) VHF Marine Radios, type Icom IC-M605 or equal.

407.2.1.1. Locations

407.2.1.1.1. Center console x2

407.2.1.1.1.1. One (1) HM-195 Command Mic located Port station from one of center station radios

407.2.1.1.2. One on starboard station

407.2.1.1.2.1. One (1) HM-195 Command Mic to Capt. S/R)

407.2.1.2. The radios shall be 25-watt DSC Class D transceivers.

407.2.1.3. Must be equipped to receive US and International marine channels as well as weather stations in the US and Canada.

407.2.1.4. They shall be equipped with Comrod AV62M9 or equivalent antennas and mounting hardware as necessary.

407.2.1.5. Coaxial cable used for interconnection shall be RG-214 or better and must have a nominal attenuation (at intended frequencies) of not more than 2.8dB per 100 feet, and never beyond 3db of loss on any run.

407.2.1.6. Two of the radios to have the MMSI programmed and be connected to the vessel's GPS source to enable DSC.

407.2.1.7. A durable placard must be posted next to bridge radiotelephone installations with the emergency broadcast instructions and information specific to the vessel.

407.2.1.8. Radios to operate on 12VDC, at least one radio shall always be connected to the emergency reserve power system, the other shall be connected to any 12VDC panel.

407.2.1.9. Bridge radios should have a playback function incorporated

407.2.1.10. Expanded VHF channels to be available on bridge VHF's

407.2.2. One (1) VHF radio IC-M510 or equivalent to be installed in the Mess area

407.2.2.1. shall be equipped with Comrod AV62M9 or equivalent antennas and mounting hardware as necessary.

407.2.2.2. Coaxial cable used for interconnection shall be RG-214 or better and must have a nominal attenuation (at intended frequencies) of not more than 2.8dB per 100 feet, and never beyond 3db of loss on any run.

407.2.2.3. This radio is not intended to be connected to a position source.

407.2.3. Aircraft radio

407.2.3.1. One (1) Each Icom AT120 Fixed Radio to be installed

407.2.3.1.1. They shall be equipped with Comrod VHF118144M or equivalent antennas and mounting hardware as necessary.

407.2.3.1.1.1. Must be a ground to air antenna for the aeronautical communication band, 118-136 MHz

407.2.3.1.1.2. VSWR should be less than 2:1

407.2.3.1.1.3. Must be capable of handling at least 50 watts of power

407.2.3.1.2. Coaxial cable used for interconnection shall be RG-214 or better and must have a nominal attenuation at intended frequencies of not more than 2.8dB per 100 feet, and never beyond 3db of loss on any run.

407.2.4. Police band radio

407.2.4.1. One (1) Each OFE Furnished Police Band Radio
407.2.4.1.1. One (1) each OmniBand antenna Shakespeare HS-2774-1-R or equivalent.
407.2.4.1.2. VHF High Band (138–174 MHz): Used by many state patrols, county sheriffs, and legacy rural or smaller-city municipal departments.
407.2.5. EPIRB
407.2.5.1. One (1) each Category 1, ACR GlobalFix V6 EPIRB or equivalent.
407.2.5.1.1. Fitted in an automatic float free container, with mounting position to comply with the applicable requirements for any radio and Electronic Position Indicating Radio Beacon (EPIRB) installations.
407.2.6. One (1) LT-4200S GMDSS Certus 200 System or other Satellite System as approved.
407.2.6.1. Distress Alert & Distress Call
407.2.6.2. Safety Calling & Safety Messaging
407.2.6.3. Maritime Safety Information (MSI)
407.2.6.4. Must include pole mounts and control unit mounting brackets as needed.
407.2.7. One (1) Navtex, Furuno NX900 or equivalent.
407.2.7.1. Cable must be appropriate for low frequency receipt of HF radio waves.
407.2.7.2. Antenna will be installed using appropriate mounting hardware as necessary.
407.2.7.3. To be interfaced with NMEA GPS position input from the Data Distribution System.
407.2.8. One (1) Single Side Band Transceiver, Icom IC-M803 or other as approved.
407.2.8.1. Radio should be equipped with Comrod AT82M or equivalent antenna using appropriate mounting hardware as necessary.
407.2.8.2. Coaxial cable used for interconnection shall be RG-214 or better and must have a nominal attenuation (at intended frequencies) of not more than 2.8dB per 100 feet, and never beyond 3db of loss on any run.
407.2.8.3. Radio to have the MMSI programmed and be connected to the vessel's GPS source to enable DSC.
407.2.8.4. A durable placard must be posted next to the bridge radiotelephone installation with the emergency broadcast instructions and information specific to the vessel.
407.2.8.5. Radio to operate on 12VDC and be connected to the emergency reserve power system.
407.2.9. Body Cam (Axom)
407.2.9.1. One (1) 8-Bay Dock, Axom AX1039 to be installed in the mud room.

407.2.9.2. Ethernet cable must connect this dock to the pilot house network distribution.

407.2.10. Network

407.2.10.1. General Requirements

407.2.10.1.1. Networks will be isolated where appropriate, and include patch panels, wall jacks, and switches to connect intended equipment.

407.2.10.1.2. Different color network cables are encouraged to identify networked components. At minimum, this includes:

407.2.10.1.2.1. Telephone Network

407.2.10.1.2.2. Camera Network

407.2.10.1.2.3. Sensor (NMEA over IP) Network

407.2.10.1.2.4. Furuno Navnet

407.2.10.1.2.5. Furuno WASSP

407.2.10.1.2.6. Vessel Lan/Wan

407.2.10.2. Vessel Operations Network

407.2.10.2.1. One (1) each Peplink Pepwave MAX BR1 Pro 5G Router or equivalent.

407.2.10.2.2. Designed with technology to enable future auto switching between cellular, Wi-Fi, and satellite internet sources using least cost routing.

407.2.10.2.2.1. WAN1 – Owner Furnished Internet

407.2.10.2.2.2. Two (2) Peplink ANT-MB-42G-S-W-6 connected to the router will use embedded modem and sim card to extend cellular range on board.

407.2.10.2.3. WiFi should be made available throughout all locations normally manned, including staterooms and the hold.

407.2.10.2.4. Where network cables are run to support the network, dual pulls should be used to ensure reliability.

408. Battery bank and inverter systems

408.1. Supplier will provide a dedicated clean-power system supplying 120 VAC to navigation, communications, computer, monitoring, and other designated wheelhouse electronic loads. The system shall provide conditioned AC power during normal vessel operation and maintain power to designated loads following loss or interruption of the vessel's normal AC supply.

408.2. The system shall include AC input protection, battery charging, energy storage, DC protection and isolation, inverter equipment, monitoring, bypass/alternate-source capability, and dedicated 120 VAC distribution.

408.3. The clean-power system shall consist of two independent power channels, designated Clean Power Bus A and Clean Power Bus B.

408.4. Noise generating equipment (chargers and inverters) should be located with batteries in a machinery space and away from crew areas.

408.5. Each bus shall include products below (or suitable substitutes to meet the needs of the intended loads):
- 408.5.1. Dedicated 24 VDC battery bank.
  - 408.5.1.1. Two (2) Size 8D AGM Batteries or other as approved. (Lithium batteries shall not be used to meet this requirement).
- 408.5.2. Pure-sine-wave inverter.
  - 408.5.2.1. Victron Energy 2400w Inverter 24dc-120vac Inverter
- 408.5.3. 24 VDC battery charger.
- 408.5.4. Battery disconnect and overcurrent protection.
  - 408.5.4.1. Bluesea 3000 Disc.
  - 408.5.4.2. Blue Sea 7560 + 3131 30a 2p Bkr / Enclosure
- 408.5.5. DC distribution/bus equipment.
  - 408.5.5.1. Victron Energy Lynx Ve Shunt Shunt (with appropriate fuse)
  - 408.5.5.2. Victron Energy Lynx-In Lynx-In
  - 408.5.5.3. Victron Energy Gx Touch 50 Sys Monitor
  - 408.5.5.4. Victron Energy Cerbo-Gx Comm Center
  - 408.5.5.5. Blue Sea 2104 Powerbar
- 408.5.6. Dedicated 120 VAC wheelhouse distribution panel.
  - 408.5.6.1. Bluesea 1202 120vac 1main + 6 Position Panel
- 408.5.7. Victron Energy Skylla-Tg 24v/50a Charger
- 408.5.8. Means of selecting clean inverter power or an alternate bypassed 120 VAC source.
  - 408.5.8.1. Bluesea 9019 Gen/Shore Select
- 408.5.9. Appropriate Receptacles connected to the distribution to feed equipment
  - 408.5.9.1. Orange Receptacles shall be used to indicate UPS source.

408.6. AC distribution will incorporate appropriately sized branch-circuit protection.

408.7. The system shall be sized for the maximum expected simultaneous operating load plus a design reserve of not less than 20–25%.

408.8. Loads shall be distributed between Bus A and Bus B to avoid a single failure disabling redundant navigation or communication function. All Bus A and Bus B components to be identified by different color coded tape markings.

408.9. System monitoring sufficient to indicate battery voltage/current, state of charge, charger condition, inverter condition, and system alarms.

408.10. Failure of a single inverter, charger, battery bank, or associated distribution channel shall not result in loss of all designated critical electronics (radars, ECS, etc.)

408.11. All equipment shall be installed in locations suitable for the marine environment and in accordance with equipment-manufacturer requirements. Conductors shall be marine-rated and sized for connected load, allowable voltage drop, ambient temperature, bundling, and applicable overcurrent protection.