

CANADIAN COAST GUARD
CCGS VECTOR



APPENDIX A
LAB REFURBISHMENT SPECIFICATION



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CCGS Vector
Docking Refit 2017

Specification No: F1782-17C814

APPENDIX A

19.0 LAB REFUBISHMENT

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19.1 Lab

19.1.A Identification

- A.1.1 The Dry Lab located between frame 14 and frame 34 on the main deck (referred to as Lab here) contains one (1) space that must be refurbished.
- A.1.2 Condition of the steel and the aluminum, and the connection between the two, in way of the Lab is to be confirmed.
- A.1.3 Asbestos must be removed from the compartment if found.
- A.1.4 The purpose of the modifications is to improve the functionality and appearance of the Lab.

19.1.B References

B.1 Equipment Data

- B.1.1 Annual Asbestos Material Re-Assessment Report CCGS Vector, PHH ARC Project: 11754F, 19 February 2012

B.2 Drawings

- B.2.1 All Drawings are listed in the General Notes. The following Drawings are to be considered as Guidance Drawings as defined in the Drawings section of the General Notes.

Drawing Number	DRAWING TITLE	Number of Sheets
1146-03-00	General Arrangement	1
1146-03-01	Reflected Ceiling Plan	1
1146-03-01	Lighting Arrangement	1
1146-03-01	Lower Cabinet Plan	1
1146-03-02	Wet Lab Elevations	5
1146-03-03	Finishing Schedule	2
1146-03-04	Typical Details	2
1146-03-06	Wet Lab Tear Out	1
1146-610-27	Storage Shelf Single	1
1146-610-28	Storage Shelf Double	1
1146-610-29	Fire Locker	1
1146-610-30	Table	1
1146-610-31	Shelf	1
1146-3-400-01	Wet Lab One Lines	3
1146-3-406-02	Wet Lab Refit Networking	2

1146-03-405-01	Wet Lab Switches and Outlets	4
1146-03-502-01	Wet Lab Compressed Air System	1
1146-03-506-01	Wet Lab Fresh Water System	1
1146-03-507-01	Wet Lab Sea Water System	1
1146-03-512-01	Wet Lab Grey Water System	1
1146-3-508	Wet Lab HVAC System	2

B.3 Regulations and Standards

B.3.1 The following Standards and Regulations apply to work carried out in this section; The Contractor must ensure all work completed in this section meets these Standards and Regulations as well as any other pertinent Federal/Territorial Regulation or Standard:

FSSM Procedures	Title	Included Yes/No
7.E.3	Handling and Discharge of Black and Grey Water	Yes
7.E.5	Handling, Storage, and Disposal of Hazardous Materials	Yes
7.B.5	Lockout and Tagout	Yes
7.B.6	Electrical Safety - Energized Circuits	Yes
7.A.12	Potable Water Quality	Yes
Publications		
	Guidelines for Canadian Drinking Water Quality - Summary Table (2014)	No
TP 14231	Marine Occupational Health and Safety Program	No
ISSN 1497-2956	Safe Work Practices for Handling Asbestos, WorkSafe BC, 2012 Edition.	No
Standards		
	Colour Coding Standard for Piping Systems	Yes
	Welding Ferrous Materials, Standard	Yes
	Paint and Coatings for Ships/Boats, Standard	Yes
IEEE 45	Recommended Practice for Electrical Installations on Shipboard	No
IMO Resolution A.468(XII)	Code on Noise Levels on Board Ships	No
ISO 9712:2005	International Standards for NDT	No
IESNA RP-12-97	(Illumination Engineering Society of North America) – Recommended Practice for Marine Lighting	No

ISO 8501-1:2007	Preparation of steel substrates before application of paints and related products	No
Regulations		
TP 127 E	Ships Electrical Standards	No
C.R.C., c.1418	Crew Accommodation Regulations	No
SOR-2017-14	Vessel Fire Safety Regulations	No
TP 14231	Marine Occupational Health and Safety Program	No
SOR/86-304	Canada Occupational Health and Safety Regulation	No
SOR/2010-120	Maritime Occupational Health and Safety Regulations	No
B.C. Reg. 296/97	Occupational Health and Safety Regulation, WorkSafe BC	No
SOR/2008-34	Transportation of Dangerous Goods Regulations, Transportation of Dangerous Goods Act	No

19.1.C Materials and Workmanship

C.1 General

- C.1.1 All materials, equipment, and outfit is to be CFM except for the Network Cable and 48 port switch which will be GSM.
- C.1.2 All materials, equipment, and outfit must be as shown in the drawing package. It must be of commercial marine quality, in full compliance with the specifications and suitable for the intended use. Unless explicitly stated otherwise, all machinery and equipment, must be new and unused (except for factory testing), of current manufacture and currently be supported by readily available spare parts and projected to be supported by spare parts for a minimum of ten years after the refit of the vessel, unless specifically waived by CCG. Where specific class society material specifications are required, the requirements must be clearly indicated on purchase orders.
- C.1.3 All materials must be free from imperfections of manufacture and from defects that adversely affect appearance and/or serviceability.
- C.1.4 Nuts, bolts, fasteners and fittings used in exterior locations must be type 316 stainless steel, unless otherwise approved by CCG.
- C.1.5 All materials and equipment must be stored, installed and tested in accordance with the manufacturer's guidelines, recommendations and requirements.

- C.1.6 All equipment must be accessible for use, inspection, cleaning and maintenance. The Contractor must ensure there is adequate room for access for maintenance behind toilets and other plumbing fixtures.
- C.1.7 Measures must be taken to avoid wear and damage incident to construction, and to prevent corrosion and deterioration. Equipment subject to freezing must be kept drained, except during sea trials. Equipment must be kept clean and protected from the environment.
- C.1.8 Contractor must review all documents and verify all dimensions and field conditions and confirm that work is buildable as shown. Any conflicts or omissions must be brought to the attention of the TI/TA prior to beginning any hotwork.
- C.1.9 After completion of tear out Contractor must measure frame spacing and bulkhead locations to confirm the arrangement can be installed as shown. Any conflicts or discrepancies must be brought to the attention of the TI/TA prior to installation of any outfit.
- C.1.10 Any work or material in which a defect becomes apparent or is deemed unacceptable, whether partially or wholly completed, even though previously passed as satisfactory, shall be remediated to the satisfaction of the TI/TA.
- C.1.11 The cost of all corrections necessary, due to defective materials or equipment, or due to poor or faulty workmanship, shall be borne entirely by the Contractor.
- C.1.12 All machinery and equipment shall be fully protected at all times to prevent damage by heat, weld spatter, water, paint, abrasive dirt or other material and shall be fully protected against mechanical damage.
- C.1.13 All materials must be corrosion resistant and suitable for use in a marine environment. All materials normally subjected to sunlight must resist degradation caused by ultraviolet radiation.
- C.1.14 Where nuts can become inaccessible after assembly, nuts must be captured to allow reassembly and prevent backing off. Unless otherwise specified, self-locking nut must be installed to prevent loosening of fasteners due to shock and vibration.
- C.1.15 Instruments, equipment, fittings, paint, insulation, adhesives, or other items containing material or components that would produce or generate noxious fumes at its operating temperature or at any temperature below 90 degrees C must not be installed or applied. For paint and adhesives, this requirement must apply after drying or curing is complete.
- C.1.16 Any dissimilar metals must be insulated from each other.

- C.1.17 Stainless steel type 316L or 316 must be used for all stainless steel applications. Fasteners must be 316.
- C.1.18 Aluminum alloy types 5086, H116 must be used for plate; aluminum alloy 6061-T6 (anodized grade), suitable for type 5356 filler alloy, must be used for extruded shapes and welded tubing and pipe.
- C.1.19 Magnesium and its alloys must not be used.
- C.1.20 Lead must not be used without prior written approval.
- C.1.21 All copper pipe used in the hot and cold water piping system must be of seamless copper and certified as lead free. Lead bearing solder is not acceptable for domestic water systems.
- C.1.22 All items that are to be reused must be protected against deterioration by the elements and against mechanical damage.
- C.1.23 The Contractor must maintain the fire rating and watertight integrity of all decks and bulkheads. Including the watertight integrity of the deck above and below the Lab and the weathertight integrity of the surrounding house structure.
- C.1.24 Care should be taken where potentially hazardous material is being removed from the vessel. All dust from grinding and any material that becomes airborne during strip-out and cleaning must be kept contained.
- C.1.25 Removal and disposal of all hazardous wastes must be in accordance with local and provincial environmental regulations.
- C.1.26 The Contractor is responsible for all disposal arrangements and associated costs. Contractor to forward Coast Guard disposal certificates.

C.2 Cables

- C.2.1 Cables for electronic equipment must be as recommended by the equipment manufacturer and shall be suitable for marine use.
- C.2.2 Cable sizes must be determined by the Contractor and be suitable for the intended service. All new cables to be certified marine type, with tinned copper strands (CSI type) UL 1426 and TP127E
- C.2.3 All Cables for existing equipment that is to be reinstalled shall be new cabling of equivalent specifications as the original.
- C.2.4 Cables must be grouped into wiring harnesses where possible. They must be colour coded and routed below deck as per ABYC standards.

- C.2.5 Cable runs must be run in a neat and orderly manner presenting a tight, straight run. The runs must be tightly fitted close to the overhead or bulkhead. Whenever cables are concealed behind panels, sheathing or other surface material, access panels to cable connections must be provided. Access panels must be labeled to identify the concealed cable connections. Accesses must be large enough to accommodate service to the cable's connections. Cables must not be installed behind nor embedded in insulation.
- C.2.6 Cabling/conductors passing through structures without watertight glands, must be protected against chafing by the use of abrasive resistant grommets.
- C.2.7 Cables and conductors are to be installed in wire trays of a sufficient size to pass other wires without obstruction. Wire trays are to be as per the finishing schedule. The wires that are not run through wireways are to be installed with clamps and straps spaced at least every 18 inches on horizontal runs and every 14 inches on vertical runs. Tie wraps are not acceptable.
- C.2.8 All terminations shall be made using solderless crimped type lugs. Control conductors and communication conductors shall have crimp on ferrules. Twist on connections shall not be used.
- C.2.9 Identify each and every control conductor with shrink-on type cable markers with numbers corresponding to wire numbers on the equipment certified drawings. Provide clearly marked terminal strips inside panels and similar equipment.
- C.2.10 All cables must be marked at each termination and on either side of a transit.
- C.2.11 Terminate conductors in terminals with no more than two conductors connected to the input or output of any terminal. Only pressure type terminals shall be used.
- C.3 Locks, Keys, and Tags**
- C.3.1 The Contractor must provide two keys for every cylinder lockset and padlock installed on the vessel. All cylinder locksets must be keyed alike. Padlocks must be keyed to a master key system. Keys must be identified with the name of the space served or padlock number inscribed on a metal or plastic tag attached to the key. The master key system must be block type rather than individual.
- C.4 Painting**
- C.4.1 All hardware, windows, light fixtures, placards and signs, and adjacent equipment and structure must be properly masked off when the surrounding areas are being painted. Items and surfaces to be protected may be removed, moved, or otherwise

protected, at the preference of the Contractor, but must be restored to their pre-removal form, appearance, and function at completion of the paintwork.

- C.4.2 All plates and shapes used in construction and all areas in way of new paint must have surface preparation performed according to the paint manufacturer's specifications to completely remove scale, rust, and other surface contaminants.
- C.4.3 All surfaces must be coated in accordance with Interspec paint specifications. The Contractor must apply the coatings with strict conformity to the Interspec recommendations, including surface preparation. The Contractor must not thin or alter coatings without approval by CCG and the manufacturer.
- C.4.4 The colour scheme for all painted components must be as per the drawing package and finishing schedule.

C.5 Outfit and Furnishings

- C.5.1 All new cabinets, consoles, and furniture that are shown in the drawing package must be fabricated and installed by the Contractor. All surfaces are to be finished as shown on the drawing package and in the finishing schedule.
- C.5.2 A suggested supplier of the interior joinery and outfit is ProNautic of Victoria at (250) 655-6388.
- C.5.3 The new furniture is designed to have square bases that must sit level on a base or plinth as shown in the design drawings. The plinths are to be supplied and adapted by the Contractor to follow the contour of the deck and must provide level surfaces at even keel.
- C.5.4 Drawers must be full extension. Drawers must have slides or glides and stops to prevent drawers from tipping when pulled out and from sliding out all the way.
- C.5.5 Drawers and cupboard doors must be latched to prevent opening in heavy seas.
- C.5.6 Items such as light switches must be located to ensure convenience to the user.
- C.5.7 Each coat hook must support 65 pounds and must be located 75 inches above the finished deck.
- C.5.8 The door separating the Lab from the Accommodation area must be replaced with a class B fire door with a window of a minimum of 10"x10" area. Contractor is to take note that the 24" coaming must remain and a door may have to be custom ordered to fit.

- C.5.9 All outfit and furnishings are to be as per the drawing package. No alternate equipment or materials are acceptable without consultation with the TI/TA.
- C.5.10 Existing pass-through pipes in bulkheads are to be maintained. Contractor must ensure all new insulation and linings are fit around these openings.
- C.5.11 All existing exterior doors, along with hardware and frames, leading to the Lab are to be reused. Contractor must ensure any damage to doors, door hardware, or door frames are repaired.
- C.5.12 All windows in the Lab are to be replaced. New windows are to be installed as per drawings. The windows must be made of laminated safety glass and are to be bolted to the superstructure and be fitted with blackout covers.

C.6 Deck coating

- C.6.1 Steel decks must be prepped prior to coating as per manufacturer's recommendations. Area 65 square meters.
- C.6.2 Deck coatings must be installed in accordance with manufacturer's recommendations. Colours and pattern of deck coating must be as shown on the drawing package and finishing schedule.
- C.6.3 Deck coating must be applied under furniture except where the furniture is built-in to the vessel structure. Cove base must be installed around boundaries, including built-in furniture as shown on the drawing package.

C.7 Insulation

- C.7.1 The Contractor must maintain all existing structural fire insulation in accordance with Transport Canada Marine Safety – Vessel Fire Safety Regulations. Any damaged structural fire insulation is required to be replaced as new and must be provided and installed by the Contractor.
- C.7.2 The Contractor must inspect the existing insulation once all the wall panels have been removed. Insulation found to require repair or replacement will be through PWGSC 1379 action.

C.8 Sheathing & Lining

- C.8.1 The Contractor must lay out and install linings (wall panels) for all exposed interior bulkheads and shell plating within the Lab. Where possible, ducts, pipes, etc. must be installed behind linings; otherwise they must be boxed in with removable panels.

- C.8.2 Bulkhead linings must be as per the drawing package and finishing schedule. They must integrate mechanically and aesthetically with the existing structure. The Contractor must fully compartmentalize and arrange the Lab with sheathing and linings.
- C.8.3 The Contractor must completely finish the interior of the vessel, with the entire compartment trimmed, finished, and furnished.
- C.8.4 Ceiling panels (headliner panels) must be suspended in the panel manufacturer's recommended grid system, with clips, to prevent dislodging the panels. Ceilings and support structure must be non-combustible, in accordance with Transport Canada requirements. Ceilings must have vibration dampers fitted.
- C.8.5 New deckheads and linings must be installed as per the Design Drawings and according to manufactures instructions.
- C.8.6 Linings in way of stiffeners and ceilings must be supported by a system of metal furring.
- C.8.7 Contractor must ensure openings are installed and labelled to access any controls such as valves or power supplies located behind the linings.

19.1.D Statement of Work

D.1 General

- D.1.1 Contractor must make a written record of all weights on and weights off.
- D.1.2 The Contractor must lock out electrical power and domestic water to the main deck during construction and must re-establish operational power, water, and grey water after completion of the work.
- D.1.3 The Contractor must perform visual inspection of the side structure in the Lab. Visual inspection is to be complemented by ultrasonic testing as per 11.2. Any repairs to the steel or aluminum structure that are required will be subject to PWGSC 1379 action.

D.2 Tear-Out

- D.2.1 All existing interior outfit in the Lab between frame 14 and frame 34 is to be stripped as per the Tear Out Drawing. This includes joiner bulkheads, the door in bulkhead 34, linings, cabinetry, deckheads, electronics, and wiring.
- D.2.2 The Contractor must strip-out all above deck hot and cold water piping servicing the Lab.

- D.2.3 The Contractor must strip-out all above deck grey water piping servicing the Lab.
- D.2.4 The Contractor must remove all gray water piping servicing the Lab up to the bulkhead penetration. Contractor is to inspect the bulkhead penetrations. Replacement of penetrations will be per PWGSC 1379 action if required.
- D.2.5 The Contractor is to strip-out the existing eyewash station and cap the supply piping at deck level.
- D.2.6 Contractor is to inspect the deck drains in the lab. Replacement of deck drains will be per PWGSC 1379 action if required.
- D.2.7 The Contractor must strip-out all 100 to 240 Volt electrical power circuits and wire, lighting, sockets, junction boxes, and heating in way of the refurbishment of the Lab back to electrical panel feeds. Main cabling from switchboard to the existing panels must be pulled back and protected and reused when new panels are installed.
- D.2.8 The Contractor is to install new electrical panels as shown on the One Line drawing.
- D.2.9 All existing communication, alarm, and fire systems are to remain. The Contractor must strip-out and retain all fire detection, communication, and alarm equipment in the Lab. The fire detector must be labelled with its original location before being removed and have its location and rotary switch settings recorded.
- D.2.10 The Contractor must strip-out all electronics from the Lab. Items that are to be reused are noted on the Tear Out drawing. All electronics and equipment that are not to be reused will remain the property of the Canadian Coast Guard and their disposal, storage, or transportation is at the discretion of the Owner's Representative. It is the Contractor's responsibility to dispose of any stripped-out equipment indicated by the Owner's Representative as equipment for disposal.
- D.2.11 All items that are to be reused must be stored in a protected environment. Existing Public-Address system, Electronics, Phone, Alarm and monitoring, and Fire Detection systems to be protected during strip-out for reuse.

D.3 Asbestos Abatement

- D.3.1 It is not known if there is asbestos containing material behind the wall panels or the deck head of the Lab. Some of the existing pipe lagging (insulation) on the vessel has been identified in the Pinchin Asbestos Report as asbestos containing material, but it is no known if there is any in the Lab. The Contractor must notify the TI/TA of any asbestos containing material.

- D.3.2 If asbestos containing material is discovered in the Lab the Contractor must perform asbestos remediation. If required this will be through PWGSC 1379 action and must comply with the following:
- D.3.3 The contractor shall comply with all aspects of the stated safety Regulations and referenced publications for the removal of asbestos.
- D.3.4 The contractor must file a Notice of Project (NOP) with WorkSafe BC, in writing or by fax, at least 24 hours before starting the project.
- D.3.5 The Contractor must perform an initial Asbestos air sample and then continuous Asbestos air sampling outside all entrances and exits to the Lab until two (2) days after the strip-out is complete at which point a final air sample will be taken. All samples must be logged and submitted with the contractors QA document.
- D.3.6 The Contractor shall conduct a risk assessment for asbestos exposure, develop an exposure control plan, write safe work procedures, and implement necessary controls as well as ensure that workers and supervisors are adequately instructed and trained.
- D.3.7 The Contractor shall keep written records of all training.
- D.3.8 The contractor shall ensure that all workers working in the area containing asbestos use proper PPE such as disposable Tyvek coveralls (or similar) with integral head covering that fits snugly at the wrists and ankles, booties, half-face respirator with P100 HEPA cartridges. All vacuum cleaners used shall be fitted with HEPA filters.
- D.3.9 The Contractor shall have an Exposure Control Plan and a Respirator Plan in place.
- D.3.10 The Contractor shall clearly mark the designated work area boundary and Place signs around the work area warning people not to enter the work area unless authorized to do so.
- D.3.11 Where complete removal of all asbestoses material is not possible, the Contractor must seal all exposed asbestos that is disturbed (where the lagging is cut by the contractor or otherwise damaged) and must not be removed to prevent fragmentation. Contractor must mark all ACM materials and record them in their QA manual and report it to PHH for their Asbestos Survey
- D.3.12 After the removal of ACM the affected area shall be cleaned using a vacuum with HEPA filter, wiping with damp cloth or by wet sweeping or mopping.
- D.3.13 For the disposal of asbestos waste the contractor shall ensure that all waste materials are placed in impervious containers — (poly bags at least 0.15 mm (0.006

in. or 6 mil) thick) — inside the asbestos work area, seal the containers, and label or tag them “ASBESTOS.” Asbestos waste should be double-bagged.

- D.3.14 Before removing the sealed containers from the work area, the Contractor shall decontaminate the outside of the containers by damp-wiping or by cleaning with a HEPA vacuum.
- D.3.15 The contractor shall package the sealed impervious containers so that they will not be punctured during handling and transportation to the disposal site. This is normally done by double-bagging them. A disposal certificate is required as part of the Contractors QA documents.
- D.3.16 The Contractor shall make prior arrangements with the appropriate authorities to deliver asbestos waste to assigned dump sites and inform transport drivers of precautions they must take. Transport vehicles may be required to display signs or placards specifying the nature of the cargo (see the Transport of Dangerous Goods Act).
- D.3.17 Upon removal of asbestos the entire space between frames 14 and 34 in the Lab is to be thoroughly cleaned prior to reconstruction work.
- D.3.18 Additional asbestos discovered after removal of deckheads or paneling is to be subject to PWGSC 1379 work arising procedure.
- D.3.19 The contractor is to subcontract Pinching PHH at 13775 Commerce Pkwy #200, Richmond, BC, V6V 2V4, Phone (604) 244-8101 to conduct a post work asbestos survey and update the ships Asbestos Survey Book.

D.4 Structural Work

The Contractor must install a new fire door in bulkhead 34. The door must be a B class steel fire door and fitted with a 10”x10” window at minimum. The coaming must remain in place and will most likely necessitate a custom door. Suggested suppliers are Earl’s Marine Enclosures at 9725 192 St, Surrey, BC V4N 4C7 (604) 888-9498 or Diamond Sea Glaze at 26995 Gloucester Way, Langley, BC V4W 3Y3 Phone: 604-607-0091

- D.4.1 Contractor must pay particular attention to the transition between the steel and aluminum structure.
- D.4.2 Contractor must ensure that the new door has a sufficient amount of room to swing fully open. Door can be moved outboard of existing location to suit.

D.5 Painting

- D.5.1 The Contractor must coat the deck between frames 14 and 34 in the Lab with epoxy paint as per Interspec recommendations and as shown on the finishing schedule. The contractor is to bid on 60 square meters. Additional areas found requiring coatings are subject to PWGSC 1379 action.
- D.5.2 The Contractor must paint all new structural steel as per Interspec.
- D.5.3 Contractor must paint all areas of steel that will be exposed after outfit such as steel decks and bulkheads as per Interspec.

D.6 Insulation

- D.6.1 The Contractor is to inspect the insulation once the panelling is removed. Required repairs to the insulation will be thru PWGSC 1379 action.
- D.6.2 The Contractor must insulate all hot and cold water piping in the Lab.

D.7 Piping

- D.7.1 Contractor is to install new grey water, sea water, and hot and cold domestic water piping in the Lab.
- D.7.2 All hot and cold domestic water piping to the Lab must be provided from the existing potable water system.
- D.7.3 All grey water piping to the Lab must lead to the existing grey water tank.
- D.7.4 Contractor shall install new fixtures for all sinks and faucets in the Lab as shown on the design drawings.
- D.7.5 The Contractor must install separate hot and cold water isolation valves for each of the port side and starboard side sinks in a labelled and accessible location.
- D.7.6 The Contractor must super chlorinate the new potable water piping in accordance with the Canadian Coast Guard Fleet Safety Manual after completion of plumbing work. The Contractor must flush the hot and cold water system using the existing potable water system.

D.8 HVAC

- D.8.1 The Contractor is to note that new mechanical drawings for the HVAC system have been issued August 16th 2017 that significantly alter and increase the scope of work from the original work package. These drawings # 11424-4-400-01 HVAC Electrical, 1146-04-507-01 HVAC Sea Water System, 1146-3-508 Wet Lab HVAC System and 1446-4-508-01 HVAC System RA are the current drawings and earlier drawings are to be discarded.

- D.8.2 Contractor must install new HVAC ducting in the Lab, the Machinery Control Room (MCR), Foc'sle and Bridge deck as shown on the HVAC drawing. Contractor is to reuse existing ducting where appropriate.
- D.8.3 Contractor must install new air handler on the deck above the Lab. Contractor is to confirm the size, location and inlet size of the air handler.
- D.8.4 The Contractor must remove the existing air handler on the bridge deck and tee into the ducting as per drawing.
- D.8.5 Contractor must install new fresh air diffusers. Diffusers are to be as shown on the HVAC drawing.
- D.8.6 Contractor must modify the Lab HVAC to supply conditioned air from the new air handler to the main deck, lower and bridge deck accommodation areas.
- D.8.7 The Contractor must install a new CFM condenser unit in the engine room as per drawing. The Contractor must fabricate a base and save all, plumb and wire both supply and controls.
- D.8.8 Contractor must install a new electrical cable to the HVAC unit on the boat deck as per drawings.

D.9 Electrical

- D.9.1 The Contractor is to install all new 100 to 240-volt electrical wiring throughout the Lab except for the existing feeder cable from the switchboard to the panels. The one line diagrams in the drawing package identify the different power supplies for each system.
- D.9.2 The Contractor is to install new electrical outlets and lighting as per the Switches and Outlets drawing.
- D.9.3 The Contractor must reinstall all fire detection, communication (including public address system), and alarm equipment.
- D.9.4 The Contractor is to supply and install emergency lighting in the Lab as per the Lighting Arrangement drawing.
- D.9.5 The Contractor is to run new wire to the lights and to connect to the existing 24V feed as specified in the design drawings.
- D.9.6 During construction, the Contractor shall disconnect all of the electronic equipment. The existing GSM that is to be reused and the new GSM shall be installed by the

Contractor. The equipment location shall be as shown in the arrangement drawings and optimized with consultation of the Owner's Representative.

- D.9.7 The Contractor must run new cable from each piece of electronic equipment to their respective power distribution and controls. All cabling must meet the manufacturer's specifications and be labelled in accordance with section C.2 Cables.

D.10 Arrangement and Outfit

- D.10.1 The Contractor shall replace all cabinetry, linings, deckheads, and other furnishings in the Lab as per the design drawings.
- D.10.2 The Contractor is to finish the Lab in accordance with the design drawings.
- D.10.3 Contractor must re-install all fire equipment.
- D.10.4 Contractor shall provide and install nameplates for the new fire door in the bulkhead at frame 34.

19.1.E Proof of Performance

E.1 Inspection Points

- E.1.1 Hold before any installation for inspection of structure, bulkheads and decks for corrosion and damage.
- E.1.2 Hold before obstructing vertical wire and pipe transits of all decks.
- E.1.3 Hold before obstructing bulk head wire and pipe transits at frame 14 and frame 34.
- E.1.4 Hold before unsealing the duct work. If the seal is broken before installation is started the Contractor must vacuum out the duct work and test for asbestos.

E.2 Testing/Trials

- E.2.1 The Contractor must demonstrate that each exiting and each new bulkhead penetration for both piping and wire transits have maintained the required watertight boundaries and are sealed against leakage. The TI/TA will accept ultrasonic testing.
- E.2.2 The Contractor must test water supplies and water drains and demonstrate that the piping is functional and there are no signs of leakage.
- E.2.3 Contractor must prove all drain lines to be clear and free of leaks.
- E.2.4 All electronic systems must be demonstrated to be complete and operational.

E.2.5 The Contractor must test water to Health Canada potable water standards.

E.2.6 The Contractor must test the Lab public address system for the TI/TA.

E.2.7 The Contractor must test the Lab fire detection system for the TI/TA.

E.3 Documentation

E.3.1 Upon completion of constructor the Contractor shall produce as-built drawings for all affected systems and the general arrangement.

E.4 Training – Not Used