USCG HOMELAND SECURITY CUTTER – LIGHT ICEBREAKER (HSC-L)

DESIGN AND READINESS REVIEW REQUIREMENTS AND CRITERIA ATTACHMENT J-2

Version: [ORIG]

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Homeland Security

Scope: This attachment defines the entrance, demonstration and exit criteria for the major Technical Reviews for the HSC-L program.

A. Preliminary Design Review (PDR)

A.1 The Contractor shall demonstrate successful completion of the following Entrance Criteria:

A.1.1 Present any proposed changes to the contract design that are technically feasible and consistent with a product that can meet the HSC-L System Specifications.

A.1.2 The revised contract design is balanced with internally consistent and convergent design characteristics of the Principal Dimensions, Arrangements, Area / Volume, Structures, Weight, Stability, Propulsion Power and Electric Power from a common design baseline with minimal risk of subsequent adverse changes.

A.1.3 The revised contract design incorporates vendor furnished information (VFI) for equipment identified for mission critical functional areas.

A.1.4 [A00001] Contract deliverables per Table 1 have been submitted to the Government per Attachment J-4 CDRL timeframe. ~~15 days prior to PDR or earlier and have been approved or accepted as applicable, and comments provided by the Government have been resolved.~~

A.1.5 Engineering descriptions of the ship system and subsystems and associated architecture are complete, as demonstrated by Government concurrence of the design changes to the following subjects:

A.1.5.1 General arrangement

A.1.5.2 Hull and deckhouse structure and scantlings

A.1.5.3 Propulsion system and bow thruster, including resistance, powering, and maneuvering (i.e., station keeping for ATON)

A.1.5.4 Control surfaces, rudder sizing, and turning performance

A.1.5.5 Weight estimate, intact stability, damage stability, and towing stability

A.1.5.6 Details of the production design for the electrical power generation, storage, and distribution system

A.1.5.7 Interior lighting system

A.1.5.8 Exterior lighting system

A.1.5.9 Pilothouse arrangement and seating

A.1.5.10 Machinery space(s) arrangement

A.1.5.11 Details of the heating, ventilation, and air conditioning systems

A.1.5.12 Mast and antenna configuration

A.1.5.13 Fire detection and suppression system

A.1.5.14 Installation details of the electronics, communications, and navigation systems

A.1.5.15 Propulsion controls, steering system, bow thruster, and autopilot

A.1.5.16 Human-machine interfaces

A.1.5.17 Aft deck arrangement including ATON and towing tackle equipment, configuration and controls

A.1.5.18 Galley, berths, and habitability details.

A.1.5.19 Human factors engineering for operators and maintainers

A.1.5.20 System reliability

A.1.5.21 Noise and vibration

A.1.5.22 Coating system, including a preservation plan in accordance with SFLC Std Spec 6310.

A.1.6 Verification Planning efforts have been established, to include:

A.1.6.1 Modeling and Simulation support efforts.

A.1.6.2 Test and Integration approach.

A.1.6.3 Inspection and Certification approach.

A.1.7 Design margins and service life allowances are documented and are in compliance with the HSC-L System Specifications.

A.1.8 Requests for Action (RFAs), Action Items, and deficiencies documented from prior review (i.e. kick-off meeting) have been resolved.

A.2 During the PDR, the Contractor shall:

A.2.1 Conduct an IMS Review

A.2.1.1 The Contractor shall provide a description of the process by which the IMS is assembled and updated, logical linkages are established, resources are applied, and the level of fidelity for the various types of work contained in the IMS, including the following efforts:

A.2.1.2 Design and Production schedule (Including PDR, CDR and PRR acceptance of contract deliverables by the Government)

A.2.2 Discuss any System Software and Cyber-related Requirements updates

A.2.3 Integrated Logistics Support (ILS) strategy development plan of action with milestones.

A.2.4 Human Systems Integration (HSI) and Human Factors Engineering (HFE), and System Safety approach and planning.

A.2.4.1 Report on approach and planning for meeting manning constraints.

A.2.4.2 Report and review HSI efforts and risks by each domain, including usability.

A.2.5 Risk assessment that includes descriptions of the top 10 critical risks, including details and status of the proposed risk mitigation actions.

A.2.6 The 3D Product Model review process is established, and reviews have been conducted, including:

A.2.6.1 The 3D Product Model Working group has been founded.

A.2.6.2 The first model review has been held.

A.2.6.3 The model data structure and elements are established.

A.2.6.4 A method for determining the model's percent complete is agreed upon and implemented.

A.2.6.5 The method for exchanging and resolving Government comments is established.

A.2.6.6 The schedule for 3D Model System reviews is established and review timelines agreed.

A.3 The PDR will be closed after the Contractor provides data and narrative in sufficient detail for the Government to verify that the Contractor has met the following Exit Criteria:

A.3.1 The revised design is a complete engineering description of a ship that meets the requirements of the HSC-L System Specification in its entirety.

A.3.2 The design is producible per the Contractor's build strategy.

A.3.3 The design's equipment, systems, and subsystems incorporate proven technology reflecting a high level of maturity proven in a representative HSC-L operating environment with demonstrated functional performance.

A.3.4 HSI analyses to confirm the following:

A.3.4.1 The design supports safe, timely, and efficient human performance to meet mission needs.

A.3.5 The Management Plan and IMS are achievable.

A.3.6 Design tools and engineering resources are available and sufficient to support design maturation and production.

A.3.7 Required Delivery Dates (RDD) and labor support for GFE and GFI are acceptable.

A.3.8 Long Lead Time Material (LLTM) items are identified with in-yard need dates per Attachment J-7 "Pricing Schedule"

A.3.9 Closed Action Items are documented and acknowledged by both the Contractor and Government.

A.3.10 All supplemental entrance criteria contract deliverables listed in A.1.4 shall be either accepted or approved, as applicable.

B. Critical Design Review (CDR)

B.1 The Contractor shall demonstrate successful completion of the following Entrance Criteria:

B.1.1 PDR has been successfully completed.

B.1.2 Action items from previous reviews identified for completion prior to CDR have been successfully addressed and closed out, or a resolution plan has been defined by the Contractor and determined by the Government to be sufficient to proceed with CDR.

B.1.3 Mockups have been developed and Coast Guard feedback incorporated into the design.

B.1.4 [A00001] Contract deliverables per Table 1 have been submitted to the Government per Attachment J-4 CDRL timeframe.~~15 days prior to CDR or earlier have been approved or accepted as applicable, and comments provided by the Government have been resolved.~~

B.1.5 Engineering descriptions of the ship system and subsystems and associated architecture are complete, as demonstrated by Government concurrence of any design changes to the following subjects:

B.1.5.1 General arrangement

B.1.5.2 Hull and deckhouse structure and scantlings

B.1.5.3 Propulsion system and bow thruster, including resistance, powering, and maneuvering (i.e., station keeping for ATON)

B.1.5.4 Control surfaces, rudder sizing, and turning performance

B.1.5.5 Weight estimate, intact stability, damage stability, and towing stability

B.1.5.6 Details of the production design for the electrical power generation, storage, and distribution system

B.1.5.7 Interior lighting system

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B.1.5.10 Machinery space(s) arrangement

B.1.5.11 Details of the heating, ventilation, and air conditioning systems

B.1.5.12 Mast and antenna configuration

B.1.5.13 Fire detection and suppression system

B.1.5.14 Installation details of the electronics, communications, and navigation systems

B.1.5.15 Propulsion controls, steering system, bow thruster, and autopilot

B.1.5.16 Human-machine interfaces

B.1.5.17 Aft deck arrangement including ATON and towing tackle equipment, configuration and controls

B.1.5.18 Galley, berths, and habitability details.

B.1.5.19 Human factors engineering for operators and maintainers

B.1.5.20 System reliability

B.1.5.21 Noise and vibration

B.1.5.22 Coating system, including a preservation plan in accordance with SFLC Std Spec 6310.

B.1.6 Government concurrence that the 3-D Product Model is at a maturity level that allows for verification of the following:

B.1.6.1 Arrangements meet HSC-L Design Artifacts and System Specification requirements, and that there are no equipment interferences.

B.1.6.2 Virtual walkthroughs and analyses to confirm that HSI requirements are met by the design.

B.1.7 The design incorporates Vendor Furnished Information (VFI) for all selected equipment for mission critical functional areas.

B.1.8 Speed power analysis is complete and results have been incorporated into the design.

B.1.9 Design margins and service life allowances are documented in compliance with the HSC-L Specification.

B.1.10 Identified technical risks have been documented in the CRMP database and acceptable mitigation plans developed. Mitigation steps scheduled for completion prior to CDR have been completed.

B.1.11 C5I system and component materials have been identified.

B.1.12 Mitigations for safety and HSI risks, identified and agreed upon at PDR, have been incorporated into the design.

B.1.13 The Contractor shall demonstrate progress of activities to prepare the production facility for execution of the Contractor's build strategy.

B.1.13.1 Submit a list of major project milestones with scheduled start and completion dates for each activity relevant to the Contractor's build strategy at the facility, and a risk and opportunity register outlining planned mitigations to prepare the facility and workforce to support the start of construction based on the Contractor's IMS.

B.2 During the CDR, the Contractor shall:

B.2.1 Provide an update to the IMS

B.2.2 Update the status of system Software and Cyber-related requirements

B.2.3 Provide an update to the ILS strategy.

B.2.4 Provide an update to the HSI and HFE, and System Safety approach.

B.2.4.1 Report on update to meeting manning constraints.

B.2.4.2 Report and review HSI efforts and risks by each domain, including usability.

B.2.5 Risk assessment that includes descriptions of the top 10 critical risks, including details and status of the proposed risk mitigation actions.

B.2.6 The 3D Product Model reviews have been conducted.

B.3 The Contractor shall provide data and narrative in sufficient detail for the Government to verify that the Contractor has met the following Exit Criteria:

B.3.1 The design's equipment, systems, and subsystems incorporate proven technology reflecting a high level of maturity proven in a representative HSC-L operating environment with demonstrated functional performance.

B.3.2 The ship design satisfies contract requirements.

B.3.3 Progress against risk mitigation plans provides confidence that the risks will be acceptable at PRR.

B.3.4 C5I Functional Interface Diagram demonstrates acceptable cost and performance risk.

B.3.5 Risk mitigation has been established for any Contractor schedule issues from Preliminary C5I System Requirements Traceability and Verification Matrix allocation to Hardware Configuration Items (HWCIs) and Computer Software Configuration Items (CSCIs).

B.3.6 The Contractor has demonstrated that human engineering, manpower, and safety requirements have been integrated into the design, and demonstrated that the design supports safe, timely, and efficient human performance to meet mission needs.

B.3.7 Identified safety and HSI risks from analysis, modeling, and testing, have been documented and tracked in the Hazard Tracking System and HSI Issues and Design Decisions databases. The Contractor has developed mitigation plans, and the mitigation plans are acceptable to the Government.

B.3.8 Identified technical risks have been documented in the CRMP database and acceptable mitigation plans developed. Mitigation steps scheduled for completion prior to CDR have been completed.

B.3.9 IDDs and updated SSDDs for Contractor responsible software / middleware have been submitted.

B.3.10 C5I System Requirements Traceability and Verification Matrix shows allocation to HWCIs and CSCIs.

B.3.11 C5I system and component material selections meet contract performance requirements.

B.3.12 CSCI requirements are defined and accepted as stable.

B.3.13 Interfaces between the CSCI and other configuration items both internal and external to the system are defined and stable.

B.3.14 Software user interfaces are identified, including critical formats and interactions.

B.3.15 Action items from the CDR have been successfully addressed and closed out, or a resolution plan has been defined by the Contractor and determined by the Government to be sufficient to exit CDR.

B.3.16 Closed Action Items are documented and acknowledged by the Contractor and Government.

B.3.17 Demonstrate the IMS, inclusive of Detail Design and Production scope, incorporates major project milestones, with scheduled start and completion dates and relationships to production related tasks, for each activity related to the Contractor's production strategy.

B.3.18 Government concurrence that the 3D Product Model and review process is at a maturity level that allows for verification of the following:

B.3.18.1 80% of the entire 3D Product Model is complete and Model Review Meetings held.

B.3.18.2 3D Product Model and comments made through the Model Review Meetings have been resolved.

~~B.3.18.2~~B.3.19 [A00001] All supplemental entrance criteria contract deliverables listed in B.1.4 shall be either accepted or approved, as applicable.

C. Production Readiness Review (PRR)

C.1 Prior to conducting the PRR the Contractor shall demonstrate successful completion of the following Entrance Criteria:

C.1.1 Action items from previous reviews identified for completion prior to PRR have been successfully addressed and closed out, or a resolution plan has been defined by the Contractor and determined by the Government to be sufficient to proceed with PRR.

C.1.2 CDR has been successfully completed. All exit criteria from CDR are complete or has Government approved resolution plan.

C.1.3 The Developmental Configuration Baseline (DCB) has been established.

C.1.4 [A00001] Contract deliverables submitted to the Government ~~15 days~~

~~prior to PRR or earlier have been approved or accepted as applicable, and comments provided by the Government have been resolved.~~ per Attachment J-4 CDRL timeframe.

C.1.5 3D Product Model and associated Construction Drawings required to support the initial 90 days of production have been accepted by USCG and all compliance comments have been resolved.

C.1.6 Identified technical risks have been documented in the Contractor's Risk Management Plan (SOW C.3.040.1.2) database and acceptable mitigation plans developed. Mitigation steps scheduled for completion prior to PRR have been completed.

C.1.7 Confirmation that mitigations for safety and HSI risks, identified and agreed upon at CDR, have been incorporated into the design.

C.1.8 The Contractor shall demonstrate progress of activities to prepare the production facility for execution of the Contractor's build strategies.

C.1.8.1 Not later than 7 days prior to PRR submit an updated report detailing progress of all major project milestones identified at CDR for each activity relevant to the Contractor's build strategy at the production facility, as well as an updated risk and opportunity register outlining the status of mitigations to prepare the facility and workforce to support the start of construction based on the Contractor's IMS.

C.1.8.2 Not later than 7 days prior to PRR submit a list of major project milestones with scheduled start and completion dates for each activity relevant to the Contractor's build strategy at the facility, and a risk and opportunity register outlining planned mitigations to prepare the facility and workforce to support the start of construction based on the Contractor's IMS.

C.1.9 Government concurrence that the 3D TDP's 3D Product Model and review process is at a maturity level that allows for verification of the following:

C.1.9.1 The entire 3D Product Model is complete and a Model Review Meeting held.

C.2 During the PRR, the Contractor shall provide data and narrative in sufficient detail for the Government to verify that the Contractor has met the following Exit Criteria:

C.2.1 Detailed work instructions, 3D Product Model output, drawings and processes attached to the Build Strategy and Producibility Report to support the start of construction and initial 90 days of production have been reviewed and accepted without comments by the Government. The Contractor shall identify all changes planned and/or that may occur prior to production for work instructions and processes during this period.

C.2.2 Required Contractor staffing levels (with proper qualifications) are established and available for Program Management, Engineering and

Production (by Trade) for the initial 90 days of production.

C.2.3 A facility preparedness and utilization assessment has been conducted (including other on-going and future scheduled work) with Government participation demonstrating that facilities, e.g., temporary and/or new fabrication buildings, erection/outfitting canopies, transporters, cranes, jigs, special fixtures, and fixed and/or temporary infrastructure required to support the Contractor's build strategy are in place to support production.

C.2.4 The IMS has been submitted and reviewed, and includes all activities specific to preparing and outfitting the production facility and workforce to start of construction, and accounts for supplier/vendor timelines if the Contractor chooses to outsource manufacture of assemblies, sub-assemblies, etc.

C.2.5 Identified safety and HSI risks from analyses, modeling, and testing, have been documented and tracked in the Hazard Tracking System and HSI Issues and Design Decisions databases. The Contractor has developed mitigation plans and the mitigation plans are acceptable to the Government.

C.2.6 Demonstrated that human engineering, manpower, and safety requirements have been integrated into the design, and demonstrated that the design supports safe, timely, and efficient human performance to meet mission needs.

C.2.7 Government concurrence that the 3D TDP's 3D Product Model and review process is at a maturity level that allows for verification of the following:

C.2.7.1 3D Product Model comments made through Model Review Meeting have been adjudicated.

C.2.7.2 Comments against model elements that are part of the initial 90 days of production have been resolved.

C.2.7.3 All systems shall have been submitted and completed Government 3D Product Model review.

~~C.2.7.3~~C.2.8 [A00001] All supplemental entrance criteria contract deliverables listed in C.1.4 shall be either accepted or approved, as applicable.

D. Test Readiness Review (TRR)

D.1 Prior to conducting the TRR, the Contractor shall demonstrate successful completion of the following Entrance Criteria:

D.1.1 The HSC-L construction has been completed and all systems have been groomed to verify they perform as intended.

D.1.2 The design is fully integrated, baselined, and placed under formal configuration control, and all ECPs and RFVs have been resolved or have completed mitigation plans established.

D.1.3 No later than 60 days prior to TRR, all test plans (Acceptance Tests and One-

Time Tests), test cases, and test procedures are fully drafted, reviewed, and approved.

D.1.4 The test environment is fully set up, verified, and available.

D.1.5 Any and all required test data have been generated, staged, and validated for use.

D.1.6 All test execution personnel are identified, fully trained on the test procedures, and available.

D.2 During the TRR, the Contractor shall:

D.2.1 Walk through all approved test plans, test cases, and test procedures

D.2.2 Confirm that the test environment is fully setup and available

D.2.3 Confirm that test personnel are trained on the test procedures and are available to conduct the tests.

D.3 The TRR will be closed after the Contractor provides data and narrative in sufficient detail for the Government to verify that the Contractor has met the following Exit Criteria:

D.3.1 All critical action items, discrepancies, and risks identified during the TRR are resolved or have formally approved mitigation plans.

E. Summary Table

Table 1 provides guidance regarding what the Government considers CDRLs to be completed as entrance criteria for each design review.

Table 1: Deliverables

CDRL	CDRL Name	PDR	CDR	PRR	TRR
040-001	Meeting Agenda, Presentation Materials and Action Items	X	X	X	X
040-002	Integrated Master Schedule (IMS)	X	X	X	
041-001	Configuration Status Accounting Data		X		
041-003	Engineering Change Proposal	X	X	X	X
041-004	Request for Variance	X	X	X	X
073-001	Airborne Noise Control and Vibration Analysis		X	X	
073-002	Torsional Vibration Analysis & Report	X	X		
074-001	Welding Schedule and Details			X	
074-002	Non-Destructive Testing (NDT) Report				X
079-001	Intact and Damage Stability Analyses	X			
083-003	List of Special Tools and Test Equipment (LST&TE)		X		
085-001	Drawing Number Assignment Report	X	X	X	

CDRL	CDRL Name	PDR	CDR	PRR	TRR
085-002	3-Dimensional Technical Data Package (3D TDP)		X	X	
085-004	3D System Model Reviews	X	X	X	
092-001	Acceptance Test Plan				X
092-002	Acceptance Test Procedures				X
092-003	Acceptance Test Schedule				X
096-001	Weight Control Plan	X			
096-002	Allocated Baseline Weight Estimate (ABWE)	X			
100-001	Structural Foundations Report and Calculations		X		
100-002	Mast Structural Analysis		X		
100-003	Standard Structural Details		X		
100-004	Foundations Drawing			X	
101-001	Tank Arrangements and Detail Drawing		X		
201-001	Machinery Arrangement Drawings	X	X	X	
202-001	Machinery Controls Network Architecture Report		X		
243-001	Propulsion Shafting Plans and Particulars		X		
243-002	Propulsion Shafting Alignment Calculations and Procedures	X	X		
245-001	Propeller Drawing		X		
252-001	Failure Modes and Effects Analysis for Electric/Electronic Control System for Propulsion and Steering		X	X	
300-001	Booklet of Standard Wiring Practice	X	X		
300-002	Electrical One Line Diagram	X	X	X	
300-003	Electric Plant Load Analysis (EPLA)	X	X		
300-004	Electrical Plant	X	X		
300-005	Easy Power Model Reports	X	X	X	
324-001	Switchboards and Power Panel Drawings	X	X		
400-001	Electronics Systems Schematic Block Diagrams	X	X		X
400-002	Electronics Systems Elementary Wiring Diagrams		X		X
401-001	Topside Arrangements and Detail Drawing			X	
402-001	Interface Design Description (IDD)			X	
402-002	System/Subsystem Design Description (SSDD)			X	
435-001	Electronics System Architecture		X	X	

CDRL	CDRL Name	PDR	CDR	PRR	TRR
	Report				
436-001	Electric Alarms, Safety & Warning Systems			X	
504-001	Instrument and Gauge Calibration Report				X
508-001	Insulation Schedule for Machinery, Equipment and Piping		X	X	
512-001	HVAC System Diagram, Equipment List, Heating and Cooling Load Calculations		X		
512-002	HVAC System Duct Pressure Loss Calculations			X	
580-001	Working Deck Arrangement and Detail Drawings	X			
582-001	Mooring, Towing and Anchor Equipment and Systems			X	
589-001	Crane Assembly and Detailed Drawings		X		
601-001	General Arrangement Drawings		X	X	
612-001	Walkways, Handrails, Gratings and Floor Plates	X			
620-001	Doors, Hatches & Manholes Schedule			X	
625-001	Window Schedule and Drawing		X		
631-001	Paint Schedule				X
633-001	(Anode Certification) Cathodic Protection System Drawing and Computational Analysis		X		
634-001	Deck Covering Schedule and Drawing			X	
635-001	Insulation and Sheathing Schedule and Drawing		X	X	
640-001	Space Arrangements Drawings		X		