RADIAN/MG-93/0019

COASTAL, HARBOR AND INLAND WATERWAY (CHI) SERVICE BOAT PROGRAM

RADIAN INC.

FEBRUARY 1993

US ARMY BELVOIR RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

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CONTENTS

CONTENTS - Continued

I. INTRODUCTION.

A. TASK: Provide engineering support for the Coastal, Harbor and Inland Waterway (CHI) Service Boat Program to analyze and evaluate the CHI Service Boat Test Bed by:

1. Preparing a cost assessment.

2. Developing a test plan.

3. Providing logistic support; spare and repair parts, special tools, and test measurement and diagnostic equipment.

4. Performing material failure analysis.

5. Evaluating the CHI Service Boat test bed to meet field requirements.

B. CHI SERVICE BOAT TEST BED:

1. The CHI Service Boat test bed was delivered to Fort Belvoir for initial operation, development of operator instructions for target audience use, development of a crew training plan, preparation of the Safety Assessment Report (Report Number VSE/AD/0034-91/46RD) and issuance of the Interim Safety Release for military operational feasibility testing. A copy of the Interim Safety Release is provided at Appendix A. The CHI Service Boat test bed was designated by Fort Belvoir as CHI-64 for testing purposes.

2. CHI-64 was delivered to Fort Eustis, VA, for technical and operational feasibility testing. Crew training was provided onboard CHI-64 for the target audience which consisted of two assigned crews, support maintenance personnel and Marine Standardization Examiners. The training was conducted according to the Crew Training Plan. A copy is provided at Appendix B.

II. COST ASSESSMENT.

The cost assessment is based on the initial cost of the CHI-Service Boat Test Bed, Government-furnished property, the operating and support cost during the testing period and projected cost of an on-condition cycle maintenance period.

A. Hardware Costs. These actual costs include the GSA Schedule CHI Service Boat Test Bed (CHI-64), basic issue items, and modification to the test bed to meet military communication and habitability requirements.

1.	Test Bed	$220,000.00
2.	Basic Issue Items	7,500.00
3.	Modifications	60,000.00
	Hardware Cost Total:	$287,500.00

B. Government-Furnished Property (GFP). The GFP provided to the boat builder was that communication equipment common to Army watercraft and not available on the commercial market.

1. The equipment cost was obtained from the June 1990 Army Master Data File (FY 90).

a.	Radio Set, AN/VRC-46	$4,986
b.	Transponder, AN/APX-72	$3,350
c.	Components used with the AN/APX-72	
(1)	Transponder Test Set, TS-1843/APX	$815.76
(2)	Computer, KIT-1A/TSEC	No Data Available
(3)	Antenna, AS-177A/UPX	$690.00
(4)	Mount, MT-3513 (TS-1843/APX)	$144.00
(5)	Mount, MT-3949A/U (KIT-1A/TSEC)	$19.48
d.	Electrical Transient Suppressor MX-7778A/GRC	$257.00
	Estimated GFP Cost Total:	$10,262.24

2. The GFP cost was estimated for several reasons:

a. No cost data is available for the computer, KIT-1A/TSEC, item 1.c.(2).

b. A box, transponder set, was fabricated and installed to assemble the transponder, item 1.b., and its components, items listed in 1.c., into a set. No cost data is available for the box.

c. The Transponder and computer were not provided because they are classified equipment that would only be provided upon deployment. Their cost may not be applicable to the CHI-64, however, the remaining components have been installed for the immediate installation of the transponder and computer.

d. The Electrical Transient Suppressor, item 1.d., was not available during construction. The electrical system was configured to allow for its later installation. Its cost may not be applicable to the CHI-64.

C. Operating Costs. This cost includes the annual pay of the military crew assigned to the CHI-64 by the testing agency and the projected diesel fuel and lubricating oil costs based on 1000 hours of operation.

a. Military crew (FY 92)

TITLE	MOS	GRADE	COST
Coxswain	88K	SSG (E-6)	$ 37,535.00
Engineer	88L	SSG (E-6)	37,535.00
Seaman	88K	PFC (E-3)	22,025.00
Engineman	88L	PFC (E-3)	22,025.00
		Crew Cost Total:	$119,120.00

NOTE: Cost information was extracted from the Army Material Command Memorandum, AMCRM-E, dated 7 April 1992, Subject: Military Pay Rates in Baseline Cost Estimates. PCS costs have been deducted.

b. Diesel fuel

Engines (2):

Rate of Consumption: 13.5 GPH per engine

Operating Cost: 1000 Hrs x 13.5 GPH x 2 Engines x $.70 (FY 92) = $18,900

Generator (1):

Rate of Consumption: .9 GPH

Operating Cost: 1000 Hrs x .9 GPH x 1 x $.70 (FY 92) = $630.00

Diesel Fuel Cost Total: $ 19,530.00

c. Lubricating Oil

Engines (2):

4 gallons per oil change per engine

100 hours between oil change = 10 changes

4 gallons x $2.32 (FY 92) x 10 changes x 2 engines = $185.60

Generator (1):

1 gallon per oil change

100 hours between oil changes = 10 changes

1 gallon x $2.32 (FY 92) x 10 changes = $23.20

Lubricating Oil Cost Total: $208.80

Operating Cost Total: $138,858.80

NOTE: Cost information was extracted from Defense Logistics Agency Memorandum DFSC-RB, dated 11 September 1992, Subject: Defense Fuel Supply Center (DFSC) standard prices for bulk petroleum products.

D. Support costs. This cost includes the actual expenditures for repair parts and services as of the date of this report and the projected cost of an on-condition cycle maintenance period.

1. Repair parts and services $15,149.83

2. On-condition cyclic maintenance $50,000.00

NOTE: This projected cost is based on the estimated cost of an on-condition cyclic maintenance period for a boat, design 4003, designation J, which is comparable in size and equipment.

Support Cost Total: $65,149.83

E. Cost Summary. The cost summary for the CHI Service Boat Test Bed as of the date of this report is:

Hardware Cost	$287,500.00
GFP Cost (Estimated)	10,262.24
Operating Cost	138,858.80
Support Cost	65,149.83
Total	$501,770.87

NOTE: The cost total should be updated to include the cost of the planned upgrading of the engine room CO_2 system after completion.

III. TECHNICAL AND OPERATIONAL FEASIBILITY TEST PLAN.

A. Development:

1. The Technical and Operational Feasibility Test Plan was developed for testing of the CHI Service Boat Test Bed. A copy is provided at Appendix C.

2. The Draft Technical Issues for the CHI Service Boat, dated 28 June 1990, issued by TECOM, and the Independent Evaluation Plan, dated 16 December 1982, issued by TRADOC, were used and tailored to the changes identified

in the Draft ROC, dated 20 March 1991, to identify technical and operational characteristics. Copies of these three documents are provided at Appendix D.

B. Testing Objectives:

1. Technical Feasibility Testing Objective: The objective of Technical Feasibility Testing is to assess the technical characteristics of the CHI Service Boat Test Bed.

2. Operational Feasibility Testing Objective: The objective of Operational Feasibility Testing is to assess the operational characteristics of the CHI Service Boat Test Bed.

C. Resources: Resources required to achieve successful feasibility testing are:

1. A fully operational CHI Service Boat (CHI-64) with all technical documentation, basic issue items, and fitted out for its intended mission.

2. A target audience crew with all programmed training completed.

3. Logistical support will be provided by Fort Belvoir to insure operational readiness of CHI-64 during testing. Additionally, this will provide ample time to establish logistical support through the Army supply system.

D. Test Site: Feasibility testing will be conducted at Fort Eustis/Fort Story, VA, or at additional locations in performance of assigned military missions. The test environment will be representative of the expected operational environment.

E. Testing Mission: The testing mission shall be the assigned CHI Service Boat mission, to the maximum extent possible, of providing minimal passenger and light cargo transport, waterborne command and control, and security services. Tasks will include passenger ferry services between anchored shipping and shore facilities, transport of maintenance contract teams and other work crews, transport of repair parts, mail, and other light cargo. Provide for command and control during waterborne operations and waterborne security patrols for anchored shipping, harbor facilities, and during operations.

F. Test Report: The activity conducting the feasibility testing shall provide a Feasibility Test Report at the conclusion of the testing.

IV. LOGISTIC SUPPORT.

A. Initial Logistic Support: The objectives of the initial logistic support for CHI-64 were:

1. Provide operational, training and testing documentation in a format acceptable to and usable by the testing activity and target audience.

a. CHI-64 Operator Instructions were developed that included operation and maintenance instructions for the boat and onboard equipment, onboard spare parts, and a basic issue item listing.

b. A Crew Training Plan was developed to train the target audience and to document the training for licensing purposes. See Appendix B.

c. A Technical and Operational Feasibility Test Plan was developed for testing of the CHI Service Boat Test Bed and documentation of the results. See Appendix C.

d. Copies of all documentation were provided to the testing activity and target audience, placed onboard the CHI-64, and remain on file at Fort Belvoir.

2. Identify and provide the onboard spare and repair parts for safe operation and maintenance. The quantities were increased to provide for extended operation of CHI-64.

3. Identify and provide the basic issue items for safe operation and maintenance. This included tools, special tools, test measurement and diagnostic equipment, and personal safety equipment.

B. Testing Logistic Support: The objective of the testing logistic support was to insure the operational readiness of CHI-64 to perform assigned missions. This was accomplished by:

1. Replenishment of onboard spare parts and providing repair parts for crew level maintenance.

2. Providing support maintenance for repair above crew level.

3. Repair of failed components by warranty claim action with the original manufacturer.

4. Providing engineering support to the crew.

C. Follow-On Logistic Support: Follow-on logistic support is to be provided by the operating activity at the conclusion of testing. The testing period provides sufficient time to establish logistical support through the Army supply system.

V. MATERIAL FAILURE ANALYSIS.

A. Material Failure: A material failure analysis was conducted on failures experienced at the component and system levels for the CHI-64.

1. Objectives. The objectives of the failure analysis were:

a. To verify that the GSA schedule equipment is compatible with the extensive and rugged service required in military operations.

b. To identify components that require replacement because of repeated failures or limited reliability.

2. Failure Analysis Reports. A total of 27 individual component and system failure analysis reports are provided at Appendix E. They are arranged in the basic order of occurrence of the failure. Several reports address repeated failure of a component to track its repair and/or correction.

3. Failure Operating Hours. The engines and generator are the only onboard components that have an operating hour meter installed. For the remaining components, estimated or engine operating hours are used as the failure operating hours to establish a relative failure point.

4. Mission Support. As of the date of this report, the CHI-64 has performed two extended missions in support of Operation Ocean Venture, the North Carolina Segment (May 92) and Florida Segment (August 92). It has accumulated a total of 404 engine operating hours.

B. Material Failure Analysis: The material failure analysis will be discussed in three elements: a combined overview of all failures, critical failures that effect operational readiness and deficiencies that effect the overall mission capability of the CHI-64.

1. Overview. An overview of the failures experienced by the CHI-64 indicates two major points:

a. GSA Schedule. Procurement from the GSA schedule is not a viable nor a cost-effective strategy for the CHI Service Boat Program.

(1) The purchaser must accept the hull design and components as offered on the GSA schedule.

(a) The CHI-64 hull design is not compatible with the shipping and watercraft equipment with which it must interface while performing its assigned mission. This is highlighted by the hull damage sustained and the problems experienced with transferring passengers/cargo during both segments of Operation Ocean Venture.

(b) The pleasure-boat-type components are not ruggedized for use in the work-boat-type atmosphere of military operation.

(2) Additional cost was incurred:

(a) To modify the GSA schedule boat to meet military communication and habitability requirements.

(b) To provide operator manuals and basic issue items for operation of the boat.

(c) To correct deficiencies that surfaced during testing.

b. Functional Purchase Description. The production CHI Service Boat must be procured using a Functional Purchase Description developed using the approved Operational Requirements Document (ORD).

(1) All operational and technical requirements and design standards can be stipulated to provide a CHI Service Boat that is capable of performing the identified mission requirements.

(2) Quality assurance provisions would be identified that include inspection, testing, and trials for the construction and acceptance of the CHI Service Boat and components.

(3) The logistic support items would be identified. The items will include engineering drawings, technical manuals, basic issue items, and spare/repair parts.

2. Critical Failures. The critical failures which effected the operational readiness of the CHI-64 were:

a. Port and Starboard Exhaust Mufflers. The most critical failure has been the leaking exhaust mufflers caused by overheating.

(1) The failure was detected by water leaking from the forward end of the water-cooled muffler. The leak developed because the hose bibb on the end bell had cracked/failed. This required the engine to be stopped before total failure of the fiberglass muffler. The loss of both engines could jeopardize the crew and/or the CHI-64.

(2) A new design muffler was provided by the muffler manufacturer. This muffler failed and was returned to the manufacturer for analysis. The design was modified by shortening the overall length and reinforcing the hose bibb on the end bells. The manufacturer provided two modified mufflers.

(3) The water injection elbows had to be modified to conform to the engine and muffler manufacturer's recommended design.

(4) The muffler holding clamp had to be modified to correct misalignment of the muffler to the exhaust system fixed components.

(5) During installation of the mufflers, it was discovered that the flexible exhaust joint ribs were damaged. It appears that the ribs were damaged by forcing the securing bolts across them. The hex head on the bolts had been ground down for installation. However, the mating flange holes precluded easy installation.

(6) The engine manufacturer stated that the sea water pump supplied with the engine is correctly sized for a water-cooled exhaust system.

(7) CHI-64 has operated satisfactorily for approximately 20 hours since installation of the modified mufflers. Extended operation is not

expected before April 1993. A repeat muffler failure will require a complete redesign of the exhaust system.

b. Engine Room Entrance Hatches. A critical failure was the engine room hatches leaking water into the engine room.

(1) The failure was detected while operating during inclement weather. The rain and/or sea water running across the deck drained into the engine room. This presented two concerns: Flooding of the engine room and wetting of the engine room components, particularly the auxiliary generator.

(2) The Government recommended that dogs be installed on the hatches and the rear hatch frame housing drain be enlarged and repositioned to the bottom of the housing.

(3) The boat manufacturer installed dogs on the engine room hatches.

(4) During testing, it was discovered that the hatch frame housing was only intermittently welded to the main deck. Consequently, when the housing filled with water, it ran into the engine room.

(5) The Government recommended that the hatch frame housing be completely seal welded to the main deck and the rear hatch frame housing drain be enlarged and repositioned to the bottom of the housing.

(6) The boat manufacturer provided silicone sealant for the hatch frame housing and an unusable plastic fitting and hose for the rear hatch frame housing drain.

(7) The silicone sealant was used to seal the hatch frame housing to the main deck.

(8) The rear hatch frame housing drain was enlarged and repositioned by the Government.

(9) These corrections prevent water from leaking into the engine room except when entering the engine room during severely inclement weather. The silicone sealant is considered a temporary repair.

c. Engine Room Ventilation System. A critical failure was the engine room ventilation system leaking water into the engine room.

(1) The failure was detected while operating during inclement weather.

(2) The system consists of 4 vents, 1 each on the port and starboard side of the pilothouse and 1 each on the outboard side of the port and starboard rear storage cabinets. The vents consist of one entrance louver and a rectangular compartment that opens directly into the engine room.

(3) The rear vents drain onto the fuel tanks.

(4) The forward vents are directly over the engine exhaust manifold. This presents a possibility of a cracked exhaust manifold from cold water hitting the hot exnaust manifold. This would require stopping the engine. With both engines stopped, the CHI-64/crew could be in jeopardy during inclement weather.

(5) The Government recommendations were to move the forward vents to the rear of the pilothouse, the rear vents to the inboard side of the rear storage cabinets and install louvers that would trap and drain the water to the outside.

(6) The rear vents were moved to the inboard side of the rear storage cabinets.

(7) The forward vents had a cover installed that was open at the top and bottom. This cover was replaced with one open only at the after end.

(8) The corrections partially solved the problem. The addition of the recommended louvers is still required to completely solve the problem.

d. Hull Damage. A critical failure in that the inadequate fendering system did not protect the CHI-64 while performing its assigned missions.

(1) The CHI-64 sustained hull damage during both operations in support of Ocean Venture. Sea conditions were Sea State 2 and less.

(2) The CHI-64 was slammed into ships and/or watercraft equipment during cargo/personnel transfer. The pleasure-boat-type fendering system was not designed for these type operations.

(3) Hull damage can be expected on the CHI-64 anytime the environmental condition exceeds Sea State 1 unless the fendering system is modified.

(4) The hull damage was repaired by the Government after each operation.

e. Alternators. A critical failure was the overcharging of the batteries by the alternators.

(1) The failure was detected at the conclusion of the North Carolina Segment (first mission) of Ocean Venture.

(2) The boat manufacturer's representative partially rewired the ground system in the 12 volt DC, 120 volt AC, and 240 volt AC electrical systems. This corrected the overcharging. NOTE: To date, drawings/sketches depicting the changes have not been provided.

(3) The failure reoccurred at the conclusion of the Florida Segment (second mission) of Ocean Venture. The overcharging is now intermittent and appears when both alternators are in operation.

(4) The boat manufacturer's representative replaced both alternators and regulators, rewired the regulators' sensing wires, and operated the engines at various speeds and electrical loads. Both charging systems operated satisfactorily.

3. Deficiencies. The following deficiencies are in addition to those identified in the Failure Analysis Reports. They were compiled from the CHI-64 initial operation, trip reports, discussion with the crew at the completion of their extended missions to support Operation Ocean Venture, and recommended changes to improve operational conditions. The deficiencies further indicate that procurement from the GSA schedule is not a viable strategy for the production CHI Service Boat. A portion of the listed deficiencies were corrected, some were recommended for correction by the operating unit and its support maintenance organization, the engine room CO_2 system upgrade is planned for completion at Government expense, the remaining should be corrected on CHI-64, during on-condition cyclic maintenance, if it is to remain in the inventory. All must be considered during development of the Operational Requirements Document and Functional Purchase Description.

a. Crew Cabin and Engine Room Heaters. Electrical heaters were installed for the crew cabin and engine room. The heaters can be energized from the auxiliary generator or shore power. They were installed for two reasons:

(1) The heaters will allow the crew to work onboard during the winter months without operating the engines. The original crew cabin and pilothouse heaters obtain their heat from the engine cooling systems.

(2) The heaters can be used to maintain the inside temperature above freezing during non-duty hours. Therefore, the engine and auxiliary generator sea water cooling systems will not require winterization, a time consuming effort. Additionally, the engine and auxiliary generator can be exercised during the winter months with a minimum of effort.

(3) Covers were manufactured for the 4 engine room vents to prevent heat loss during operation of the engine room heater.

b. Storage Space. The CHI-64 does not have sufficient storage space for the basic issue items, onboard spares, operating supplies, and crew personal items to perform extended missions. There is no storage space for individual or crew served weapons. This deficiency cannot be corrected without major modification to the CHI-64.

c. Hatch Safety Catch. The lazarette and bow/anchor storage locker safety catches do not hold the hatches open safely. Any movement of the hatch causes the safety catch to release. This information was provided to the boat manufacturer.

d. Handrails. The screws that secure the handrails in the pilothouse and down into the crew cabin are stripping out of the plywood-backed paneling. This deficiency cannot be corrected without modification to the interior paneling of CHI-64.

e. Lifting Slings and Spreader Bars. The requirement for a dedicated set of lifting slings and spreader bars became evident each time the CHI-64 was lifted from the water. This had been a requirement, however, it was deleted based on information from the proposed testing site.

f. Potable Water Tank. Two deficiencies were identified for the tank:

(1) The tank has a 1-1/2" fill line and 3/4" vent. This could lead to possible rupture of the tank or the hoses used to connect the fill and vent lines.

(2) The tank has no means of determining its water level.

(3) Both items could be corrected with minor modifications to the tank/potable water system.

g. Rudder Angle Indicator. The CHI-64 is not equipped with a rudder angle indicator. This is a navigational aid that is used extensively by the coxswain during docking/undocking of the CHI-64. This deficiency could be corrected with minor modification to CHI-64.

h. Access/Step Platforms. The engine room is relatively small and very congested. This requires the crew member to maneuver over, under, and between components to perform maintenance/operational checks and services. Because there are no access/step platforms, the crew member must step into the bilge to perform required actions on the outboard side of the engines and in the rear of the engine room. This is a very serious safety hazard. Numerous slips, scrapes, and minor injuries have been experienced by the maintenance/operational personnel. Small access/step platforms must be installed to provide solid footing for these personnel. This deficiency could be corrected by minor modification to CHI-64. However, drydocking and hull painting would also be required.

i. Starboard Engine. The oil level dipstick on the starboard engine is located at the forward outboard end of the engine, under the main deck. To check the oil, the crew member must extend himself across the engine and reach under the main deck. This presents a hazard to the crew member and/or the engine once the engine is operating and up to temperature: the crew member could sustain a burn trying to check the engine oil level or the engine may be operated with a low oil level. Neither situation is acceptable. This deficiency could be corrected by modification to the engine oil pan.

j. Recommended Changes. A list of recommended changes was submitted by the crew to improve/enhance operational conditions. The recommended changes were evaluated. Those changes considered valid were recommended for completion by the operating unit and its support maintenance organization. Brief

guidance was provided to insure documentation of the changes and identify compatible materials/components.

(1) Modify the life lines and stanchions for easy removal/replacement by the crew. RATIONALE: Prevent damage during cargo/~~personal~~ PERSONNEL transfer operations.

(2) Extend the jack staff 24". RATIONALE: To raise to acceptable height.

(3) Relocate stern light above rubrail. RATIONALE: To improve visibility of the light during night operations.

(4) Add chart cabinet above port side chart table. RATIONALE: Provide flat storage for navigational charts.

(5) Change operation of the pilothouse windows (currently the forward window can be opened, the aft window is stationary). RATIONALE: To improve communication between coxswain and crew during docking/undocking operations.

(6) Provide pigtail adapter for shore power cable (Hubble plug to Marinco plug). RATIONALE: Previously, the shore power cable had the Hubble plug installed to connect to shore power at their docking location. The pigtail will allow connection to shore power at various locations.

(7) Provide black-out curtain for crew cabin. RATIONALE: Improve/insure night vision of coxswain during night operation.

(8) Aft deck area cover. RATIONALE: Protection of the crew from the elements (sun, rain).

(9) Shore power cable rack. RATIONALE: Provide protected storage for the shore power cable.

k. Engine Room CO_2 System. An additional recommended change was to increase the quantity of CO_2 in the engine room. The evaluation (see failure analysis report No. 27) of the recommended change concluded that the system required upgrading to meet CFR requirements. The system upgrade is planned for completion at Government expense. This deficiency is indicative of problems associated with procurement from the GSA schedule.

VI. FIELD REQUIREMENTS EVALUATION.

This evaluation is based on the initial operation of the CHI-64, the material failure analyses identified in Section V and the logistical support provided. The CHI-64 has a total of 404 engine operating hours as of the date of this report.

A. Field Requirements: The elements of the field requirements are identified in the Draft Revised Required Operational Capability for a Coastal, Harbor and Inland Waterway Service Boat, dated 20 March 1991. A copy is provided

guidance was provided to insure documentation of the changes and identify compatible materials/components.

(1) Modify the life lines and stanchions for easy removal/replacement by the crew. RATIONALE: Prevent damage during cargo/personnel transfer operations.

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VI. FIELD REQUIREMENTS EVALUATION.

This evaluation is based on the initial operation of the CHI-64, the material failure analyses identified in Section V and the logistical support provided. The CHI-64 has a total of 404 engine operating hours as of the date of this report.

A. Field Requirements: The elements of the field requirements are identified in the Draft Revised Required Operational Capability for a Coastal, Harbor and Inland Waterway Service Boat, dated 20 March 1991. A copy is provided

at Appendix D. This evaluation will identify those elements that the CHI-64 does not meet and provide a possible solution to meet the requirement, if applicable.

1. Cargo space: Minimum of 100 square feet on the after deck:

a. The after deck provides only 61 square feet of usable cargo space. No cargo tiedown points or equipment were provided. The forward 18" of the after deck must remain clear for the crew to enter/exit the pilothouse. The starboard engine room hatch must remain clear for inspection of the engine room.

b. The size of the after deck will preclude meeting the space requirement. Tiedown points and equipment could be provided at minimal cost.

2. Capability:

a. Possess emergency manual steering:

(1) There is no manual steering capability for the CHI-64.

(2) Installation of a system is possible with modifications. Cost should be minimal.

b. Possess adequate stowage facilities for the Basic Issue Items (BII):

(1) There is not adequate storage space for the Basic Issue Items. Additionally, there is no storage space for crew personal items or individual/crew served weapons. This has presented serious problems during extended operations.

(2) The size/configuration of CHI-64 precludes meeting this requirement without major modifications and cost.

c. Have suitable rails around the outermost periphery of the deck line:

(1) The installed rails (fendering system) have sustained damage during both major operations. The hull design/fendering system does not protect CHI-64 when docking with shipping/watercraft equipment while performing its mission.

(2) A redesign of the fendering system may eliminate the problem, cost may be prohibitive.

d. Have twin propulsors, twin diesel drive:

(1) Twin diesel engines are installed, however, the water-cooled mufflers in both exhaust systems have experienced repeated failures. Additional failures must dictate redesign of the exhaust system/components.

(2) Engine room space is very limited, cost would be a determining factor in the design and components.

e. Be operable and maintainable by the 5th through 95th percentile soldiers:

(1) The limited space within the engine room and forward machinery room presents serious problems to the soldier in the upper percentile range. Movement is further restricted by the quantity of equipment in these spaces. To perform operational/maintenance checks and services, the soldier must maneuver over, under and around equipment. This has resulted in damage to equipment. Additionally, the soldier must step into the bilge area to perform these operations. This hazardous situation has resulted in minor cuts, scratches, and bruises.

(2) No action can be taken to correct the limited congested space, however, small step platforms could be installed to provide secure footing for the soldier. The CHI-64 would require drydocking and touch up of the bottom paint. Cost would be lower if the platforms were installed during on-condition cyclic maintenance.

f. Be fitted with crew-served weapons mounts and ammunition lockers:

(1) Neither are installed. Space is a major problem on the CHI-64. The size and configurations of CHI-64 may preclude installation of both items. The requirement must be reviewed and the crew-served weapon identified.

(2) Modification could be accomplished for use of an M-60 machine gun. Storage of ammunition onboard is not feasible.

g. Lifeline shall be capable of being readily removed and reinstalled:

(1) The lifeline stanchions are welded to the main deck. The lifelines have turnbuckles at one end, permanent connections at the other end, and are threaded through the intermediate stanchions. Removal is only partially possible.

(2) Cost to meet this requirement would be relatively high because of the modifications to the hull.

(3) This was submitted as a recommended change by the crew. The change was recommended for completion by the operating unit and its support maintenance organization.

3. Transportability. Each vessel shall be supplied with a sling:

a. This requirement was deleted based on information from the proposed testing activity. However, during testing it became evident that a dedicated sling(s) is required for the CHI-64.

b. Cost to provide the sling(s) should be minimal.

4. Standards: Comply with all state, federal, and U.S. territory; water, air, and noise pollution control requirements.

a. Water.

(1) The CHI-64 has no bilge water/slop holding tank. The bilge pumps can be placed in automatic operation. The forward machinery room (FWD) bilge pump discharges directly overboard and has possible sewage, lubricating oil and antifreeze pollution sources. The engine room (mid) bilge pump can discharge into the lazarette bilges or directly overboard and has possible diesel fuel, lubricating oil, hydraulic oil and antifreeze pollution sources. The lazarette (AFT) bilge pump discharges directly overboard or to a deck connection and has the same pollution sources as the engine room (MID) bilge pump.

(2) Modifications to correct these deficiencies would be costly because of the scope of work. Additionally, space for the holding tank is limited.

b. Noise.

(1) The hearing hazards associated with the CHI-64 are documented in the Safety Assessment Report (SAR) for the Coastal, Harbor Inland Waterway Service Boat, Report Number VSE/ASD/0034-91/46RD. Primarily, the noise hazard areas are:

(a) The engine room and after deck area during operation of the engines at high RPM.

(b) The engine room with the engines at idle rpm or above and/or the generator operating.

(c) Hearing protection is required for these areas.

(2) The cost to reduce the noise levels in these areas would be prohibitive.

5. Reliability and availability:

a. The reliability and availability of the CHI-64 is highly questionable because of the repeated critical failures that have not been completely or satisfactorily repaired. These failures are identified as:

(1) engine exhaust system mufflers
(2) engine room hatches
(3) engine room ventilation system
(4) hull
(5) alternators

Please review the respective Failure Analysis Reports in Appendix E for recommendations.

b. The reliability and availability of the CHI-64 is effected by the existing deficiencies and failure of the pleasure boat type components installed onboard.

c. Cost to correct/repair these items to improve reliability and availability could equal the cost of the on-condition cycle maintenance period.

6. Inclement weather operation: Although not specifically identified, a major concern is operation during inclement weather.

a. Water leaking into the engine room through the entrance hatches and ventilation system are just not acceptable.

b. For safe operation, the coxswain must be able to see clearly. The inadequate windshield defog system and questionable windshield wipers do not/will not provide for acceptable vision.

c. Missions for the CHI Service Boat can be expected during inclement weather in support of military operation.

B. Overall Evaluation: The CHI-64 has failed to meet field requirements in many areas that affect the mission of the CHI Service Boat and its safe operation by the soldier. Corrections/repairs to meet field requirements, if possible, would be very costly. Again, this is indicative that the production CHI Service Boat must be procured using a Functional Purchase Description.

VII. RECOMMENDATIONS.

Based on the information provided in this report, the following recommendations are provided:

A. That follow-on procurement of the CHI Service Boat be from a Functional Purchase Description.

B. That the critical failures and deficiencies be completely and satisfactorily repaired if the CHI-64 is to remain in the inventory. (Repairs should be completed as a warranty item by the boat manufacturer.)

C. That the boat manufacturer provide corrected electrical system drawings.

APPENDIX A

INTERIM SAFETY RELEASE

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005-5055

REPLY TO ATTENTION OF
AMSTE-TA-T (70)

2 MAR 1992

MEMORANDUM FOR Commander, U.S. Army Belvoir Research, Development and Engineering Center, ATTN: STRBE-FMS, Fort Belvoir, VA 22060-5606

SUBJECT: Interim Safety Release for the Coastal, Harbor and Inland Waterway (CHI) Service Boat

1. References:

a. Safety Assessment Report (SAR) for Coastal, Harbor and Inland Waterway (CHI) Service Boat, VSE Corporation, Feb 92.

b. Memorandum, USACSTA, STECS-AE-SM, 28 Feb 92, subject: Recommendation for Safety Release for the Coastal, Harbor, and Inland Waterway Service Boat (CHI) Prototype, "U.S. Army CHI-64", TECOM Project No. 8-VS-510-CHI-001. (enclosed)

2. The purpose of this document is to provide an interim safety release for the prototype CHI Boat for the military operational feasibility testing to be conducted in conjunction with Ocean Venture 92 and Resolute Venture 92. The testing will follow the draft Technical and Operational Feasibility Test Plan prepared by BRDEC (STRBE-FMS) and dated Sep 91.

3. A full technical description of the commercially available prototype military boat is presented in both of the above references. In addition, the boat is known to be designed and built in accordance with U.S. Coast Guard regulations and Code of Federal Regulations Title 33 and Title 46. As such, industrial safety devices/requirements have become an integral part of the boat design.

4. The SAR (referenced 1a) has not been approved by the BRDEC Safety Office (Development Command). The stipulations of paragraph 5 below will constitute the interim safety release, upon BRDEC Safety Office approval of the SAR document as written.

5. An Interim Safety Release for conduct of the operational feasibility test is granted with the following points of emphasis:

a. All SAR significant hazards (paragraph 5.2) and precautions for eliminating significant hazards (paragraph 5.3) are to be addressed/briefed to all crew members.

b. All items presented in paragraph 4 of reference 1b unless modified below must be complied with prior to and/or during boat operation.

c. Single hearing protection is required for anyone within 50 feet of the boat with the engines in operation: double hearing protection is required for anyone within 50 feet of the boat with the engine compartment open and the engines in operation during preventative or required maintenance actions.

d. There shall be no ordnance items (ammunition and weapons) permitted or board this craft based upon the lack of proper storage and mounting positions for these items.

e. Due to the lack of any cargo tiedown capability, the boat may not be used for extraneous cargo transportation during the feasibility testing.

f. Certification by the commercial manufacturer that boat and ancillary equipment meet MIL-STD-209H requirements will permit timely conduct of the feasibility testing.

g. If at all possible during the feasibility testing, the boat's anchor should not be used. However, if test conditions require its use, all crew members must be aware of the awkward task of removing and storage of the anchor from its locker as a one person task in lieu of the MIL STD-required two persons.

6. Point of contact at this headquarters is Mr. Richard H. Britton, DSN 298-3640/3766, Data FAX 7653, and e-mail: amstatat@apg-9.apg.army.mil.

FOR THE COMMANDER:

Michael C. Ritondo

Encl

MICHAEL C. RITONDO
Chief, Troop Support Division
Directorate for Test and Assessment

Dal M. Nett

DAL M. NETT
Chief, Safety Office

CF:
Comdt, USATS, ATTN: ATSP-CDM-MT
Cdr, BRDEC, ATTN: STRBE-Q
Cdr, AMC, ATTN: AMCSF-E
Dir, FSA, ATTN: AMXOS-ES

APPENDIX B

CREW TRAINING PLAN

CREW TRAINING PLAN

FOR THE

COASTAL, HARBOR, AND INLAND

WATERWAY (CHI) SERVICE BOAT

(NDI PROTOTYPE)

FEBRUARY 1992

PREPARED BY:

MARINE AND MECHANICAL EQUIPMENT DIVISION,
LOGISTICS SUPPORT DIRECTORATE

U.S. ARMY BELVOIR RESEARCH,
DEVELOPMENT AND ENGINEERING CENTER
FORT BELVOIR, VIRGINIA 22060-5606

TABLE OF CONTENTS

PURPOSE: To train the assigned crew to safely operate the CHI Service Boat (CHI 64).

LOCATION: Onboard CHI 64, Ft. Eustis, VA

DOCUMENTS: Technical and Operational Feasibility Test Plan, CHI Service Boat Operating Instructions, Onboard Equipment Manufacturers Manuals, and Boat Manufacturers Engineering Drawings.

PROCEDURE: Using reference document and CHI 64:

- Identify equipment and controls
- Operate onboard equipment
- Operate CHI 64
- Explain maintenance operations
- Crew sign/initial training item sheet

I. INTRODUCTION:

A. Identify the technical and operational characteristics of the CHI Service Boat.

B. Identify the general layout of the CHI Service Boat.

C. Identify the major and auxiliary equipment.

II. EQUIPMENT OPERATION:

A. Describe onboard equipment and systems.

B. Identify equipment controls and their location.

C. Explain operation.

D. Operate equipment and systems.

III. WINTERIZATION:

A. Explain and perform procedures for winterization of sea and potable water systems.

B. Explain and perform procedures for start up after winterization.

IV. BOAT OPERATIONS:

A. Explain the procedures for initial, underway, docking, securing, and drydocking operations.

B. Explain caution and warning information for the above operations.

V. MAINTENANCE OPERATION:

A. Explain the procedures for protection and care of aluminum.

B. Explain the minimum maintenance required for maintenance of onboard equipment.

C. Explain maintenance action data collection sheet and use. (Provided in Appendix 1.)

VI. ONBOARD SPARE PARTS:

A. Identify the onboard spare parts to components.

B. Identify procedures to replace onboard spare parts.

VII. BASIC ISSUE ITEM (BII) LIST:

Joint inventory of BII.

VIII. DOCUMENTS:

A. Explain/review Technical and Operational Feasibility Test Plan, CHI Service Boat Operating Instructions, Equipment Manufacturers' Manuals, and Boat Manufacturers' Engineering Drawings.

B. Provide crew copies of documents.

C. Provide copies of Maintenance Action Data Collection Sheet.

IX. TRAINING VERIFICATION:

Have crew member sign/initial that training item(s) has been completed and understood. Use the training item sheet at Appendix 2.

APPENDIX 1

MAINTENANCE ACTION DATA COLLECTION SHEET

ISSUE: MAINTENANCE ACTION

CRITERIA: IDENTIFY SCHEDULED AND REQUIRED MAINTENANCE ACTIONS IN DETAIL TO PROVIDE FOR AN ASSESSMENT OF LOGISTICAL SUPPORT.

DATE: NAME: TELEPHONE #: UNIT:

A. STATE THE ACTION/PROBLEM, IDENTIFY SYSTEM, AND DEFECTIVE PART IF POSSIBLE.

B. STATE CORRECTIVE ACTION AND LIST ANY SPECIAL TOOLS REQUIRED.

C. PROVIDE ESTIMATE OF MANHOUR TO REPAIR, PROVIDE MOS AND SKILL LEVEL.

D. STATE EFFORTS TO OBTAIN REPAIR PART.

E. REMARKS:

F. MAIL TO:

US ARMY RESEARCH DEVELOPMENT AND ENGINEERING CENTER
ATTN: STRBE-FMS, MR. SCOTT STORY
FT. BELVOIR, VA 22060
TELEPHONE COMM: 703-704-2303, DSN: 654-2303

APPENDIX 2

TRAINING ITEM SHEET

CREW MEMBER NAME _____ INITIALS _____

CREW MEMBER NAME _____ INITIALS _____

CREW MEMBER NAME _____ INITIALS _____

ITEM	INITIALS	DATE
I. INTRODUCTION:		
A. Identify the technical and operational characteristics of the CHI Service Boat.		
B. Identify the general layout of the CHI Service Boat.		
C. Identify the major and auxiliary equipment.		
II. EQUIPMENT OPERATION:		

	DESCRIBED	IDENTIFY COMPONENTS/ CONTROLS	OPERATE
A. ELECTRICAL SYSTEMS			
240/120 VAC			
12 VDC			
24 VDC			
CAUTIONS			
BATTERY CHARGING			
B. GENERATOR			
CAUTIONS/WARNINGS			
C. ENGINE AND MARINE TRANSMISSION			
CAUTIONS/WARNINGS			
D. TOILET AND TREATMENT UNIT			
CAUTIONS			
E. HOT WATER HEATER			
CAUTIONS			
F. REFRIGERATOR			
G. CREW CABIN PILOTHOUSE AND ENGINE ROOM HEATERS			
H. BILGE PUMPS			
NOTICE			

	DESCRIBED	IDENTIFY COMPONENTS/ CONTROLS	OPERATE
I. AIR CONDITIONING UNIT			
J. TRIM TABS			
CAUTION			
K. STEERING SYSTEM			
L. FUEL SYSTEM			
WARNING			
M. POTABLE WATER SYSTEM			
CAUTION			
N. FIRE EXTINGUISHER FIXED SYSTEM			
CAUTIONS/WARNINGS			
O. INTERCONNECTING VALVES			
CAUTION			
P. SAFETY EQUIPMENT			
Q. COMMUNICATION/NAVIGATION EQUIPMENT			
MAGNETIC COMPASS			
RADAR			
FATHOMETER			
VHF FM BRIDGE TO BRIDGE RADIO			
GLOBAL POSITIONING SYSTEM (GPS)			
AN/VRC 46			
RT 9000 (HF/SSR)			
AN/APX-72			
III. WINTERIZATION			
A. MAIN ENGINE			
B. GENERATOR			
C. AIR CONDITIONING UNIT			
D. TOILET AND TREATMENT UNIT			
E. POTABLE WATER SYSTEM			
CAUTIONS			
IV. BOAT OPERATIONS			
WARNING/CAUTION			
A. INITIAL OPERATION			
CAUTION/WARNING			

	DESCRIBED	IDENTIFY COMPONENTS/ CONTROLS	OPERATE
B. UNDERWAY OPERATIONS			
C. DOCKING OPERATION			
WARNING/CAUTION			
D. SECURING OPERATIONS			
E. CRADLING/DRYDOCKING OPERATIONS			
CAUTIONS/NOTICE			
V. MAINTENANCE OPERATION			
A. ALUMINUM PROTECTION AND CARE			
WARNINGS			
B. EQUIPMENT MAINTENANCE			
C. REPAIR PARTS			
MAINTENANCE ACTION DATA			
COLLECTION SHEET			
VI. ONBOARD SPARE PARTS			
A. ENGINE AND MARINE TRANSMISSION			
B. GENERATOR			
C. AUXILIARY EQUIPMENT			
D. REPLENISHMENT			
VII. BASIC ISSUE ITEMS (BII) LIST			
JOINT INVENTORY OF BII			
VIII. DOCUMENTS			
A. TECHNICAL AND OPERATION FEASIBILITY TEST PLAN			
B. CHI SERVICE BOAT OPERATING INSTRUCTIONS			
C. EQUIPMENT MANUFACTURERS' MANUAL			
D. BOAT MANUFACTURER ENGINEERING DRAWINGS			

APPENDIX C

TECHNICAL AND OPERATIONAL FEASIBILITY TEST PLAN

TECHNICAL AND OPERATIONAL FEASIBILITY

TEST PLAN

FOR THE

COASTAL, HARBOR, AND INLAND

WATERWAY (CHI) SERVICE BOAT

FEBRUARY 1992

PREPARED BY:

MARINE AND MECHANICAL EQUIPMENT DIVISION,
LOGISTICS SUPPORT DIRECTORATE

U.S. ARMY BELVOIR RESEARCH,
DEVELOPMENT AND ENGINEERING CENTER
FORT BELVOIR, VIRGINIA 22060-5606

INDEX

I. DESCRIPTION

A. Test Plan: This technical and operational feasibility test plan was developed for testing of the CHI Service Boat NDI prototype. The Army Watercraft Requirements Master Plan, approved in concept by the VCSA, states replacement watercraft will be procured under the NDI concept. The NDI concept has been validated by extensive market investigations, the Commercial Market Survey Report, dated July 1983, and the Manufacturer's Survey Report, dated April 1990. Any differences in the functional capability of the prototype and the production boat will be insignificant.

The Draft Technical Issues for the Draft Test and Evaluation Master Plan for the CHI Service Boat, dated 28 June 1990, issued by TECOM, and the Independent Evaluation Plan, dated 16 December 1981, issued by TRADOC, were used and tailored to the changes identified in the Draft ROC, dated 20 March 1991, to identify the technical and operational characteristics.

B. Mission: The Coastal, Harbor and Inland Waterway (CHI) Service Boat will provide minimal passenger and light cargo transport, waterborne command and control and security services. Tasks will include passenger ferry services between anchored shipping and shore facilities, transport of maintenance contract teams and other work crews, transport of repair parts, mail, and other light cargo. Provide for command and control during waterborne operations and waterborne security patrols for anchored shipping, harbor facilities, and during operations. It will be capable of performing its assigned mission in climatic design types hot and basic when not impeded by ice.

C. Unique Characteristics: There are no unique characteristics of the CHI Service Boat which will require special testing.

D. Technical Characteristics:

1. Cargo Space	Will possess a minimum of 100 square feet of cargo space on the aft deck.
2. Fuel	Shall be capable of using diesel fuel conforming to MIL-F-16884 as standard fuel;
	be capable of using JP-8, MIL-T-83133, as an emergency fuel without harmful effects or greater than a 10% reduction in performance;
	be capable of using diesel fuel with a sulphur content up to and including one percent without degrading the lubricating oil and overhaul interval as specified for engines using one half percent sulphur content fuel.

3. Lubricating Oil	The engines and reduction gears shall be capable of using MIL-L-2104 and MIL-L-9000 lubricating oils.
4. Length	Shall not exceed 36 feet in length at the waterline.
5. Draft	Draft shall not exceed four feet when fully loaded.
6. Propulsion	Will have twin propulsors, twin diesel inboard drive.
7. Climatic Control Equipment	Will have adequate climatic control equipment for preservation of electronic equipment and for habitation requirements.
8. Rails	Will have suitable rub and safety rails around the outermost periphery of the deck line.
9. Floodlights	Will possess adequate floodlighting for the aft deck cargo area.
10. Anchor	Will possess an anchor to hold a fully-loaded boat.
11. Steering	Will possess a powered and manual steering capability.
12. Generator	Will have installed a dedicated diesel engine driven generator capable of providing the entire electrical load on a 24-hour-a-day basis.
13. Shore Power	Shall be capable of using shore power for the electrical load.
14. Marine Sanitation Device (MSD)	Will have installed one USCG-approved MSD with holding tank. The tank shall be sized to preclude pump out more than once per day.
15. Weapons Mounts	Will have two crew-served weapon mounts installed.

16. Construction — Will be manufactured of aluminum and to the extent feasible designed and constructed to the ABS Rules for Building and Classing Aluminum Vessel and meet the requirements of Subchapter C -Uninspected Vessels, Title 46, CFR.

E. Operational Characteristics:

1. Operation in Various Climatic Conditions — Will be capable of performing its assigned mission in climatic design types hot and basic when not impeded by ice.

2. Transport Weather-Protected Personnel — Will be capable of transporting 5 weather-protected personnel.

3. Transport One Ton of Cargo — Will be capable of transporting one ton of cargo on the afterdeck.

4. Fully Loaded Speed In:

   a. Sea State 3 (2-6 foot waves, 11-16 knots wind) — Maintain a minimum of 20 knots sustained speed.

   b. Sea State 3 — Attain 25 knots for 1 hour during emergency operations.

   c. Sea State 4 (4-8 foot waves, 17-21 knots wind) — Maintain steerage and 10 knots sustained speed.

5. Endurance — Be capable of 8 hours continuous operation at a sustained speed of 20 knots with a 25 percent fuel safety margin remaining.

6. Operational Control — Shall have the capability to operate all onboard equipment from the pilothouse.

7. Crew Accommodations — Will have installed a refrigerator, microwave oven, dinette with seating for 4, sink with potable water supply, and two berths.

8. Storage — Will provide adequate storage space for Basic Issue Items (BII) and individual/crew-served weapons.

9. Mast and Antennas — Mast and all antennas shall have the capability of being readily removed and installed.

10. Life Line	Life line shall be capable of being readily removed and installed.
11. Transportability:	
a. Boat	Shall have lifting pads and eyes installed to provide a 4-point lift.
b. Cradle	Will be provided with a cradle for transportation and maintenance. Additionally, the cradle shall have a means of securing it to the boat, have permanently installed lifting pads and eyes for sling loading, and securing hardware/fixtures for securing cradle to the deck of a ship or barge.
12. Health and Safety	Shall comply with all Federal, State, and US territory; water, air, and noise pollution control requirements. Additionally, it shall have the lifesaving equipment required by Title 46, Part 94, Code of Federal Regulations (CFR).
13. Navigation and Communication Equipment	Shall be fitted with the state-of-the-art navigation and communication equipment required by Title 33, Code of Federal Regulations (CFR).
14. Logistical Support	Shall be fully supportable by a commercial supply support plan augmented by the Federal supply system.

II. FEASIBILITY TESTING

A. Technical Feasibility Testing Objective: The objective of the technical feasibility testing is to assess the technical characteristics of the prototype CHI Service Boat.

B. Operational Feasibility Testing Objectives: The objective of the operational feasibility testing is to assess the operational characteristics of the prototype CHI Service Boat.

C. Resources: Resources required to achieve successful feasibility testing are:

1. A fully operational prototype CHI Service Boat with all technical documentation, basic issue items, and fitted out for its intended mission.

2. A target audience crew of 3 with all programmed training completed.

3. Logistical support identical to that the boat and crew will be provided upon fielding.

D. Test Site: Feasibility testing will be conducted at Fort Eustis/Fort Story, VA. The test environment will be representative of the expected operational environment.

III. DOCUMENTATION. The documentation required to support the feasibility testing is listed in the appropriate appendix in the order provided in Paragraph I. It is intended that the information required be entered into the space provided for each issue. Sufficient data collection sheets are provided for multiple periods of operation.

A. Technical Characteristics - Appendix A.

B. Operational Characteristics - Appendix B.

C. Data Collection - The documentation for data collection and multiple testing of specific characteristics is provided in Appendix C.

D. Technical Data - Appendix D provides technical data for use during testing.

APPENDIX A

TECHNICAL CHARACTERISTICS

ISSUE: CARGO SPACE

CRITERIA: POSSESS A MINIMUM OF 100 SQUARE FEET OF CARGO SPACE ON THE AFTERDECK.

DATE:

OBSERVER/TESTER:

GENERAL LAYOUT AND MEASUREMENT:

REMARKS:

ISSUE: FUEL

CRITERIA: (a) BE CAPABLE OF USING DIESEL FUEL CONFORMING TO MIL-F-16884.

(b) BE CAPABLE OF USING JP-8, MIL-T-83133 AS EMERGENCY FUEL WITHOUT HARMFUL EFFECTS OR GREATER THAN A 10% REDUCTION IN PERFORMANCE.

(c) BE CAPABLE OF USING DIESEL FUEL WITH A SULPHUR CONTENT UP TO AND INCLUDING ONE PERCENT WITHOUT DEGRADING THE LUBRICATING OIL AND OVERHAUL INTERVAL AS SPECIFIED FOR ENGINES USING ONE-HALF PERCENT SULPHUR CONTENT FUEL.

DATE:

OBSERVER/TESTER:

(a) MIL SPEC:

NSN:

(b) MIL SPEC:

NSN:

(c) MIL SPEC:

NSN:

COMMERCIAL IDENTIFICATION:

REMARKS:

ISSUE: LUBRICATING OIL

CRITERIA: MAIN ENGINES, MARINE TRANSMISSION, AND GENERATOR ENGINE SHALL BE CAPABLE OF USING MIL-L-2104 AND MIL-L-9000 LUBRICATING OIL.

DATE:

OBSERVER/TESTER:

REMARKS:			
	MIL-L-2104	NSN	GRADE
	MIL-L-9000	NSN	GRADE

ISSUE: LENGTH

CRITERIA: SHALL NOT EXCEED 36' IN LENGTH AT THE WATER LINE.

DATE:

OBSERVER/TESTER:

REMARKS:

ISSUE: DRAFT

CRITERIA: DRAFT SHALL NOT EXCEED FOUR FEET WHEN FULLY LOADED.

DATE:

OBSERVER/TESTER:

FWD:

MIDSHIP:

AFT:

LOAD:

FUEL:

PASSENGER:

CREW:

CARGO:

REMARKS:

ISSUE: PROPULSION

CRITERIA: WILL HAVE TWIN PROPULSORS, TWIN DIESEL INBOARD DRIVE.

DATE:

OBSERVER/TESTER:

ENGINE	PORT	STBD
MANUFACTURER:	CATERPILLAR	CATERPILLAR
MODEL NO.:	3208TA	3208TA
SERIAL NO.:	01Z23646	01Z23663

TRANSMISSION/REDUCTION GEAR	PORT	STBD
MANUFACTURER:	TWIN DISC INC	TWIN DISC INC
MODEL NO.:	MG 507	MG 507
SERIAL NO.:	5AK 584	5AK 581

REMARKS:

ISSUE: CLIMATIC CONTROL EQUIPMENT

CRITERIA: WILL HAVE ADEQUATE CLIMATIC CONTROL EQUIPMENT FOR PRESERVATION OF ELECTRONIC EQUIPMENT AND HABITATION REQUIRES. (NOTE: TEMPERATURE AND HUMIDITY READING ARE PROVIDED FOR ON DATA COLLECTION SHEET 1, PAGE C-1.)

DATE:

OBSERVER/TESTER:

AIR CONDITIONING

MANUFACTURER:	MARINE AIR SYSTEMS
RATING:	24,000 BTU
LOCATION:	FORWARD MACH. ROOM
QTY:	ONE

HEATING	CREW CABIN	PILOTHOUSE
MANUFACTURER:	HADEES	HADEES
RATING:	46,800	46,800
LOCATION:	FOWARD MACH. ROOM	FORWARD MACH. ROOM
QTY:	ONE	ONE
HEATER	CREW CABIN	ENGINE ROOM
MANUFACTURER:	VALAD	VALAD
RATING:	2 KW 230 VAC	2 KW 230 VAC
QTY:	ONE	ONE

VENTILATION

MANUFACTURER:	VETUS
RATING:	36 CFM
LOCATION:	HEAD
QTY:	ONE

WINDOW DEFROST SYSTEM - SUPPLIED FROM THE PILOTHOUSE HEATER

REMARKS: (Comment on adequacy of the above systems.)

ISSUE: RAILS

CRITERIA: WILL HAVE SUITABLE RAILS AROUND THE OUTERMOST PERIPHERY AT THE DECK LINE.

DATE:

OBSERVER/TESTER:

RUB RAILS

SAFETY RAILS

REMARKS:

ISSUE: FLOODLIGHTS

CRITERIA: WILL POSSESS ADEQUATE FLOODLIGHTING FOR THE AFT DECK CARGO AREA.

DATE:

OBSERVER/TESTER:

MANUFACTURER: ITT - JABSCO

TYPE: 4" X 6", MODEL 45900-0000

LOCATION: TOP PILOTHOUSE

QTY: TWO

ADEQUATE ILLUMINATION FOR NIGHTTIME CARGO OPERATIONS?

TIME OF OBSERVATION:

REMARKS:

ISSUE: ANCHOR

CRITERIA: WILL POSSESS AN ANCHOR RATED TO HOLD A FULLY-LOADED BOAT.

DATE:

OBSERVER/TESTER:

ANCHOR

MANUFACTURER:

TYPE:

WEIGHT:

REMARKS:

ISSUE: STEERING

CRITERIA: WILL POSSESS POWERED AND MANUAL STEERING CAPABILITY.

DATE:

OBSERVER/TESTER:

MANUFACTURER: TELEFLEX

TYPE: SEA STAR II HYDRAULIC

CAN THE BOAT BE OPERATED AT 25 KNOTS AND BE SAFETY STEERED MANUALLY?

REMARKS:

ISSUE: GENERATOR

CRITERIA: WILL HAVE INSTALLED A DEDICATED DIESEL-ENGINE-DRIVEN GENERATOR CAPABLE OF PROVIDING THE ENTIRE ELECTRICAL LOAD ON A 24-HOUR-A-DAY BASIS. (NOTE: READINGS FOR GENERATOR OPERATION ARE INCLUDED ON DATA COLLECTION SHEET 2, PAGE C-2.)

DATE:

OBSERVER/TESTER:

MANUFACTURER: ONAN

MODEL: MDKD

OUTPUT:

VOLTS: 230 VAC

AMPS:

KW: 8 KW

TYPE OF ENGINE COOLING SYSTEM?

USES SEA WATER FOR ENGINE AND MUFFLER COOLING.

REMARKS:

ISSUE: SHORE POWER

CRITERIA: SHALL BE CAPABLE OF USING COMPATIBLE SHORE POWER FOR THE ELECTRICAL LOAD. (NOTE: DATA COLLECTION SHEET 3-1, PAGE C-31, IS TO BE USED TO RECORD SHORE POWER INFORMATION.)

DATE:

OBSERVER/TESTER:

SHORE POWER BOX INSTALLED: STARBOARD SIDE OF PILOTHOUSE

AMPERE AND VOLTAGE RATING OF SYSTEM AND COMPONENTS: 125/250 VAC 50 AMP 3P, 4W, 1 PH

SHORE POWER CABLE PROVIDED: 50'

CAN ONBOARD INSTRUMENTS INDICATE VOLTAGE PHASE/SEQUENCE OF SHORE POWER PRIOR TO ENERGIZING BOAT ELECTRICAL SYSTEM:

HAS VOLTMETERS AND REVERSE POLARITY LIGHT ON AC MASTER BREAKER.

REMARKS:

ISSUE: MARINE SANITATION DEVICE

CRITERIA: WILL HAVE INSTALLED ONE USCG-APPROVED MSD WITH HOLDING TANK. TANK SHALL BE SIZED TO PRECLUDE PUMP OUT MORE THAN ONCE PER DAY. (NOTE: UNIT TANK SHOULD HOLD INFLUENT EQUIVALENT TO 5 FLUSHES PER CREW MEMBER AND PASSENGERS PER 12 HOURS OPERATION.)

DATE:

OBSERVER/TESTER:

MANUFACTURER: RARITAN

MODEL: LECTRA/SAN EC, 12 VDC, TYPE I

CAPACITY OF HOLDING TANK: 11 GALLONS

COMMODE MANUFACTURER: RARITAN

MODEL: PH11

QUANTITY OF WATER PER FLUSH: VARIES

REMARKS:

ISSUE: WEAPONS MOUNTS

CRITERIA: WILL HAVE TWO CREW-SERVED WEAPON MOUNTS INSTALLED.

DATE:

OBSERVER/TESTER:

LOCATION:

TYPE OF CREW-SERVED WEAPON:

ADEQUATE FIELD OF FIRE TO PROTECT BOAT:

STOPS INSTALLED TO PRECLUDE FIRING INTO THE BOAT:

AMMUNITION LOCKER INSTALLED:

LOCATION AND TYPE:

REMARKS:

ISSUE: CONSTRUCTION

CRITERIA: (1) WILL BE CONSTRUCTED OF ALUMINUM

(2) DESIGNED AND CONSTRUCTED TO THE ABS RULES FOR BUILDING AND CLASSING ALUMINUM VESSELS

(3) MEET THE REQUIREMENTS OF SUBCHAPTER C, UNINSPECTED VESSELS, TITLE 46 CFR

DATE:

OBSERVER/TESTER:

(1) DOES THE BOAT HAVE CONSTRUCTION DRAWING PROVIDED? NO

(2) WHAT CERTIFICATION/APPROVAL DOCUMENTS DOES THE BOAT HAVE? NONE

DO THE DOCUMENTS SPECIFY PERSONNEL/CARGO LIMITS? N/A

(3) NUMBER LIFE JACKETS WITH LIGHTS AND REFLECTIVE MATERIAL: 10

NUMBER RING BUOY W/WATER LIGHT: 2

PORTABLE FIRE EXTINGUISHER:

TYPE: CO2

LOCATION: 2 AFT DECK, 1 CREW CABIN

QTY: 3

VENTILATOR DUCTS (ENGINE/FUEL COMPARTMENT)

FIXED FIRE SYSTEM:

TYPE: CO2 AUTOMATIC AND/OR MANUAL OPERATION

LOCATION: ENGINE ROOM

SIZE: 50 LBS

REMARKS:

APPENDIX B

OPERATIONAL CHARACTERISTICS

ISSUE: OPERATE IN VARIOUS CLIMATIC CONDITIONS

CRITERIA: WILL BE CAPABLE OF PERFORMING ITS ASSIGNED MISSION IN CLIMATIC DESIGN TYPES HOT AND BASIC WHEN NOT IMPEDED BY ICE. SEE PAGE D-4 FOR TYPES DEFINITION. (NOTE: AMBIENT TEMPERATURE READINGS ARE RECORDED ON DATA COLLECTION SHEET 1, PAGE C-1.)

DATE:

OBSERVER/TESTER:

REMARKS:

ISSUE: TRANSPORT WEATHER-PROTECTED PERSONNEL

CRITERIA: WILL BE CAPABLE OF TRANSPORTING 5 WEATHER-PROTECTED PERSONNEL.

DATE:

OBSERVER/TESTER:

NUMBER AND TYPE OF PERSONNEL: (HATCH GANG, VESSEL CREWMEMBER, STAFF)

DURATION/TRANSPORT TIME:

VERIFY SEATING FOR 4 AT CABIN DINETTE:

REMARKS:

ISSUE: TRANSPORT ONE TON OF CARGO

CRITERIA: WILL BE CAPABLE OF TRANSPORTING ONE TON OF CARGO ON THE AFTER DECK.

DATE:

OBSERVER/TESTER:

TYPE OF CARGO:

WEIGHT:

DURATION OF TRANSPORT:

ESTIMATE SEA STATE:

HOW CARGO SECURED:

REMARKS:

ISSUE: SPEED (NOTE: USE DATA COLLECTION SHEETS 3-1, 3-2, AND 4.)

CRITERIA: FULLY LOADED CONDITION AND IN: (NOTE: DEFINITIONS OF SEA STATES ARE PROVIDED ON PAGE D-5.)

(1) SEA STATE 3 (2'-6' WAVES 11-16K WIND) - MAINTAIN 20 KNOTS SPEED

(2) SEA STATE 3 - ATTAIN 25 KNOTS FOR 1 HOUR DURING EMERGENCY OPERATIONS

(3) SEA STATE 4 (4'-8' WAVES 17-21 KNOT WIND) - MAINTAIN STEERAGE AND 10 KNOTS SUSTAINED SPEED

DATE:

OBSERVER/TESTER:

CRITERIA (1)

FUEL:

CREW:

PASSENGERS:

CARGO:

WAVES:

WIND:

SPEED:

DURATION: START: STOP:

DATE:

OBSERVER/TESTER:

CRITERIA (2)

FUEL:

CREW:

PASSENGERS:

CARGO:

WAVES:

WIND:

SPEED:

DURATION: START: STOP:

DATE:

OBSERVER/TESTER:

CRITERIA (3)

FUEL:

CREW:

PASSENGERS:

CARGO:

WAVES:

WIND:

SPEED:

DURATION: START: STOP:

REMARKS:

ISSUE: ENDURANCE

CRITERIA: BE CAPABLE OF 8 HOURS CONTINUOUS OPERATION AT A SUSTAINED SPEED OF 20 KNOTS WITH A 25% FUEL SAFETY MARGIN REMAINING. (NOTE: INFORMATION ON DATA COLLECTION SHEETS 3-1, 3-2, AND 4.)

DATE:

OBSERVER/TESTER:

FUEL: START (FULL) GALLONS
COMPLETION GALLONS
% REMAINING

TIME: START
COMPLETION

SPEED: (AVERAGE PER HOUR OF 4 READINGS AT 15-MINUTE INTERVALS)

HOUR 1		+	+	+	=	÷ 4 =
2						
3						
4						
5						
6						
7						
8						

REMARKS:

ISSUE: OPERATIONAL CONTROL

CRITERIA: SHALL HAVE THE CAPABILITY TO OPERATE ALL ONBOARD EQUIPMENT FROM THE PILOTHOUSE.

DATE:

OBSERVER/TESTER:

GENERATOR: YES

ENGINE: YES

AIR CONDITIONER: YES

BILGE PUMP: YES

EMERGENCY FIRE SYSTEM: YES

DEFROSTER/HEATER: YES

COMMUNICATION EQUIPMENT: YES

NAVIGATION EQUIPMENT: YES

REMARKS: NOTE: THE APPLICABLE ELECTRICAL EQUIPMENT ON PAGE D-3 SHALL BE VERIFIED AND ADDED TO THE ABOVE LIST.

ISSUE: CREW ACCOMMODATIONS

CRITERIA: WILL HAVE INSTALLED A REFRIGERATOR, MICROWAVE OVEN, DINETTE WITH SEATING FOR 4, SINK WITH POTABLE WATER SUPPLY, AND TWO BERTHS.

DATE:

OBSERVER/TESTER:

REFRIGERATOR

MANUFACTURER: NORCOLD

MODEL: DE 251

CAPACITY: 1.94 CU FT

MICROWAVE OVEN

MANUFACTURER: GOLDSTAR

MODEL: MA 653M

CAPACITY: .6 CU FT

DINETTE W/SEATING FOR 4: YES

SINK: 1 GALLEY, 1 HEAD

POTABLE WATER

GALLONS: 30-GALLON STORAGE TANK

TWO BERTHS

LENGTH:

WIDTH:

CLEARANCE:

REMARKS:

ISSUE: STORAGE

CRITERIA: WILL PROVIDE ADEQUATE STORAGE SPACE FOR BASIC ISSUE ITEMS (BIL) AND INDIVIDUAL/CREW-SERVED WEAPONS.

DATE:

OBSERVER/TESTER:

OBTAIN BIL LIST, PROVIDE STORAGE LOCATION FOR EACH ITEM.

PROVIDE LOCATION FOR WEAPONS STORAGE, IDENTIFY TYPE (CREW SERVED/INDIVIDUAL).

REMARKS:

ISSUE: MAST AND ANTENNA

CRITERIA: MAST AND ALL ANTENNAS SHALL HAVE THE CAPABILITY OF BEING READILY REMOVED AND INSTALLED.

DATE:

OBSERVER/TESTER:

IDENTIFY HOW MAST IS REMOVED: REMOVE BOLTS TO LAY BACK MAST ASSEMBLY.

IDENTIFY ALL ITEMS THAT MUST BE REMOVED/DISCONNECTED TO REMOVE MAST:

REMARKS:

ISSUE: LIFE LINE

CRITERIA: CAPABLE OF BEING READILY REMOVED AND INSTALLED.

DATE:

OBSERVER/TESTER:

IDENTIFY TYPE OF SOCKET AND HARDWARE FOR REMOVAL AND INSTALLATION OF LIFE LINE/STANCHIONS:

LIFE LINES CAN BE REMOVED AT THE PORT AND STARBOARD SIDE, STANCHIONS ARE WELDED IN PLACE.

REMARKS:

ISSUE: TRANSPORTABILITY

CRITERIA:

(1) BOAT

SHALL HAVE LIFTING PADS AND EYES INSTALLED TO PROVIDE A 4-POINT LIFT.

(2) CRADLE

- CRADLE PROVIDED WITH INSTALLED LIFTING PADS AND EYES.

- PROVIDE HARDWARE TO SECURE BOAT TO CRADLE.

- PROVIDE HARDWARE FOR SECURING CRADLE TO DECK FOR SHIPMENT.

(3) SLING

TESTED FOR LIFT OF BOAT AND CRADLE.

DATE:

OBSERVER/TESTER:

(1) OBSERVE LIFT OF BOAT:

(2) OBSERVE LIFT OF BOAT AND CRADLE, IDENTIFY TYPE AND LOCATION OF TIEDOWN EQUIPMENT:

(3) CERTIFICATE OF SWL OF SLING:

REMARKS:

ISSUE: HEALTH AND SAFETY

CRITERIA:

(1) SHALL COMPLY WITH ALL FEDERAL STATE AND US TERRITORY WATER AIR AND NOISE POLLUTION CONTROL REQUIREMENTS.

(2) SHALL HAVE THE LIFESAVING EQUIPMENT REQUIRED BY TITLE 46, PART 94 CFR.

DATE:

OBSERVER/TESTER:

(1) WATER (IDENTIFY MSD AND BILGE PUMPING ARRANGEMENT)

AIR

NOISE (USE DATA COLLECTION SHEET 4)

(2) THIS LIST HAS BEEN TAILORED FOR THE CHI SERVICE BOAT. THE REQUIREMENT OF 46 CFR SUBCHAPTER C APPLY.

REMARKS:

ISSUE: NAVIGATION AND COMMUNICATION EQUIPMENT

CRITERIA: SHALL BE FITTED WITH STATE-OF-THE-ART NAVIGATION AND COMMUNICATION EQUIPMENT REQUIRED BY TITLE 33, SUBCHAPTER C AND D. (NOTE: IDENTIFY ALL ONBOARD EQUIPMENT.)

DATE:

OBSERVER/TESTER:

NAVIGATION EQUIPMENT

1. NOMENCLATURE: RADAR

   MANUFACTURER: RAYTHEON

   MODEL/TYPE: R40X

   RANGE:

2. NOMENCLATURE: MAGNETIC COMPASS

   MANUFACTURER: DANFORTH

   MODEL/TYPE: HIGH-SPEED CONSTELLATION 560

3. NOMENCLATURE: NAVTRAC GPS

   MANUFACTURER: TRIMBLE NAVIGATION

   MODEL/TYPE:

COMMUNICATION EQUIPMENT

1. NOMENCLATURE: VRC 46

   MANUFACTURER: MIL SPEC

   FREQUENCY RANGE: 30-75

2. NOMENCLATURE: HF/SSB

   MANUFACTURER: SUNAIR

   MODEL/TYPE: RT9000

   FREQUENCY RANGE:

3. NOMENCLATURE: VHF FM

   MANUFACTURER: ROSS

MODEL/TYPE: DSC 500

FREQUENCY RANGE:

COMSEC EQUIPMENT

1. NOMENCLATURE: APX 72

   MANUFACTURER:

   MODEL:

2. NOMENCLATURE:

   MANUFACTURER:

   MODEL:

3. NOMENCLATURE:

   MANUFACTURER:

   MODEL:

REMARKS:

ISSUE: LOGISTICAL SUPPORT

CRITERIA: SHALL BE FULLY SUPPORTABLE BY A COMMERCIAL SUPPORT PLAN AUGMENTED BY THE FEDERAL SUPPLY SYSTEM.

DATE:

OBSERVER/TESTER:

LOGISTICAL SUPPORT WILL BE ASSESSED BY TRACKING SCHEDULED AND/OR REQUIRED MAINTENANCE ACTIONS. DATA COLLECTION SHEET 5 SHALL BE PREPARED FOR EACH MAINTENANCE ACTION. THE SHEETS ARE PROVIDED IN APPENDIX C, PAGE C-5.

REMARKS:

APPENDIX C

DATA COLLECTION

DATA COLLECTION SHEET 1

ISSUE: CLIMATIC CONTROL EQUIPMENT

DATE:

OBSERVER/TESTER:

	TIME	TEMPERATURE			RELATIVE HUMIDITY			SKY CONDITION	
		AMBIENT	PILOTHOUSE	CREW CABIN	AMBIENT	PILOTHOUSE	CREW CABIN	% CLOUD	% SUN
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

OPERATING EQUIPMENT:

NUMBER OF CREW: PASSENGERS:

REMARKS: 1 SHEET PER 12 HR OPERATIONAL SHIFT
LIST OPERATING EQUIPMENT
LIST NUMBER OF CREW AND PASSENGERS
RELATIVE HUMIDITY CONVERSION TABLES ARE PROVIDED ON PAGES D1 AND D2

DATA COLLECTION SHEET 2

ISSUE: GENERATOR

DATE:

OBSERVER/TESTER:

HOUR		BATTERY VOLTS	LO PRESS	WATER TEMP	A/C VOLTS
	1.				
	2.				
	3.				
	4.				
	5.				
	6.				
	7.				
	8.				
	9.				
	10.				
	11.				
	12.				

TOTAL MAXIMUM ELECTRICAL LOAD = (FROM CORRECTED ELECTRICAL LOAD ANALYSIS)

NOTE: THE PROJECTED PROTOTYPE ELECTRICAL LOAD ANALYSIS, PAGE D-3, MUST BE CORRECTED ON BOARD THE CHI BOAT AND ADJUSTED TO CALCULATE THE INPORT AND UNDERWAY ELECTRICAL LOAD.

REMARKS:

DATA COLLECTION SHEET 3-1

ISSUE: SPEED, ENDURANCE, NORMAL OPERATIONS (NOTE: READINGS TO BE TAKEN ON THE HOUR.)

DATE:

OBSERVER/TESTER:

	PORT ENGINE						STBD ENGINE								
TIME	RPM	WATER TEMP	OIL PSI	GEAR OIL	FUEL QTY	BATT VOLT	RPM	WATER TEMP	OIL PSI	GEAR OIL	FUEL QTY	BATT VOLT	KNOTS	SEA STATE	WIND SPD

DATA COLLECTION SHEET 5

ISSUE: MAINTENANCE ACTION

CRITERIA: IDENTIFY SCHEDULED AND REQUIRED MAINTENANCE ACTIONS IN DETAIL TO PROVIDE FOR AN ASSESSMENT OF LOGISTICAL SUPPORT.

DATE:

OBSERVER/TESTER:

a. STATE THE ACTION/PROBLEM, IDENTIFY SYSTEM, AND DEFECTIVE PART IF POSSIBLE.

b. STATE CORRECTIVE ACTION AND LIST ANY SPECIAL TOOLS REQUIRED.

c. PROVIDE ESTIMATE OF MANHOUR TO REPAIR, PROVIDE MOS AND SKILL LEVEL.

d. STATE EFFORTS TO OBTAIN REPAIR PART. PROVIDE DOCUMENT NUMBER AND DATE REPAIR PARTS RECEIVED.

e. DATE NAME UNIT

TELEPHONE NUMBER

REMARKS:

APPENDIX D

TECHNICAL DATA

TABLE 7

Relative Humidity, %

Dry-bulb temp. F	Difference between dry-bulb and wet-bulb temperatures														Dry-bulb temp. F
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
−20	7														−20
18	14														18
16	21														16
14	27														14
12	32														12
−10	37														−10
8	41	2													8
6	45	9													6
4	49	16													4
−2	52	22													−2
0	56	28													0
+2	59	33	7												+2
4	62	37	14												4
6	64	42	20												6
8	67	46	25	5											8
+10	69	50	30	11											+10
12	71	53	35	17											12
14	73	56	40	23	7										14
16	76	60	44	28	13										16
18	77	62	48	33	19	4									18
+20	79	65	51	37	24	10									+20
22	81	68	55	42	29	16	4								22
24	83	70	58	45	33	21	10								24
26	85	73	61	49	38	26	15	4							26
28	86	75	64	53	42	31	20	10							28
+30	88	77	66	56	45	35	25	15	6						+30
32	89	79	69	59	49	39	30	20	11	2					32
34	90	81	71	62	52	43	34	25	16	8					34
36	91	82	73	64	55	47	38	29	21	13	5				36
38	91	83	74	66	58	50	42	33	25	18	10	2			38
+40	92	84	76	68	60	52	45	37	30	22	15	7			+40
42	92	84	77	69	62	54	47	40	33	26	19	12	5		42
44	92	85	78	70	63	56	49	43	36	29	23	17	10	4	44
46	93	86	79	72	65	58	52	45	39	32	26	20	14	8	46
48	93	86	79	73	66	60	54	47	41	35	29	24	18	12	48
+50	93	87	80	74	68	61	55	49	44	38	32	27	21	16	+50
52	94	87	81	75	69	63	57	51	46	40	35	29	24	19	52
54	94	88	82	76	70	64	59	53	48	42	37	32	27	22	54
56	94	88	82	77	71	65	60	55	50	44	39	35	30	25	56
58	94	88	83	77	72	67	61	56	51	46	42	37	32	28	58
+60	94	89	83	78	73	68	63	58	53	48	43	39	34	30	+60
62	95	89	84	79	74	69	64	59	54	50	45	41	37	32	62
64	95	89	84	79	74	70	65	60	56	51	47	43	38	34	64
66	95	90	85	80	75	71	66	61	57	53	49	44	40	36	66
68	95	90	85	81	76	71	67	63	58	54	50	46	42	38	68
+70	95	90	86	81	77	72	68	64	59	55	51	48	44	40	+70
72	95	91	86	82	77	73	69	65	61	57	53	49	45	42	72
74	95	91	86	82	78	74	69	65	62	58	54	50	47	43	74
76	95	91	87	82	78	74	70	66	63	59	55	51	48	45	76
78	96	91	87	83	79	75	71	67	63	60	56	53	49	46	78
+80	96	91	87	83	79	75	72	68	64	61	57	54	50	47	+80
82	96	92	88	84	80	76	72	69	65	62	58	55	52	48	82
84	96	92	88	84	80	76	73	69	66	62	59	56	53	49	84
86	96	92	88	84	81	77	73	70	67	63	60	57	54	51	86
88	96	92	88	85	81	77	74	71	67	64	61	58	55	52	88
+90	96	92	89	85	81	78	74	71	68	65	61	58	55	52	+90
92	96	92	89	85	82	78	75	72	68	65	62	59	56	53	92
94	96	93	89	85	82	79	75	72	69	66	63	60	57	54	94
96	96	93	89	86	82	79	76	73	70	67	64	61	58	55	96
98	96	93	89	86	83	79	76	73	70	67	64	61	59	56	98
+100	96	93	90	86	83	80	77	74	71	68	65	62	59	57	+100

TABLE 7 (cont'd.)

Relative Humidity

Dry-bulb temp. F	Difference between dry-bulb and wet-bulb temperatures														Dry-bulb temp. F
	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
+46	2														+46
48	7	1													48
+50	10	5													+50
52	14	9	4												52
54	17	12	7	3											54
56	20	16	11	7	2										56
58	23	19	14	10	6	2									58
+60	26	21	17	13	9	5	1								+60
62	28	24	20	16	12	8	4	1							62
64	30	26	22	19	15	11	8	4							64
66	32	29	25	21	17	14	10	7	4						66
68	34	31	27	23	20	16	13	10	7	3					68
+70	36	33	29	26	22	19	16	12	9	6	3				+70
72	38	34	31	28	24	21	18	15	12	9	6	3			72
74	40	36	33	30	26	23	20	17	14	11	8	6	3		74
76	41	38	35	31	28	25	22	19	16	14	11	8	5	3	76
78	43	39	36	33	30	27	24	21	18	16	13	10	8	5	78
+80	44	41	38	35	32	29	26	23	20	18	15	13	10	8	+80
82	45	42	39	36	33	30	28	25	22	20	17	15	12	10	82
84	46	43	40	38	35	32	29	27	24	21	19	17	14	12	84
86	48	45	42	39	36	33	31	28	26	23	21	18	16	14	86
88	49	46	43	40	37	35	32	30	27	25	22	20	18	16	88
+90	50	47	44	41	39	36	34	31	29	26	24	22	19	17	+90
92	51	48	45	42	40	37	35	32	30	28	25	23	21	19	92
94	51	49	46	44	41	39	36	34	31	29	27	25	23	20	94
96	52	50	47	45	42	40	37	35	33	30	28	26	24	22	96
98	53	51	48	45	43	41	38	36	34	32	29	27	25	23	98
+100	54	51	49	46	44	42	39	37	35	33	31	29	27	25	+100

Dry-bulb temp. F	Difference between dry-bulb and wet-bulb temperatures														Dry-bulb temp. F
	29°	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
+78	3														+78
+80	5	3													+80
82	7	5	3	1											82
84	10	7	5	3	1										84
86	11	9	7	5	3	1									86
88	13	11	9	7	5	3	1								88
+90	15	13	11	9	7	5	3	1							+90
92	17	15	13	11	9	7	5	3	1						92
94	18	16	14	12	11	9	7	5	3	2					94
96	20	18	16	14	12	10	9	7	5	4	2				96
98	21	19	17	16	14	12	10	9	7	5	4	2	1		98
100	23	21	19	17	15	13	12	10	9	7	5	4	2	1	+100

CAUTION

THE GENERATOR WILL NOT CARRY ALL ONBOARD EQUIPMENT. ENERGIZE ONLY THE EQUIPMENT NECESSARY FOR SAFE OPERATION OF THE BOAT.

PROTOTYPE ELECTRICAL LOAD ANALYSIS

ITEM	QTY	VOLT	AMP	WATTS	TOTAL	INPORT	UNDERWAY
SEARCH LIGHT	2	12	7.5	90	180		X
WINDSHIELD WIPER	2	12	E5	60	120		X
ELECTRIC HORN	1	12	E4.5	54	54		X
NAVIGATION LIGHT	4	12	2	25	100		X
ANCHOR LIGHT	1	12	.83	10	10	X	
INTERIOR LIGHTS	5	12	2	25	125	X	X
PUMP, WATER SET	1	12	4	48	48	X	X
BILGE, PUMP	3	12	E15	180	540	X	X
TREATMENT UNIT	1	12	50	600	600	X	X
MOTOR, HEATER	2	12	E5	60	120	X	X
INSTRUMENTATION (GAGES/LIGHTS)	13	12	.4	5	65		X
HOLDING TANK, MOTOR	1	12	8	96	96	X	
ELECTRIC HEATER, CABIN	1	230	9.5	2200	2200	X	X
ELECTRIC HEATER ENGINE ROOM	1	230	9.5	2200	2200	X	X
AIR CONDITIONER, PUMP	1	230	15.2	3496	3496	X	X
MICROWAVE	1	115	9.5	1100	1100	X	X
OUTLETS, 115 VAC	7	115	15	1725	1725	X	X
REFRIGERATOR	1	115	.4	46	46	X	X
BATTERY CHARGER	1	115	45	5175	5175	X	X
DECK FLOODLIGHT	2	12	4.1	50	100	X	X
RADIO, MARINE	1	12		40	40	X	X
AN/VRC 46	1	24	10	240	240	X	X
AN/URC 92	1	24	21.8	525	525		X
AN/APX 72	1	24	9.4	226	226		X
COMPASS, LIGHT	1	12	.4	5	5		X
RADAR, 32NM	1	12					X
GPS	1	24	.5	12	12		X
FATHOMETER	1	12	.25	3	3		X
TRIM TABS	1	12	18	216	216		X
CHART LIGHT	1	12	.4	5	5		
LIGHTS ENG RM	5	12	2	25	125	X	X
VENTILATION BLOWER HEAD	1	12	2	25	25	X	X
HEATER WATER	1	115	10.9	1250	1250	X	X

Summary of Temperature, Solar Radiation, and Relative Humidity

Climatic Design Type	Daily Cycle (QSTAG 360 Equivalents)*	Operational Conditions			Storage and Transit Conditions	
		Ambient Air Temperature °F (°C)	Solar Radiation Eqh (W/m²)	Ambient Relative Humidity %	Induced Air Temperature °F (°C)	Induced Relative Humidity %
Hot	Hot-Dry (A1)	90 to 120 (32 to 49)	0 to 335 (0 to 1120)	3 to 8	91 to 160 (33 to 71)	1 to 7
	Hot-Humid (B3)	88 to 105 (31 to 41)	0 to 343 (0 to 1080)	59 to 88	91 to 160 (33 to 71)	14 to 80
Basic	Constant High Humidity (B1)	Nearly Constant 75 (24)	Negligible	95 to 100	Nearly Constant 80 (27)	95 to 100
	Variable High Humidity (B2)	78 to 95 (26 to 35)	0 to 307 (0 to 970)	74 to 100	86 to 145 (30 to 63)	19 to 75
	Basic Hot (A2)	86 to 110 (30 to 43)	0 to 335 (0 to 1120)	14 to 44	86 to 145 (30 to 63)	5 to 44
	Basic Cold (C1)	-5 to -25 (-21 to -32)	Negligible	Tending toward saturation	-13 to -28 (-25 to -33)	Tending toward saturation
Cold	Cold (C2)	-35 to -50 (-37 to -46)	Negligible	Tending toward saturation	-35 to -50 (-37 to -46)	Tending toward saturation
Severe Cold	Severe Cold (C3)	-60 (Cold soak) (-51)	Negligible	Tending toward saturation	-60 (-51)	Tending toward saturation

DEFINITIONS OF SEA CONDITIONS: WAVE AND SEA FOR FULLY ARISEN SEA

Sea — General		Wind				Sea								
Sea State	Description	(Beaufort) Wind force	Description	Range (knots)	Wind Velocity (knots)	Wave Height: Average	Wave Height: Significant	Wave Height: Average of One-Tenth Highest	Significant Range Periods (sec)	Periods of maximum Energy of Spectra $T_{max} = T_z$	Average Period $\bar{T}_z$	Average Wavelength $\bar{L}_o$ (ft unless otherwise indicated)	Minimum Fetch (nautical miles)	Minimum Duration (hr unless otherwise indicated)
	Sea like a mirror	0	Calm	1	0	0	0	0	—	—	—	—	—	—
0	Ripples with the appearance of scales are formed, but without foam crests.	1	Light airs	1–3	2	0.04	0.01 0.01	0.09	1.2	0.75	0.5	10 in	5	18 min
1	Small wavelets; short but pronounced crests have a glossy appearance, but do not break.	2	Light breeze	4–6	5	0.3	0.5	0.6	0.4–2.8	1.9	1.3	6.7 ft	8	39 min
	Large wavelets; crests begin to break. Foam of glossy	3	Gentle	7–10	8.5	0.8	1.3	1.6	0.8–5.0	3.2	2.3	20	98	1 7
	appearance. Perhaps scattered white horses.		breeze		10	1.1	1.8	2.3	1.0–6.0	3.2	2.7	27	10	2.4
2					12	1.6	2.6	3.3	1.0–7.0	4.5	3.2	40	18	3.8
	Small waves, becoming larger;	4	Moderate		13.5	2.1	3.3	4.2	1.4–7.6	5.1	3.6	52	24	4.8
	fairly frequent white horses.		breeze	11–16	14	2.3	3.6	4.6	1.5–7.8	5.3	3.8	59	28	5.2
3					16	2.9	4.7	6.0	2.0–8.8	6.0	4.3	71	40	6.6
					18	3.7	5.9	7.5	2.5–10.0	6.8	4.8	90	55	8.3
4	Moderate waves, taking a more	5	Fresh	17–21	19	4.1	6.6	8.4	2.8–10.6	7.2	5.1	99	65	9.2
	pronounced long form; many white horses are formed (chance of some spray).		breeze		20	4.6	7.3	9.3	3.0–11.1	7.5	5.4	111	75	10
5					22	5.5	8.8	11.2	3.4–12.2	8.3	5.9	134	100	12
	Large waves begin to form;	6	Strong	22–27	24	6.6	10.5	13.3	3.7–13.5	9.0	6.4	160	130	14
	white crests are more extensive everywhere (probably some spray).		breeze		24.5	6.8	10.9	13.8	3.8–13.6	9.2	6.6	164	140	15
6					26	7.7	12.3	15.6	4.0–14.5	9.8	7.0	188	180	17
					28	9	14.3	18.2	4.5–15.5	10.6	7.3	212	230	20
	Sea heaps up, and white foam from	7	Moderate	28–33	30	3	16.4	20.8	4.7–16.7	11.3	8.0	250	280	23
	breaking waves being to be blown in streaks along the direction of the wind (Spindrift begins to be seen).		gale		30.5	1.0	16.9	21.5	4.8–17.0	11.5	8.2	258	290	24
7					32	1 5	18.6	23.6	5.0–17.5	12.1	8.6	285	340	27
					34	13.1	21.0	26.7	5.5–18.5	12.8	9.1	322	420	30
7					36	14.8	23.6	30.0	5.8–19.7	13.6	9.6	363	500	34
	Moderate high waves of greater	8	Fresh	34–40	37	15.6	24.9	31.6	6–20.5	13.9	9.9	376	530	37
	length; edges of crests break into spindrift. The foam is blown in well-marked streaks along the direction of the wind. Spray affects visibility.		gale		38	16.4	26.3	33.4	6.2–20.8	14.3	10.2	392	600	38
					40	18.2	29.1	37.0	6.5–21.7	15.1	10.7	444	710	42
8					42	20.1	32.1	40.8	7–23	15.8	11.3	492	830	47
	High waves. Dense streaks of foam	9	Strong		44	22.0	35.2	44.7	7–24.2	16.6	11.8	534	960	52
	along the direction of the wind. Sea begins to roll. Visibility affected.		gale	41–47	46	24.1	38.5	48.9	7–25	17.3	12.3	590	1110	57
	Very high waves with long over-hanging crests. The resulting foam				48	26.2	41.9	53.2	7.5–26	18.1	12.9	650	1250	63
	is in great patches and is blown in dense white streaks along the direction of the wind. On the whole, the	10	Whole* gale	48–55	50	28.4	45.5	57.8	7.5–27	18.8	13.4	700	1420	69
					51.5	30.2	48.3	61.3	8–28.2	19.4	13.8	736	1560	73
	surface of the sea takes on a white appearance. The rolling of the sea				52	30.8	49.2	6.25	8–28.5	19.6	13.9	750	1610	75
9	becomes heavy and shocklike. Visibility is affected.				54	33.2	53.1	67.4	8–29.5	20.6	14.5	810	1800	81
	Exceptionally high waves. Sea completely covered with long white patches of foam lying in direction of wind. Everywhere edges of wave crests are blown into froth. Visibility affected.	11	Storm*	56–63	56 59.5	35.7 40.3	57.1 64.4	72.5 81.8	8.5–31 10–32	21.1 22.4	15 15.9	910 985	2100 2500	88 101
	Air filled with foam and spray. Sea white with driving spray. Visibility very seriously affected.	12	Hurricane*	64–71	> 64	> 46.6	74.5	96.6	9–33	24.1	17.2	—	—	—

APPENDIX D

TEST PLAN SUPPORT DOCUMENTS

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005-5055

REPLY TO ATTENTION OF

AMSTE-TA-G (70-10p) 28 Jun 1990

MEMORANDUM FOR Commander, U.S. Army Belvoir Research, Development and Engineering Center, ATTN: STRBE-FMS (Mr. Scott Story), Fort Belvoir, VA 22060-5606

SUBJECT: Draft Technical Issues for the Draft Test and Evaluation Master Plan (TEMP) of the Coastal, Harbor, and Inland Waterway (CHI) Service Boat

1. Reference: Draft Revised Required Operational Capability (DRROC) for a Coastal, Harbor, and Inland Waterway Service Boat, 24 Jan 1990.

2. Enclosed are the draft technical issues for preparation of the CHI service boat TEMP.

3. Points of contact for the CHI boat program are Mr. Brian Stolarz, AMSTE-TA-G, amstetag@apg-9.apg.army.mil, AUTOVON 298-5221/5222 and Mr. Richard Britton, AMSTE-TA-T, amstetat@apg-9.apg.army.mil, AUTOVON 298-3640/3766.

FOR THE COMMANDER:

Encl

LARRY L. WEST
Chief, Ground Warfare Assessment Division
Directorate for Test and Assessment

TECOM TECHNICAL ISSUES
FOR THE
COASTAL, HARBOR, AND INLAND WATERWAY (CHI) SERVICE BOAT

1. Physical and Performance Characteristics.

a. Issue: What are the physical and performance characteristics of the CHI boat and to what extent do they satisfy mission requirements?

b. Criteria.

(1) Have the capability to transport 5 weather protected passengers. (Draft Revised Required Operational Capability (DRROC), para 5b(1)).

(2) Be capable of transporting 1 ton of cargo on the afterdeck area. Cargo space should be approximately 100 square feet. (DRROC, para 5b(2)).

(3) Be capable, when fully loaded, of 20-25 knot sustained speed in sea state 3 (2 to 6 foot waves and wind speed of 11-16 knots) and of sustained operation in sea state 4 (4 to 8 foot waves and wind force of 17 to 21 knots). Intermittent top speeds of 30 knots is requirement for emergency operations. (DRROC, para 5c(1))

(4) Be capable of 20 hours of continuous operation at sustained speed of 25 knots with a 25-percent fuel safety margin in a light condition. (DRROC, para 5c(2))

(5) Use standard U.S. military diesel fuel. (DRROC, para 5c(3))

(6) Not exceed 36 feet in length, a maximum draft of 4 feet. (DRROC, para 5d(1))

(7) Have twin propulsors, twin-diesel inboard drive. (DRROC, para 5d(2))

(8) Possess pilothouse (cabin) controls for operation of craft. (DRROC, para 5d(3))

(9) Be capable of providing facilities and service necessary for supporting a crew of three and one officer for one day. (DRROC, para 5d(4))

(10) Have suitable rub rails around the outermost periphery deck line. (DRROC, para 5d(6))

(11) Possess adequate floodlighting of the aft deck area. Port and starboard searchlights with internal controls are required for patrol duty and navigation. (DRROC, para 5d(7))

(12) Possess power capability for raising and lowering the anchor. The system shall not be a design to preclude emergency free fall for the anchor. (DRROC, para 5d(8))

(13) Possess an emergency manual steering capability. (DRROC, para 5d(9))

(14) Be capable of operating all mission essential electrical systems at any time. Service generators shall be capable of operating all electrical systems on a 24-hour-per-day basis. A capability of using compatible shore power will also be provided. (DRROC, para 5d(10))

(15) Possess adequate stowage facilities for Basic Issue Item List (BIIL) items. (DRROC, para 5d(11))

(16) There shall be installed one USCG approved marine head with holding tank. There will also be a means of pumping contents of holding tank to shore facilities. The tank shall be sized to preclude the need to pump out the tank more than once per day. (DRROC, para 5d(13))

(17) Will possess two (2) crew served weapon mounts one (1) forward and one (1) aft to accommodate 50 caliber machine guns. Ammunition storage lockers to accommodate basic load of ammunition for crew served and individual weapons will be provided. (DRROC, para 5d(14))

(18) Be constructed to American Bureau of Shipping (ABS) and U.S. Coast Guard (USCG) regulations to the maximum extent practical. (DRROC, para 5f(1))

(19) Comply with all; State, Federal, and U.S. Territory; water, air, and noise pollution requirements. (DRROC, para 5f(2))

(20) Asbestos-free materials will be used in insulation and fire barrier materials throughout the vessel, and will conform to all federal regulations regarding the use of asbestos-free materials. (DRROC, para 5f(4))

2. Reliability and Durability.

a. Issue: Does the CHI boat meet its reliability requirements and, if not, what impact will this have on mission performance? Does the CHI boat exhibit adequate durability?

b. Criteria: Criteria are not yet available. A RAM Rationale Report is to be prepared that will develop appropriate RAM requirements for a commercial boat of this size which will be compatible with the mission profile. (DRROC)

3. Logistic Supportability.

a. Issue: Does the CHI boat meet its quantitative maintainability requirements and, if not, what impact will this have on maintenance burden? Are other logistic support aspects of the CHI boat adequate or adequately planned and, if not, what elements must be corrected or improved for fielding?

b. Criteria.

(1) Quantitative maintainability criteria are not yet available. A RAM Rational Report is to be prepared that will develop appropriate RAM requirements for a commercial boat of this size which will be compatible with the mission profile. (DRROC)

(2) Logistic support is to be provided by the crew and organization to which the CHI boat is assigned and by the direct and general support maintenance organizations. The contractor's commercial distribution channels and other support services will be used where feasible. (DRROC)

4. Transportability.

a. Issue: To what degree does the CHI boat meet user requirements for transportability?

b. Criteria.

(1) The CHI boat shall be capable of being lifted by means of permanently installed lifting pads and eyes designed and installed to provide a 4-point lift. (Recommended changes to DRROC)

(2) Each CHI boat shall be supplied with a cradle designed for the CHI boat. The cradle shall be designed and constructed to withstand the dynamic load placed on it with the CHI boat loaded on the cradle and the CHI boat and cradle loaded onto a ship or barge for ocean deployment. The cradle shall be fitted with lifting pads and eyes to enable the cradle and CHI boat to be lifted as a single lift. Means shall be provided on the cradle to enable the CHI boat to be securely lashed to the cradle and cradle lashed to the deck of a ship or barge. (Recommended changes to DRROC)

(3) Each CHI boat shall be supplied with a sling capable of lifting the CHI boat into the cradle and of lifting the cradle with the CHI boat in place. The need for spreader bars will be considered. (Recommended changes to DRROC).

(4) The CHI boat shall be equipped with lifting and tiedown eyes which will meet the requirements of MIL-STD-209G, Slinging and Tiedown Provisions for Lifting and Tying Down Military Equipment. (TECOM)

5. Safety and Health.

a. Issue: Have the safety and health hazards associated with the operation, maintenance, and transportation of the CHI boat been eliminated or controlled to an acceptable?

b. Criteria.

(1) The CHI boat shall be safe for its intended purpose under conditions of use specified in the mission profile and requirements document. Its design shall present no uncontrolled safety or health hazards (category I-A, I-B, I-

C, I-D, II-A, II-B, II-C, or III-A hazards IAW MIL-STD-882) throughout the life cycle of the system. (DRROC/TECOM)

b. The design and construction of the CHI boat shall have required lifesaving equipment to include one USCG approve ten man inflatable/ containerized life raft with hydrostatic release. The construction of the CHI boat shall also consider the location and adequacy of USCG approved lifesaving equipment (e.g. life lines, flotation rings, man-overboard beacons, etc.). (DRROC, para 5g(1)/TECOM)

c. The CHI boat must possess a USCG-approved automatic fire smoke detection system with alarm for the engine compartment(s) and fuel tank compartment(s), if different. The compartment(s) shall be fitted with a USCG-approved fixed fire extinguishing system. (DRROC, para 5g(2)/TECOM)

d. The CHI boat shall have installed emergency fire fighting/fire containing equipment to combat/contain class A, B, and C fires. (DRROC, para 5g(3))

e. The CHI boat must be designed with the health and safety of the operator as primary considerations. Evaluation of CHI boat communication equipment for potential exposure of personnel to non-ionizing radiation hazards will be accomplished IAW para 9-9 AR 40-5. A health hazard assessment is required in accordance with AR 40-10. (DRROC/TECOM)

f. The materials used in the construction or operation of the CHI boat shall not be hazardous to personnel to include when materials are subjected to heat/flame. In cases where non-hazardous (e.g. fire-resistance, non-toxic) substitutes can not be utilized, means must be provided to insure that generated hazards (e.g. toxic fumes/gases) are within acceptable exposure limits (see TB Med 265). (DRROC/TECOM)

g. The CHI boat shall have provisions to protect operator, maintenance and other personnel from rotating or reciprocating parts, from electrical shock, from parts subject to high temperatures and pressures. Non-functional sharp edges and projections shall be eliminated. Exhaust discharges shall have no leaks and shall be directed so as not to endanger personnel. Platforms, steps and ladders shall have appropriate rails and non-skid surfaces, appropriate to their use. Provisions in accordance with system safety engineering concepts and in compliance with requirements of Department of Transportation (DOT) and Department of Labor (DOL) (concerning adherence to Occupational Safety and Health Administration (OSHA) Act and meeting the mandatory maritime standards). (DRROC/TECOM)

h. The CHI boat shall be designed to comply with the hearing conservation requirements of MIL-STD-1474 and TB Med 501. (DRROC/TECOM)

i. The CHI boat shall comply with electrical and/or electronic systems, standards and requirements addressed in MIL-STD-454. (TECOM)

j. The CHI boat shall comply with Federal water and air pollution control regulations, appropriate USCG regulations and Federal Communications Commission (FCC) regulations. (DRROC/TECOM)

k. The CHI boat will be compatible with government furnished equipment without adversely affecting the safe use/operation of the equipment. (TECOM)

l. CHI boat components handling procedures shall be designed/implemented to comply with weight lifting/carrying requirements of MIL-STD 1472. (DRROC/TECOM)

6. Human Factors Engineering (HFE).

a. Issue: Are the CHI service boat human engineering design and soldier-machine interface characteristics satisfactory?

b. Criteria.

(1) Have the capability to transport 5 weather protected passengers. (DRROC, para 5b(1))

(2) Possess pilothouse (cabin) controls for operation of craft. (DRROC, para 5d(3))

(3) Be capable of providing limited facilities and service necessary for supporting a crew of three and one officer for one day. (DRROC, para 5d(4))

(4) Have adequate climate control...for habitation requirements. (DRROC, para 5d(5))

(5) Have suitable rails around the outermost periphery deck line. (DRROC, para 5d(6))

(6) Possess adequate floodlighting of the aft deck area. Port and starboard searchlights are required for patrol duty and navigation. (DRROC, para5d(7))

(7) Possess an emergency manual steering capability. (DRROC, para 5d(9))

(8) Have required lifesaving equipment to include one USCG approved ten man inflatable/containerized life raft with hydrostatic release. (DRROC, para 5g(1))

(9) Meet applicable MIL-STD-1472 human engineering design requirements. (TECOM)

7. Communications, Electronic, and Navigational (CEN) Equipment.

a. Issue: Does the CEN equipment meet the user requirements?

b. Criteria.

(1) The vessel must have the latest state-of-the-art navigation and electronic equipment required by Title 33 of U.S. Code of Federal Regulations (CFR) and the International Safety of life at Sea (SOLAS) as well as the tactical equipment essential for logistic support coordination. This includes a magnetic compass, navigational radar, Bridge-to-Bridge VHF radio, tactical HF-SSB radio, tactical VHF-FM radio, and associated COMSEC equipment. (DRROC, para 5h)

(2) Conform with MIL-STD-461 for electromagnetic interference criteria. (TECOM)

(3) Comply with appropriate regulations and standards of the USCG and the Federal Communications Commission. (TECOM)

8. Climatic and Environmental.

a. Issue: Does the design of the CHI boat permit full operational capability within the climatic and operational environments slated for its use?

b. Criteria.

(1) Be capable of performing its assigned mission in climatic design types hot and basic, when not impeded by ice (AR 70-38). (DRROC, para 5a)

(2) Have adequate climatic control equipment for preservation of electronic equipment and for habitation requirements. Environmental requirements for personnel-occupied areas shall conform to MIL-STD-1472. (DRROC, para 5d(5)/TECOM)

ATSP-CD-TE

16 DEC 1987

SUBJECT: Approved Independent Evaluation Plan (IEP) for the Coastal, Harbor, and Inland (CHI) Waterway Service Boat

SEE DISTRIBUTION

1. Attached as inclosure 1 is the approved Independent Evaluation Plan (IEP) for the Coastal, Harbor, and Inland (CHI) Waterway Service Boat for your information and retention.

2. USATSCH POC is CW3 J. R. Gagliano, Directorate of Combat Developments, Test & Evaluation Office (ATSP-CD-TE), Fort Eustis, VA, 23604, AUTOVON 927-2340/3208.

FOR THE COMMANDANT:

1 Incl
as

SAMUEL A. BARNES
CPT, AGC
Adjutant

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INDEPENDENT EVALUATION PLAN

FOR

COASTAL, HARBOR, AND INLAND (CHI) WATERWAY

SERVICE BOAT

(ACN 58589)

Prepared by

CW3 JOSEPH R. GAGLIANO

DECEMBER 1981

DIRECTORATE OF COMBAT DEVELOPMENTS
US ARMY TRANSPORTATION SCHOOL
Fort Eustis, Virginia 23604

TABLE OF CONTENTS

1.0 SYSTEM DESCRIPTION

1.1 Name of System. Coastal, Harbor, and Inland (CHI) Waterway Service Boat.

1.2 Background. The Trans-Hydro Craft Study and the DARCOM/TRADOC Army Watercraft Requirements Master Plan established the need for a coastal, harbor, and inland waterway service boat with an efficient means of transporting limited amounts of personnel and cargo ship-to-shore in a logistical operation. The three small boats the Army now has in its inventory that can be classified as CHI service boats are: Type J, Type Q, and Type T. Presently, all three vessels are obsolete due to the average age of each craft. In addition, there are numerous makes and models, causing excessive maintenance and training requirements which continuously escalate operational and maintenance costs. To correct this problem, a Required Operational Capability (ROC) document for a replacement craft was submitted to DA for approval on 28 July 1978. DA approval was granted 17 January 1979. Cards Reference Number 1679.

1.3 Characteristics and Configuration. The CHI service boat will be a steel hull craft approximately 60 feet in length, have a maximum light draft of 6 feet, and a desired light displacement of 35 long tons. The twin-screw, twin-diesel drive engines will be capable of sustaining speeds of 12-15 knots, while fully loaded (1½ to 2½ long-tons), in a Sea State Code 3 (1.6 - 4.1 ft. seas; 11-16 knot winds), as described in the American Practical Navigator (HO-9), dated 1977. The service boat will be capable of 18-20 hours of continuous operation using standard US military diesel fuel with a 25 percent fuel safety margin.

1.4 Concept of Employment. The Army will utilize the CHI service boat for transporting passengers and cargo along coastlines, in harbors, and on inland waterways, as required, in a logistical operation. The craft will be provided to companies, battalions, or transportation terminal groups currently authorized passenger and cargo (J, Q, T) boats. It is required that this craft be capable of being transported overseas either by being lifted into a boat cradle and placed aboard a vessel or transported overseas in a lighter aboard ship (LASH) barge.

1.5 Test Manager. CW3 Joseph R. Gagliano, US Army Transportation School, Directorate of Combat Developments, Test and Evaluation Office (ATSP-CD-TE), Fort Eustis, VA 23604, telephone: Commercial: (804)-878-2340/3208; AUTOVON: 927-2340/3208.

2.0 ISSUES AND ASSOCIATED CRITERIA.

*2.1 Issue: Is the candidate vessel capable of performing its mission in all climatic conditions specified in the ROC?

2.1.1 Scope: An objective and subjective assessment of the candidate vessel will be based on the performance of the mission tasks of the CHI service boat under various climatic conditions encountered during the test scenario/ market survey.

2.1.2 Criterion: When not restricted by ice, the CHI service boat will be capable of operating along coastlines, in harbors, and on inland waterways in climatic conditions Hot (B3), Basic (A2, B1, B2, C1), IAW AR 70-38.

2.1.3 Rationale: To insure the candidate vessel will be capable of performing the intended mission in all required climatic environments.

2.1.4 Source: Paragraph 5a, page 2 of the Required Operational Capability (ROC) document for the CHI Service Boat.

*2.2 Issue: Is the vessel capable of transporting personnel ship-to-shore in a logistical operation?

2.2.1 Scope: An assessment of the candidate vessel's ability to transport personnel, ship-to-shore in a logistical operation, complete with work equipment, in an inclosed deckhouse, will be based on the demonstrated performance during the test scenario/market survey.

2.2.2 Criterion: The candidate vessel will be capable of transporting 15-20 stevedores, complete with the appropriate cargo set (TOE 55-117H), in Sea State Code 3 (1.6 - 4.1 ft seas, 11-16 knot winds) along coastlines, in harbors, and on inland waterways.

2.2.3 Rationale: To insure the service boat is capable of providing ship-to-shore/shore-to-shore transportation for personnel during a logistical operation.

2.2.4 Source: Paragraph 5b(1), page 2, of the ROC document.

*2.3 Issue: Is the vessel capable of effectively transporting cargo?

2.3.1 Scope: The demonstrated performance of the service boat will be assessed while being utilized to transport light packaged cargo during the test scenario/market survey.

2.3.2 Criterion: The service boat will have a minimum of 100 square feet of cargo space on the afterdeck. The vessel will be capable of transporting 1½-to-2½ long tons of ROC-described cargo effectively during Sea State Code 3.

2.3.3 Rationale: To insure the candidate vessel is capable of transporting cargo during an operation.

2.3.4 Source: Paragraph 5b(2), page 2, of the ROC document.

*Critical issues only.

*2.4 Issue: Is the vessel able to perform the mission under specified sea states?

2.4.1 Scope: The performance of the service boat under specified sea state conditions will be objectively and subjectively evaluated according to the demonstrated performance while being utilized as a command and control craft for various operations.

2.4.2 Criterion: While fully loaded, the CHI service boat will be capable of sustaining 12-15 knots for 18-20 hours in Sea State Code 3 and be able to operate in Sea State Code 4. Intermittent top speeds of 20 knots are required for emergency operations.

2.4.3 Rationale: To insure the CHI service boat will be seaworthy and capable of maintaining the specified speeds while operating in specified sea states.

2.4.4 Source: Paragraph 5c(1), page 2, of the ROC.

*2.5 Issue: Does the service boat possess the required controls and power source to accomplish its mission in all required weather conditions?

2.5.1 Scope: While operating under various assigned tasks as specified in the mission profile, the performance of the candidate vessel will be evaluated according to the demonstrated performance.

2.5.2 Criterion: The CHI service boat will be equipped with both pilothouse and flying bridge controls, along with twin-screw, twin-diesel drive engines to facilitate maneuvering in close quarters situations up to Sea State Code 4.

2.5.3 Rationale: To insure the service boat is capable of performing its intended mission.

2.5.4 Source: Paragraph 5d(3), page 2, of the ROC document.

2.6 Issue: Will the service boat be capable of performing in all mission profiles and required weather environments?

2.6.1 Scope: An assessment of the cruising range of the CHI service boat will be determined by its fuel consumption, to include a 25 percent fuel safety margin.

2.6.2 Criteria:

2.6.2.1 The candidate vessel will operate on standard US Military diesel fuel and lubricants.

2.6.2.2 The service boat, when fully loaded, will be capable of maintaining 12-15 knots in Sea State Code 3, while continuously operating for 18-20 hours.

2.6.3 Rationale: To insure the service boat will perform in all mission profiles and required weather environments.

2.6.4 Source: Paragraph 5c(3), page 2, of the ROC document.

*2.7 Issue: Is the vessel capable of accommodating a crew of six for a minimum of 72 hours of continuous operation?

2.7.1 Scope: The candidate vessel will be evaluated on the adequacy/suitability of the crew accommodations in various weather conditions.

2.7.2 Criterion: During the test scenario/market survey, the CHI service boat, while fully loaded, will adequately accommodate a crew of four and an additional requirement to accommodate two officers for a minimum of 72 hours during Sea State Code 3.

2.7.3 Rationale: To insure the CHI service boat will accommodate a full crew during operations.

2.7.4 Source: Paragraph 5d(4), page 2, of the ROC.

2.8 Issue: Does the candidate vessel have adequate climatic control equipment for electronic and habitation requirements?

2.8.1 Scope: An objective evaluation of the heating/cooling system of the service boat will be conducted during the test scenario/market survey.

2.8.2 Criterion: The CHI service boat will have adequate climatic control for both electronic and habitation requirements as specified in MIL-STD-1472B.

2.8.3 Rationale: To insure the CHI service boat will be able to meet the requirements set forth in MIL-STD-1472B.

2.8.4 Source: Paragraph 5d(5), page 2, of the ROC document.

2.9 Issue: Are the rub rails around the outermost periphery of the deckline on the candidate vessel sufficient?

2.9.1 Scope: The ability of the rub rails to keep all exposed areas of the vessel from receiving damage, while docking/undocking, will be assessed on their demonstrated performance during the test scenario/market survey.

2.9.2 Criterion: The candidate vessel will be equipped with sufficient rub rails, extending longitudinally on both sides of the hull above the water-line to protect it against damage from the bending and battering effects of quay-walls, piles, etc., or when going along other vessels.

2.9.3 Rationale: To insure the candidate vessel has adequate rub rails to protect the hull.

2.9.4 Source: Paragraph 5d(6), page 3, of the ROC document.

*2.13 Issue: Does the candidate vessel possess a continuous AC power system which can either be operated independently or can be adaptable for shore power operation?

2.13.1 Scope: The AC generators and shore power capability will be assessed according to their demonstrated performance during the evaluation.

2.13.2 Criteria:

2.13.2.1 The CHI service boat will be capable of sustaining the mission essential electrical systems while operating from compatible shore power.

2.13.2.2 The ship's generator will be capable of operating all electrical systems on a 24-hour-a-day basis.

2.13.2.3 The ship's generator will have a 25 percent growth potential.

2.13.3 Rationale: To insure the service boat will be capable of producing AC power required for the accomplishment of the intended mission.

2.13.4 Source: Paragraph 5d(10), page 3, of the ROC document.

2.14 Issue: Are there adequate stowage facilities onboard the candidate vessel?

2.14.1 Scope: The adequacy of the stowage facilities will be subjectively and objectively evaluated according to their size, location, and accessibility to the intended user while pierside and during operations outlined in the mission profile.

2.14.2 Criterion: The CHI service boat will possess sufficient stowage facilities to accommodate the Basic Item Listing (BII), to include crew required NBC equipment, for an extended voyage of 72 hours.

2.14.3 Rationale: To insure the CHI service boat has sufficient stowage facilities to carry out its intended mission.

2.14.4 Source: Paragraph 5d(11), page 3, of the ROC document.

*2.15 Issue: Are there any constraints associated with the loading/unloading of the craft for overseas deployment?

2.15.1 Scope: An objective and subjective evaluation will be conducted to determine and ascertain any constraints during slinging and lifting of the vessel and/or cradle for the purpose of transportability.

2.15.2 Criteria:

2.15.2.1 The CHI service boat will be capable of being sling loaded/unloaded with webbed slings safely with minimal amount of constraints for transportability IAW AR 70-44 and MIL-STD-209.

2.15.2.2 In addition, the service boat will be capable of being deck-loaded aboard on oceangoing ship and/or transported in a lighter aboard ship (LASH) barge.

2.15.3 Rationale: To insure the transportability of the CHI service boat to an overseas area.

2.15.4 Source: Paragraph 5e(1), page 3, of the ROC document.

*2.16 Issue: Does the candidate vessel possess adequate pollution abatement systems currently required and those projected requirements that are scheduled in future years by existing statutory regulations?

2.16.1 Scope: The pollution abatement systems will be assessed according to their capability of providing the vessel with a safe and efficient means of complying with current and future environmental regulations.

2.16.2 Criteria:

2.16.2.1 The CHI service boat will possess a USCG certified marine sanitation device for human waste control and an oil/water separator for oily waste disposal for a mission of 72 hours or until it can be transferred to an approved shoreside facility or disposed of IAW CG 257.

2.16.2.2 The service boat will comply with Federal water and air pollution control regulations, noise abatement, and electromagnetic interference criteria IAW MIL-STD-1474, MIL-STD-461, and MIL-STD-1472B.

2.16.2.3 The candidate vessel will adhere to 29 CFR 1910, 1001, insofar as utilization of asbestos-free materials in insulations and fire barrier material.

2.16.2.4 The service boat will emphasize human engineering design characteristics IAW MIL-STD-1472B.

2.16.3 Rationale: To insure the CHI service boat will meet current EPA standards set forth in MIL-STD-1474, MIL-STD-1472B, and MIL-STD-461.

2.16.4 Source: Paragraph 5f(2 and 3), page 3, of the ROC document.

*2.17 Issue: Does the candidate vessel possess adequate firefighting capabilities for onboard fires?

2.17.1 Scope: The firefighting/containing capabilities will be evaluated according to the demonstrated performance of the various systems during the test scenario/market survey.

2.17.2 Criteria:

2.17.2.1 The CHI service boat will have installed emergency fire-fighting/containing capability equipped to contain/combat Class A and B fires.

2.17.2.2 The boat will possess an automatic fire-sensing, alarm, and extinguishing system for the engine compartment and fuel tank compartment.

2.17.3 Rationale: To insure the candidate vessel will be capable of containing/combating fires onboard.

2.17.4 Source: Paragraph 5g(2 and 3), page 4, of the ROC document.

*2.18 Issue: Does the candidate vessel possess adequate lifesaving equipment?

2.18.1 Scope: The lifesaving equipment onboard the candidate vessel will be assessed according to the requirements set forth in CG 257.

2.18.2 Criterion: The CHI service boat will be provided with life-rafts, liferings, lifejackets, and other lifesaving equipment, as required and approved by AR 56-9 and CG 257. All lifesaving equipment will be readily assessible and have proper fastening devices to prevent them from breaking loose during adverse weather.

2.18.3 Rationale: To insure compliance with AR 56-9 and CG 257.

2.18.4 Source: Paragraph 5g(1), page 4, of the ROC.

2.19 Issue: Are there any known hazards to operators, maintenance, and user personnel that have not been identified and eliminated?

2.19.1 Scope: An evaluation will be conducted to identify and insure elimination or control of any safety or health violations.

2.19.2 Criterion: If the CHI service boat has any identified hazards to operator, maintenance, or user personnel, they will be eliminated or controlled in accordance with the system safety engineering in MIL-STD-882, and in compliance with requirements of Department of Transportation (DOT) and Department of Labor (DOL) concerning adherence to Occupational Safety and Health Administration (OSHA) Act and appropriate maritime standards.

2.19.3 Rationale: To insure compliance with appropriate regulations and enhance crew safety.

2.19.4 Source: Paragraph 5g(5), page 4, of the DOC document.

2.20 Issue: Does the commercial candidate vessel possess adequate levels of reliability, availability, and maintainability (RAM) for operational effectiveness and logistic supportability?

2.20.1 Scope: The RAM information, which will be collected from commercial industry, will be utilized to enable the US Army to obtain required technical information.

2.20.2 Criterion: The craft components/subsystems must adhere to American Bureau of Shipping (ABS) and be certified by the US Coast Guard. The basic boat will be in commercial use for one year, satisfactorily performing user-determined tasks similar to those proposed for its military application.

2.20.3 Rationale: To enable the US Army to utilize the appropriate RAM information for this craft.

2.20.4 Source: Paragraph 5i, page 4, and paragraph 5f(1), page 3, of the ROC document.

*2.21 Issue: Does the candidate vessel possess suitable navigation and electronic equipment?

2.21.1 Scope: The candidate vessel's navigation and electronic equipment will be based on vessel type, class, and intended use.

2.21.2 Criteria:

2.21.2.1 The candidate vessel will possess the latest state of the art navigation and electronic equipment.

2.21.2.2 The navigation and electronic equipment will be IAW US Code 33 and the International Safety at Sea Council.

2.21.2.3 The required tactical equipment essential for logistic support coordination will be IAW SB 11-636.

2.21.4 Source: Paragraph 5h, page 4, of the ROC.

2.22 Issue: Is the logistical support concept adequate?

2.22.1 Scope: The evaluation of the logistical support concept will include an examination of the commercial user supply and maintenance concepts and plans, the allocation of maintenance and repair responsibilities, and the adequacy of equipment publications and comparison of the results of commercial industry to that of the Army's.

2.22.2 Criterion: The CHI service boat, when fielded, will be supportable through normal Army supply channels. The supply and maintenance concepts and plans, along with the allocation of responsibilities, shall be clearly defined and allocated to the proper level IAW AR 750-1 for amphibians and watercraft.

2.22.3 Rationale: To insure an effective supply and maintenance support concept.

2.22.4 Source: Paragraph 7, page 5, of the ROC document.

2.23 Issue: Can the operator and maintenance personnel perform their respective tasks to the prescribed standard?

2.23.1 Scope: The adequacy of operator and maintenance personnel performing their required tasks will be subjectively and objectively evaluated during the test scenario/market survey.

2.23.2 Criteria:

2.23.2.1 During the user/market survey, this issue will be assessed by gathering data on average experience levels of personnel prior to training, and any performance shortfalls noted following the training and observation of individual/crew performance while performing missions/operations. Additionally, crew should be surveyed to determine acceptability of training to the crews.

2.23.2.2 A FOE is planned during which personnel will undergo a pre-training test to insure that requisite skills in appropriate MOS's are mastered. The appropriate training will be provided. After this training, a performance oriented test will be given to insure test players can perform the tasks to standards. Any additional training provided will be documented if failures occur. Player performance data to assess this issue will be collected during the test.

2.23.3 Rationale: To insure that user personnel are adequately trained and identify any additional training requirements that may be unique to this boat.

2.23.4 Source: Paragraph 9, page 5, of the ROC.

2.24 Issue: Is the candidate vessel capable of performing its mission in an NBC environment?

2.24.1 Scope: The candidate boat's ability to provide crew protection against the hazards of chemical contamination and radiological fall-out as well as protection of equipment sensitive to NBC hazards will be addressed both objectively and subjectively during the test scenario/user/market survey.

2.24.2 Criterion: The candidate vessel will be able to provide NBC protection to the crew (shirt-sleeve environment) and sensitive mission equipment as outlined in the ROC.

2.24.3 Rationale: Since the user/market survey will inspect commercial equipment, inherent or required modifications to provide ROC level protection needs to be determined.

2.24.4 Source: Commander, USATRADOC.

3.0 CONCEPT OF EVALUATION. Information pertinent to the evaluation of the craft will be derived from the user market survey, First Article Initial Production Testing (FA-IPT), and Follow-on Evaluation (FOE) conducted by both materiel and combat developers. The data source matrix, paragraph 4.0, identifies the primary data source to satisfy each of the test criteria.

3.1 User Market Survey: The issues and associated criteria developed in both the materiel and combat developer's independent evaluation plan (IEP), along with information from the ROC document, will be incorporated into a detailed market survey questionnaire, developed by the Nondevelopmental Item Work Group (NDIWG). Upon approval of these documents, a survey team will conduct a user market survey as directed by revised AR 70-1, Chapter 6, paragraph 2b(2)(c), items 1-14, provided by letter, DAMA-PPM-A, DCSRDA, subject: Non-development Items (NDI). Upon completion of the survey, the survey team will prepare a report on their findings. In turn, the materiel and combat developer will prepare separate independent evaluation reports (IER's). The results of the market survey report and each IER will enable the materiel and combat developer to prepare a position prior to the Materiel Acquisition and Decision Process I (MADP-I) Review.

3.2 First Article Initial Production Testing (FA-IPT): A contractor run, government supervised FA-IPT on the initial CHI service boat will be conducted to insure the service boat is produced according to the technical data package and answer any noncritical issues that aren't satisfactorily addressed or answered during the user market survey.

3.3 Follow-on Evaluation (FOE): TRADOC will sponsor a FOE to satisfy software, i.e., technical manuals (TM), repair procedures, repair parts special tools list (RPSPL), maintenance allocation chart (MAC), lubrication orders (LO), data collection and documentation forms (TRADOC Reg 71-9).

4.0 DATA SOURCE MATRIX: Upon completion of the user/market survey, the combat developer will update the IEP, then any unanswered issues or criteria will be addressed during FA-IPT and/or FOE.

CRITERIA	USER/MARKET SURVEY	FAT-IPT	FOE	(P)PRIMARY; (S)SECONDARY
2.1.2	P	S		
2.2.2	P		S	
2.3.2	P	S		
2.4.2	P	S		
2.5.2	P	S		
2.6.2.1	P	S		
2.6.2.2	P	S		
2.7.2	P	P	S	
2.8.2	P	P	S	
2.9.2	P	S		
2.10.2.1	P	S		
2.10.2.2	P	S		
2.11.2.1	P	S		
2.12.2	P	S		
2.13.2.1	P	S		
2.13.2.2	P	S		
2.13.2.3	P	S		
2.14.2	P		S	
2.15.2.1	P	S		
2.15.2.2	P	S		
2.16.2.1	P	S	S	
2.16.2.2	P	S	S	
2.16.2.3		P	S	
2.16.2.4		P	S	

CRITERIA	USER/MARKET SURVEY	FAT-IPT	FOE	(P)PRIMARY; (S)SECONDAR
2.17.2.1	P	S		
2.17.2.2	P	S		
2.18.2	P	S	S	
2.19.2	P	S		
2.20.2.1	P	S		
2.21.2.1	P	S		
2.21.2.2	P	S		
2.21.2.3		P	S	
2.22.2		S	P	
2.23.2.1	P	S		
2.23.2.2		S	P	
2.24.2		S	P	

5.0 MAJOR MILESTONE CHART. Due to a revision of Chapter 6, AR 70-1, directed by DAMA-PPM-A letter dated 1 May 1980, it is feasible for the CHI service boat to be purchased as a nondevelopmental item (NDI) by a Materiel Acquisition Decision Process (MADP) Review to satisfy an approved Required Operational Capability (ROC). The following milestones are presently scheduled and the plan will be updated as required:

5.1 Project initiated:

5.2 ROC approved: 17 Jan 1979

5.3 Program Management Plan: 1 Sep 82

5.4 Preliminary market survey: 1 Oct 82

5.5 Materiel Developer's IEP: 1 Apr 82

5.6 Combat Developer's IEP: 1 Apr 82

5.7 User/Market Survey: 1 Apr 82

5.8 TRADOC/DARCOM IER: 1 Sep 82

5.9 MADP I: 15 Dec 83

5.10 Acquisition Plan (Procurement):

5.11 Functional Purchase Description: 15 Feb 84

5.12 MFP (Draft):

5.13 RFP:

5.14 MADP II: 15 Jun 84

5.15 Contract Award: 15 Dec 84

5.16 FA-IPT: 15 Dec 85

5.17 TECOM IER:

5.18 Update Combat Developer's IEP:

5.19 Test Design Plan:

5.20 FOE: 15 Mar 86

5.21 Test Report:

5.22 Combat Developer's IER:

5.23 Materiel Release/IOC:

ANNEX A

COORDINATION ANNEX

AGENCY	OFC SYMBOL	COMMENTS NOT REC'D	CONCUR W/O CMT	COMMENTS SUBMITTED	COMMENTS ACCEPTED	COMMENTS REJECTED
USATRADOC	ATTE-ZA			29	28	1
	ATTE-ZC	X				
	ATEN-S		X			
	ATCD-SL	X				
USAOTEA	CSTE-PON			2	2	
USATSC	ATIC-DST-DS		X			
USACAC	ATZL-CAT-EO			42	40	2
USALOGC	ATCL-MS			3	2	1
USAADMIN CEN	ATZI-NCR-PS			6	3	3
USALEA	DALO-LEI		X			
USATECOM	DRSTE-AD-A			3	3	0
	DRSTE-CT-T			5	4	1
USAMERADCOM	DRDME-MRD			11	8	3
USATSARCOM	DRCPO-AWC-T			10	10	0
	DRSTS-QEG		X			
USAMEDDAC	ATZF-HD-PMA			2	2	0

*Comments from the above agencies were either accommodated or the rationale for nonaccommodation is as follows:

1. USATRADOC (ATTE-ZA):

COMMENT: The issue is specific by asking if personnel can perform tasks; however, the criteria does not reference or list the tasks examined.

RATIONALE FOR NONACCOMMODATION: This information is impossible to acquire during the user/market survey. This issue, along with all software of the craft, will be incorporated into a revised IEP used specifically for the FOE conducted by the USAARENBD.

2. USACAC (ATZL-CAT-EO)

a. COMMENT: Delete "ideally" or substitute preferably or some other adverb which indicates a firmer acceptance criteria.

RATIONALE FOR NONACCOMMODATION: The term "ideally" in this situation is not a measure of acceptance, but deals with the location of the rub rails.

b. COMMENT: Consideration should be given to the firefighting/containing capability of the boat cooking facilities.

RATIONALE FOR NONACCOMMODATION: The craft will possess the latest state of the art galley equipment and the fire systems used to contain/combat Class C (electrical fires) will be inherent.

3. USALOGC (ATCL-MS):

COMMENT: A time interval for performing tasks should be stated.

RATIONALE FOR NONACCOMMODATION: This issue will be examined during the FOE and expounded upon in the Test Design Plan.

4. USAADMINCEN (ATZI-NCR-PS)

a. COMMENT: Does the candidate vessel have the appropriate decontamination equipment onboard?

RATIONALE FOR NONACCOMMODATION: Civilian industry will not have the required equipment onboard for decontamination; therefore, upon revision of USATSCH IEP, this will be evaluated during the user's FOE.

b. COMMENT: Is the engine area accessible to personnel while wearing protective clothing (i.e., NBC, cold weather, wet weather)?

RATIONALE FOR NONACCOMMODATION: This will be incorporated into a revised USATSCH IEP used for a FOE conducted by TRADOC.

c. COMMENT: Are all controls accessible to personnel while wearing protective clothing (i.e., NBC, cold weather, wet weather).

RATIONALE FOR NONACCOMMODATION: Same as item 4b, above.

5. USATECOM (DRSTE-CT-T):

COMMENT: Pages 2-4 and 2-5 - Delete and substitute the following: "Does the candidate vessel have sufficient fuel for continuous cruising of 20 hours at a speed up to 20 knots?"

RATIONALE FOR NONACCOMMODATION: The above has been incorporated into the criteria (2.5.2.2) to establish parameters for the issue.

6. USAMERADCOM (DRDME-MRS):

a. COMMENT: Add to end of paragraph, "... Sea State 1, with neglible wind and tide/current."

RATIONALE FOR NONACCOMMODATION: Paragraph 5b(1) in the ROC states the service boat while fully loaded be capable of maintaining sustained speed (12-15 knots) in Sea State 3.

b. COMMENT: Add to end of paragraph, "... with one stateroom for two officers and one stateroom for the crew of 4."

RATIONALE FOR NONACCOMMODATION: There is no requirement in the ROC for separate staterooms for the ship's crew and officers.

c. COMMENT: Does the candidate vessel possess adequate emergency AC capability to operate C&E equipment and emergency/running lights?

RATIONALE FOR NONACCOMMODATION: There is no requirement for an emergency AC generator in the ROC. Due to the size of the service boat, a separate AC generator will not be required by CG 257.

MISSION PROFILE

COASTAL, HARBOR AND INLAND WATERWAY (CHI) SERVICE BOAT

1. References:

a. DA approved missions, US Army Trans-Hydro Craft Study, 1 Dec 73.

b. TOE 55-530, Teams FB and FE.

c. US Army Trans-Hydro Craft Study, 1 Dec 73.

d. Chief of Staff Memorandum #75-56-11, 13 Feb 75.

e. HQ, TRADOC approved PROC, 24 March 1977.

2. Background/Discussion:

a. Approved roles and mission for US Army Trans-Hydro Craft for the 1975-85 time frame.

(1) Operate trans-hydro craft in order to provide for the cross-water movement of cargo and passengers through water terminals. Adjacent beaches and shorelines may form a part of the total terminal complex.

(2) Operate trans-hydro craft in order to provide for the over-water movement of cargo and passengers in logistics over-the-shore operations (these trans-hydro craft may possess land mobility to permit uninterrupted movement to inland delivery or transfer points).

(3) Operate trans-hydro craft in harbors and in inland and coastal waterways in order to provide for the over-water movement of cargo and personnel in port clearance and line haul operations as the military situation requires.

(4) Operate trans-hydro craft in providing over-water movement of cargo and passengers within floating logistic bases, and between these bases and the tactical area of operations.

(5) Operate trans-hydro craft in the performance of harbor service functions in support of water terminal and logistics over-the-shore operations.

(6) Operate trans-hydro craft in support of forces conducting amphibious operations and shore-to-shore operations.

(7) Provide for the movement of waterborne cargo and passengers and operate trans-hydro craft in other water transport service as directed.

b. TOE 55-530, Teams FB and FE.

(1) MISSION. The new CHI service boat will replace the present 46' J-Boat, Design 4003 (Team FB), The 65' Q-Boat, Design 4002 (Team FE) and the 65' T-Boat, Design 2001 (Team FE).

The boat will provide transport on a 24 hour a day basis, for at least 15 weather protected passengers (single haul) with personal and work equipment or to transport 1½ short tons of cargo on the afterdeck area. It will also be utilized as a command and control vessel, rescue, patrol/security, harbor inspection or general utilities services in support of water terminal or inland operations.

(2) OPERATIONAL AREAS. Coastal, Harbor and Inland Waterways.

(3) ASSIGNMENT. The CHI Service Boat will normally be assigned to a logistical support command in a theater of operations and attached to

a transportation terminal battalion for direct command, control, maintenance support and operational supervision.

c. US Army Trans-Hydro Craft Study, 1 Dec 73, identified the vessels which are necessary for the US Army to perform its assigned missions on/in coastal, harbor and inland waterway (CHI) environments during the 1975/1985 time frame.

d. Chief of Staff Memorandum, CSM 75-56-11, 13 Feb 75. Specific Recommendation #16. "Prepare ROC document for a small harbor service boat . . ."

e. On 24 March 1977, the HQ, TRADOC ROC review board met and approved the PROC for a CHI Svc boat. On 5 July 1977 the PROC was forwarded to HQ DA for approval.

3. Tasks: The following tasks support the DA approved missions in para 1a above in those areas not immediately associated with a LOTS environment. Because the tasks and percentage rates involved are, except for occasional very broad parameters, not quantifiable from existing documentation, the estimates given below are based almost entirely on empirical data.

a. Provide routine passenger service as required, in and around or between terminal service units or vessels.

Utilization in this task: 5%

b. Provide passenger service for Cargo Ship hatch gangs and equipment.

Utilization in this task: 5%

c. Transport of up to 1½ short tons of cargo, i.e.: Mail, repair parts and supplies.

Utilization in this task: 5%

d. Command and Control craft for boat operations.

Utilization in this task: 40%

e. The craft will be utilized as a patrol craft for harbor security personnel.

Utilization in this task: 20%

f. General Utilities. The craft will provide such services as required by the terminal commander. Such services shall include but not be limited to: Pilot boat, barge/ship anchorage inspections and special services for morale purposes.

Utilization in this task: 20%

g. Conduct rescue operations in waters as directed by the terminal commander which are within the limitations of the craft.

Utilization in this task: 5%

RECAP

PERCENTAGE OF TOTAL AVAILABLE CRAFT TIME

DEVOTED TO EACH DESIGNATED TASK

TASK	%
Routine Passenger Service	5
Cargo Ship Hatch Gang Passenger Service	5
Transport of Light Packaged Cargo	5
Command and Control	40

TASK	%
Patrol/Security	20
General Utilities	20
Rescue Operations	5
TOTAL:	100%

4. Required Essential Characteristics:

a. Main Propulsion: Twin screw, Twin diesel drive.

b. Speeds: Be capable, when fully loaded of 12-15 knot sustained speed in sea state 3 (international scale). Intermittent top speed of 20 knots is necessary for emergency operations.

c. Payload: Be capable of transporting at least 15 weather protected passengers with personal and work equipment; or, up to 1½ short tons of cargo.

d. Operational day: 24 hours (two shifts).

e. Operational environment: Worldwide.

f. Transportabiltiy: Be capable of being deck loaded aboard an oceangoing ship for transport to a theater of operations.

DRAFT REVISED
REQUIRED OPERATIONAL CAPABILITY
FOR A COASTAL, HARBOR, AND
INLAND WATERWAY SERVICE BOAT
(20 MARCH 1991)

1. STATEMENT OF NEED:

a. Title. Draft Revised Required Operational Capability (DRROC) for a Coastal, Harbor, and Inland Waterway (CHI) Service Boat. There is a need for a vessel which will provide command and control, passenger, and light cargo transport in coastal, harbor, and inland (CHI) operations.

b. CARDS Reference Number: 1677, LIN: Z10796

2. TIME FRAME: Initial operational capability (IOC) of FY 93 is required.

3. THREAT/OPERATIONAL DEFICIENCY: The Trans-Hydro Study and Army Watercraft Requirements Master Plan (AWRMP) validated the need for a coastal, harbor, and inland waterway service boat with the capability of carrying personnel and light cargo. An efficient transportation means is necessary for exchange of personnel and light cargo between anchored shipping and shore facilities in the areas of logistical operations. There are several types of small boats -- type J, type Q, and type T -- in the Army inventory that will be replaced by CHI service boats. Due to the average craft age, the fleet is obsolete, and have been type reclassified to contingency. The current proliferation of numerous makes and models is costly to support, cannot meet mission requirements and requires excessive maintenance. The factors make the cost of ownership unreasonably prohibitive. In addition, there is no standardization between the various makes and models; furthermore, some boats have wooden hulls that require specialized expertise to repair.

4. OPERATIONAL/ORGANIZATIONAL CONCEPT:

a. The CHI Service Boat will provide minimal passenger and light cargo transport along coastlines, in harbors, and on inland waterways and will be capable of operation in sea state 3 (2 to 6 foot waves and 11 to 16 knot

winds) when not restricted by ice conditions. Its tasks include passenger ferry service; transport of repair parts, mail, and other light cargo; movement of contact maintenance teams and other work parties; waterborne command and control; and security patrol and inspection service.

b. This craft will be provided to those companies battalions, or transportation terminal groups currently authorized type Q, J, and T boats, and to other activities for special U.S. Army use. The vessels are normally manned by transportation watercraft teams (TOE 55-530) or by personnel assigned to TOE units, such as transportation company (heavy boat) (TOE 55-829) and the transportation floating craft general support maintenance company (TOE 55-157). See BOIP 76-0125-I which was approved by Department of the Army on 30 March 1977.

5. ESSENTIAL CHARACTERISTICS:

a. Operational Environment. Be capable of performing its assigned mission in climatic design types hot and basic, when not impeded by ice (AR 70-38).

b. Payload and Cargo.

(1) Have the capability to transport 5 weather protected passengers and a crew of 3.

(2) Be capable of transporting one ton of cargo on the afterdeck area. Cargo space should be a minimum of 100 square feet.

c. Speed, Endurance, Fuels, and Lubricants.

(1) Be capable, when fully loaded, of a minimum of 20 knots sustained speed in sea state 3 (2 to 6 foot waves and wind speed of 11 to 16 knots), and capable of maintaining steerage and a speed of 10 knots when fully loaded, in sea state 4 (4 to 8 foot waves and wind force of 17 to 21 knots). The capability of attaining an intermittent top speed of 25 knots for a

minimum of one hour, when fully loaded, and operating in sea state 3 shall be provided for emergency operations.

(2) Be capable of a minimum of 8 hours continuous operation when fully loaded and operating at sustained speed of 20 knots with a twenty-five percent fuel safety margin remaining.

(3) The diesel engines shall be capable of using diesel fuel conforming to MIL-F-16884, as standard fuel. Additionally, the diesel engines shall be capable of using JP-8, conforming to MIL-T-83133, as emergency fuel without harmful effects, abnormal wear, or greater than a 10% reduction in performance.

(4) The diesel engines shall be capable of utilizing diesel fuel with a sulphur content up to and including one percent without degradation of the manufacturer's specified lube oil change or engine overhaul intervals as specified for engines utilizing diesel fuel with a sulphur content of one-half percent or less. Increasing engine oil reservoirs shall not be used as a means of combating effects of high sulphur fuels.

(5) The diesel engines and reduction gears shall be capable of using lubricating oil conforming to MIL-L-2104 and MIL-L-9000 as standard lubricating oil.

d. Operational Size and Capability.

(1) Not exceed 36 feet in length at the waterline and possess a maximum draft of 4 feet when fully loaded.

(2) Have twin propulsors, twin-diesel inboard drive.

(3) Possess pilothouse (cabin) controls for operation of craft.

(4) Provide limited facilities and services consisting of two berths, microwave oven, dinette with seating for 4, refrigerator, and sink with water to support crew and passenger requirements.

(5) Have adequate climatic control equipment for preservation of electronic equipment and for habitation requirements.

(6) Have suitable rails around the outermost periphery at the deck line.

(7) Possess adequate floodlighting of the AFT deck area. Port and starboard searchlights with internal controls are required for patrol duty and navigation.

(8) Possess power and emergency manual steering capability.

(9) Possess a dedicated diesel engine driven (DED) service generator capable of providing power to the entire electrical system on a 24-hour-per-day basis. The capability of using compatible shore power shall be provided.

(10) Possess adequate stowage facilities for the Basic Issue Items (BII).

(11) The craft will be operable and maintainable by 5th through 95th percentile soldiers, dressed appropriately for the intended environments of use, with less than 5 percent error (errors of omission and commission) in soldier performance of critical tasks. The craft will be in accordance with applicable Human Factors Engineering criteria of MIL-STD-1472.

(12) There shall be installed one USCG approved marine sanitation device with holding tank. A means of pumping contents of holding tank to shore facilities shall be provided. The tank shall be sized to preclude the need to pump out the tank more than once per day.

(13) Be fitted with crew-served weapons mounts and ammunition lockers as jointly agreed by the Combat and Materiel Developers.

(14) The vessel hull and superstructure shall be constructed of aluminum.

(15) The vessel mast, communication, electronics, and navigation (CEN) equipment antennas, and life lines shall be capable of being readily removed and reinstalled. Provisions to protect openings where removals have been made shall be provided.

e. Transportability.

(1) Be capable of being lifted by means of permanently installed lifting pads and eyes designed and installed to provide a 4-point lift.

(2) Each vessel shall be supplied with a cradle designed for the vessel. The cradle shall be designed and constructed to withstand the dynamic load placed on it with the CHI Service Boat loaded on the cradle and the vessel and cradle loaded onto a ship or barge for ocean deployment. The cradle shall be fitted with lifting pads and eyes to enable the cradle and vessel to be lifted as a single lift. Means shall be provided on the cradle to enable the vessel to be securely lashed to the cradle and cradle lashed to the deck of a ship or barge.

(3) Each vessel shall be supplied with a sling capable of lifting the vessel into the cradle and of lifting the cradle with vessel in place. The need for spreader bars will be considered.

f. Standards.

(1) The vessel shall be designed and constructed to the American Bureau of Shipping (ABS) Rules for Building and Classing Aluminum Vessels and Subchapter C - Uninspected Vessels, Title 46, Code of Federal Regulations (CFR).

(2) Comply with all; State, Federal, and U.S. Territory; water, air, and noise pollution control requirements.

(3) All electrical and electronic equipment shall meet applicable Electromagnetic Compatibility (EMC) requirements.

(4) Asbestos-free materials will be used in insulation and fire barrier materials throughout the vessel, and will conform to all federal regulations regarding the use of asbestos-free materials.

g. Safety.

(1) Have required lifesaving equipment.

(2) Possess a USCG-approved automatic fire/smoke detection system with alarm for the engine compartment(s) and fuel tank compartment(s) if different from the engine compartment. The above areas shall be fitted with a USCG-approved, fixed fire extinguishing system.

(3) Have installed emergency fire fighting/fire containing equipment to combat/contain class A, B, and C fires.

(4) Have all hazards to operator, maintenance, and other personnel identified and either eliminated or controlled in accordance with the concepts of system safety engineering; and in compliance with requirements of Department of Transportation (DOT), Department of Labor (DOL) (concerning adherence to Occupational Safety and Health Administration (OSHA) Act and meeting the mandatory maritime standards).

h. Noise Limits. Noise levels produced by the craft shall be in accordance with MIL-STD-1474. Noise levels in the pilothouse and any crew/passenger occupied space shall not exceed MIL-STD-1474, Category E (75 dB(A)). All other spaces and areas shall be in accordance with MIL-STD-1474, Category D (less than 85 dB(A)).

i. Navigation and Communications. The vessel shall be fitted with state-of-the-art navigation and electronic equipment required by Title 33 of U.S. Code of Federal Regulations (CFR) as well as the tactical equipment essential for logistic support coordination. This includes a magnetic compass, navigational radar, Bridge-to-Bridge VHF radio, tactical HF-SSB radio, tactical VHF-FM radio, and associated COMSEC equipment.

j. Reliability, Availability and Maintainability (RAM). Commercial state-of-the-art technical developments must be used to obtain current commercially available life expectancy and RAM characteristics in the equipment. Strict adherence to ABS standards required in commercial vessels will meet specific quantitative RAM needs for this type equipment. The requirements are that RAM characteristics be consistent with the commercial vessel performance proven acceptable through use by commercial marine operators.

6. TECHNICAL ASSESSMENT: A market investigation will be conducted to survey and evaluate commercially available equipment. By limiting the selection of candidate items to commercially available equipment, advantage can be taken of the boat building industry's research and development efforts. Identification of vessels in proven commercial service, in essentially the same configuration as required in this document, will eliminate the need for extensive military design development, testing, and evaluation.

7. LOGISTIC ASSESSMENT:

a. Baseline Logistics Support Concept. Logistics support is provided by the crew, the organization that the CHI Service Boat is assigned to, and by the direct and general support maintenance organizations (TOE 55-157). The contractors commercial distribution channels and other support services will be used where feasible. Below-the-waterline services (bottom appendages) will be performed at the time of cyclic dry-docking at the maintenance category prescribed in the Maintenance Allocation Chart and in accordance with current maintenance policy.

b. Potential Logistics Problem Areas. There are no potential logistic problem areas, provided appropriate and responsive spare and repair parts support is assured for this low density item. The onboard Basic Issue Items (BII) and possible use of parts contracts with commercial vendors can help assure adequate spare and repair parts support.

c. Preferred Limits on the Need for Logistics Support Element Resources. Logistics support resources have been estimated as for the then-year. Costs will be logistically assessed after the field survey. Retention of these craft after their useful life will result in abnormally high logistics support due to commercial replacement of components.

8. OTHER SERVICE OR ALLIED NATION INTEREST: Coordination has been accomplished with the U.S. Navy. No allied interest has been expressed for this type item.

9. TRAINING ASSESSMENT:

To be provided by TRADOC.

10. LIFE CYCLE COST ASSESSMENT: Annex A (Under Development; Belvoir)

APPENDIX E

FAILURE ANALYSIS REPORTS

FAILURE ANALYSIS REPORTS INDEX

FAILURE ANALYSIS REPORT NO. 1

DATE: November 1991 - October 1992

ITEM: Port and Starboard Exhaust Muffler

FAILURE/PROBLEM: Mufflers cracked, leaks water into the engine room.

FAILURE OPERATING HOURS: There have been multiple problems with the mufflers since delivery of the CHI-64 to the Government.

(1) November 1991 -- During initial operation of CHI-64, the port and starboard mufflers cracked. Estimated at 50 engine operating hours.

(2) June 1992 -- During Operation Ocean Venture, North Carolina Segment, the port muffler cracked. Estimated at approximately 238 engine operating hours.

(3) September 1992 -- During Operation Ocean Venture, Florida Segment, both mufflers cracked. Estimated at approximately 385 engine operating hours.

INSPECTION/CORRECTION:

(1) The original exhaust mufflers cracked at the forward end bell hose bibb from overheating during initial operation of the CHI-64. The engine/muffler cooling system is piped for direct overboard discharge and/or discharge overboard through the muffler. During initial operation, the overboard discharge valve was regulated to provide approximately 50% of the cooling water through the muffler.

(2) The boat manufacturer was contacted and stated that all water from the engine/muffler sea water cooling system must pass through the muffler for proper cooling. Additionally, the overboard discharge valve must remain closed and should not have been installed. This information was not included in the manufacturer's operating instructions provided with the CHI Boat. It has now been included in the CHI Boat operator instructions.

(3) Replacement mufflers were purchased by the Government from the muffler manufacturer. The hose bibb on the end bells of these mufflers were of irregular thickness. This was documented and provided to the manufacturer. He agreed that the port muffler was not in tolerance and would be replaced as a warranty item. Both replacement mufflers were installed to allow CHI-64 to participate in Operation Ocean Venture. The hose bibbs on the forward and after end bells of both mufflers had to be shortened by approximately 3" for the installation.

(4) During Operation Ocean Venture, North Carolina Segment, the port muffler developed a crack in the forward end bell hose bibb.

(5) During follow-on coordination with the manufacturer, it was determined that the boat manufacturer had not installed his recommended water injection elbows. The port and starboard water injection elbows were modified in accordance with the drawing provided by him.

(6) The failed port muffler was replaced with a redesigned muffler from the manufacturer. The forward and after end bell hose bibb had to be shortened by approximately 3" for installation. During operational testing, temperature readings were taken on the forward end bell as close as possible to the hose bibb. The maximum temperature recorded was 116°F.

(7) During Operation Ocean Venture, Florida Segment, both mufflers developed cracks in the hose bibb on the forward end bell. The redesign muffler was returned to the manufacturer for analysis.

(8) The muffler manufacturer's analysis determined that the end bells required additional fiberglass to reinforce and strengthen them. Additionally, cutting of the end bell hose bibb had weakened them. The body of the muffler was shortened by 6" to eliminate cutting the end bell hose bibbs and the end bells had additional fiberglass applied to strengthen them.

(9) Two reinforced/shortened mufflers were provided by the manufacturer. During installation, the muffler holding clamps were lengthened approximately 2-1/4" to lower the mufflers and improve alignment with the water injection elbows. A two-hour operational test was conducted satisfactorily.

FAILURE ANALYSIS:

(1) The original exhaust muffler failures were attributed to overheating caused by a limited amount of cooling water passing through them and faulty cooling water injection elbows.

(2) The redesigned port muffler failure was attributed to:

(a) Insufficient strength in the muffler end bell.
(b) Cutting of the end bell hose bibbs.
(c) Additionally, the misalignment that was corrected by extending the muffler holding clamps may have been a contributing factor.

(3) Additional muffler failures are not acceptable for operational readiness. A replacement design muffler and/or exhaust system may be required to eliminate the failures.

RECOMMENDATION: Operate CHI-64 for extended periods under various operating conditions. The recurrence of a muffler failure should dictate redesign of the muffler and/or the exhaust system.

FAILURE ANALYSIS REPORT NO. 2

DATE: November 1991

ITEM: Windshield Defog System

FAILURE/PROBLEM: The installed windshield defog system is inadequate during inclement weather. Visibility is severely restricted which presents a safety hazard.

FAILURE OPERATING HOURS: Approximately 75 engine operating hours.

INSPECTION/CORRECTION:

(1) During inclement weather the pilothouse windows fog up and severely reduce visibility. The installed defog system consists of 3" vent registers for the port and starboard windshield that receives air from the pilothouse heater. Air volume is very low.

(2) The manufacturer installed 6" diameter oscillating fans for the port and starboard windshield. Additionally, air was diverted from the crew cabin heater into the defog system. The fans and additional air flow only corrected the problem to a minor extent.

(3) In April 1992, the manufacturer provided an in-line 225 cfm blower that was installed by the crew. The blower was connected to the installed defog system and receives its air from the crew cabin. The blower, in combination with the oscillating fans, defogs the windshield except under extreme weather conditions. The correction is not totally satisfactory for safe operation of the CHI-64 to meet all possible mission requirements.

FAILURE ANALYSIS:

(1) The problem is directly attributed to a faulty design and a limited quality control/testing program.

(2) This problem must be corrected on the CHI-64 because of its mission requiring docking alongside other watercraft for personnel and cargo transfer.

RECOMMENDATION: Redesign/upgrade the defog system to provide adequate visibility during extreme inclement weather for safe operation of the CHI-64.

FAILURE ANALYSIS REPORT NO. 3

DATE: November 1991

ITEM: Bilge Pumps and Storage Tank

FAILURE/PROBLEM: Installed equipment inadequate.

(1) The forward machinery room bilge pump (forward):

(a) The pump discharges directly overboard.
(b) The discharge line has no check valve or shut-off valve.
(c) The discharge opening is below water level, this caused back syphon when the pump was first operated and flooded the forward machinery room.

(2) The engine room bilge pump (mid) discharges directly overboard.

(3) The CHI Boat has no storage tank for bilge water/slop.

FAILURE OPERATING HOURS: Documented during initial operation of the CHI-64.

INSPECTION/CORRECTION:

(1) Forward Bilge Pump:

(a) The forward machinery room presents a water pollution possibility from three sources:

(1) The marine toilet, marine sanitation device (type 1), sewage transfer pump, and sewage holding tank are located in and/or drain into the forward machinery room bilge.

(2) The air conditioning compressor is located in the forward machinery room. A casualty to the piping or compressor could drain lubricating oil into the bilges.

(3) The hot water heater, cabin, and pilothouse heaters use the engine cooling system water as a heat source. Any ruptured component would drain antifreeze into the bilge.

(b) The boat manufacturer installed a check and shut-off valve in the overboard line.

(c) The bilge pump manufacturers installation instruction specifically state that the thru-hull fitting be located at least 12" above the waterline to prevent water from flowing back into the hull when the pump is off. This was not completed/corrected on the CHI Boat.

(2) Mid Bilge Pump: The mid bilge pump was repiped by the boat manufacturer to allow discharge into the lazarette bilge. This will allow the engine room bilge water/slop to be pumped through the lazarette bilge pump to the deck connection for proper disposal onshore.

(3) Holding Tank: Using the lazarette bilges as a holding area for bilge water/slop is unsatisfactory. A holding tank must be provided and piped for pump off to the deck connection for proper disposal onshore.

FAILURE ANALYSIS:

(1) The problems are directly attributed to a faulty design, limited quality control program during construction/testing, and failure to follow component manufacturers' installation instructions.

(2) This is one of numerous problems with the prototype CHI Boat that indicates procurement of commercial watercraft from the GSA schedule is not a viable nor cost-effective option.

RECOMMENDATION: The CHI-64 must have the capability to meet pollution requirements.

(1) A bilge water/slop holding tank must be installed and piped to allow pump off using existing bilge pump(s) and deck hose connection.

(2) The forward bilge pump discharge be relocated 12" above waterline, when the CHI Boat is docked, and repiped to allow discharge into the storage tank.

(3) The mid and aft bilge pumps be repiped to allow discharge into the holding tank.

FAILURE ANALYSIS REPORT NO. 4

DATE: November 1991

ITEM: Sewage Holding Tank Pump

FAILURE/PROBLEM: No pump installed to pump out the sewage holding tank, no hose provided to pump sewage to a shore connection.

FAILURE OPERATING HOURS: Documented during initial operation of CHI-64.

INSPECTION/CORRECTION:

(1) Drawings provided with the prototype CHI-64 shows a sewage tank pump, however, none was installed.

(2) Pump was installed by the manufacturer as a warranty item.

(3) The Government provided a hose, with valve, for sewage tank pump out.

FAILURE ANALYSIS:

(1) Problem is attributed to a limited quality control program during construction.

(2) The addition of the hose was a mission requirement for the CHI-64.

RECOMMENDATION: The production CHI Service Boat be procured using a Functional Purchase Description developed to meet technical and operational requirements.

FAILURE ANALYSIS REPORT NO. 5

DATE: November 1991

ITEM: Overboard Discharge Piping Valves

FAILURE/PROBLEM: The below listed overboard discharge piping terminates at or below the waterline when the CHI-64 is docked. Additionally, it's draft will increase because of the weight of operating supplies, repair parts, and crew personal items required for military operations. The piping does not have check or shut-off valve installed:

(1) Head sink drain
(2) Galley sink drain
(3) Sewage overboard discharge pipe
(4) Air conditioning cooling water discharge pipe

FAILURE OPERATING HOURS: Documented during initial operation of CHI-64.

INSPECTION/CORRECTION: The manufacturer installed check and shut-off valves in the overboard discharge piping as a warranty item.

FAILURE ANALYSIS: The problem is directly attributed a faulty design of the systems involved and a limited quality control program during construction and testing.

RECOMMENDATION: The production CHI Service Boat be procured using a Functional Purchase Description developed to meet technical and operational requirements.

FAILURE ANALYSIS REPORT NO. 6

DATE: January and April 1992

ITEM: Air Conditioning Unit

FAILURE/PROBLEM: AC unit will only run a short period when turned on (short cycles). Repaired unit requires addition of refrigerant periodically.

FAILURE OPERATING HOURS: Documented during initial operation of CHI-64.

INSPECTION/CORRECTION:

(1) AC unit appeared to short cycle due to a shortage of refrigerant.

(2) Condensing unit was removed, repaired, and reinstalled as a warranty item by the AC unit manufacturer.

(3) No information was provided identifying the cause of failure or its corrective action.

(4) The unit requires addition of refrigerant periodically. It has been inspected by the manufacturer on two occasions, no leak was located.

FAILURE ANALYSIS:

(1) No determination can be made for the condensing unit failure.

(2) The leak is attributed to improper installation or damage to a component(s) during assembly of the unit.

RECOMMENDATION: The AC unit be repaired or replaced to prevent refrigerant from entering the atmosphere.

FAILURE ANALYSIS REPORT NO. 7

DATE: 11 March 1992

ITEM: Engine Room Entrance Hatches

FAILURE/PROBLEM: Water enters the engine room during inclement weather.

FAILURE OPERATING HOURS: Approximately 70 engine operating hours.

INSPECTION/CORRECTION:

(1) Water enters the engine room because the hatch gasket does not seal to the hatch frame coaming and the rear hatch frame drain is incorrectly sized and positioned.

(2) The Government recommendations were to install dogs on the engine room hatches to insure the gasket seals to the coaming and to enlarge and reposition the rear drains. Currently, the forward drains (approximately 1-1/2" diameter pipe) are connected to the bottom of the frame housing and angled down to drain properly. The rear drains (approximately 3/4" diameter) are connected at the top of the housing and have two 90° turns in the hose and pipe before going overboard. When the CHI-64 is underway, it is down in the stern, all water in the hatch frame housing runs to the rear. Whenever the hatch is opened, water drains into the engine room.

(3) The manufacturer installed engine room hatch dogs.

(4) The boat was operated in inclement water. Water leaked into the engine room because the rear drains could not remove the water from the hatch frame housing. Additionally, the hatch frame was discovered to be only intermittently welded instead of continuously welded to the main deck.

(5) Government recommendations were to enlarge and reposition the rear hatch drains and seal weld the hatch frame to the main deck.

(6) The manufacturer provided plastic materials and hose for the hatch drains that were unusable to correct the problem and a silicone sealant to seal the hatch frame.

(7) The silicone sealant was applied. It only prevents water from entering the engine room between the hatch frame and main deck. it is considered to be a temporary repair.

(8) The hatch frame housing drains were enlarged and repositioned by the Government at a commercial shipyard during hull repairs, see report number 14.

FAILURE ANALYSIS:

(1) The problems are attributed to faulty designs, a limited quality control program during construction, and a nonresponsive manufacturer for warranty repair.

(2) This is one of numerous problems with the prototype CHI Boat that indicates procurement of commercial watercraft from the GSA schedule is not a viable nor cost-effective option.

RECOMMENDATION: The hatch frame housings on the CHI-64 be seal welded to the main deck.

FAILURE ANALYSIS REPORT NO. 8

DATE: 11 March 1992

ITEM: Engine Room Ventilation

FAILURE/PROBLEM: Water leaks into engine room during inclement weather.

FAILURE OPERATING HOURS: Approximately 70 engine operating hours.

INSPECTION/CORRECTION:

(1) The forward (2) and after (2) engine room vents are located on the outboard side of the pilothouse and rear storage cabinets. The vents consist of one entrance louver and a rectangular compartment that opens directly into the engine room.

(2) During inclement weather, water enters the vent compartments and drains into the engine room.

(3) The forward vents are directly over the engine exhaust manifolds. This allows the water to drain onto the engine and exhaust manifold.

(4) The water presents the possibility of a cracked exhaust manifold. This would require stopping the engine. With both engines stopped, the CHI-64/crew could be lost in inclement weather.

(5) The Government recommendations provided when the problem initially occurred were:

(a) Move the rear vents to the inboard side of the rear storage (this was completed).

(b) Move the forward vents to the rear of the pilothouse (this was not completed).

(c) Install louvers that would trap and drain the water to the outside to preclude its entry into the engine room. (This was not completed.)

(6) The manufacturer moved the rear vent to the inboard side of the rear storage cabinets. This corrected the leaking except in extreme inclement weather, during which the boat should not be operated.

(7) The manufacturer installed a cover over the forward vents. However, the cover was open at the top and bottom which allowed water to enter. The cover was replaced with one open at the rear. This corrected the problem except during periods of heavy rain or spray. At these times, the in-flowing air pulls the water into the vent; thus, leaking into the engine room and onto the engine exhaust manifold.

FAILURE ANALYSIS:

(1) The problems are attributed to faulty original and corrective designs for the intended mission of the CHI-64.

(2) Corrections were partially completed, problems still exist during inclement weather.

(3) This is one of numerous problems with the prototype CHI Boat that indicates procurement of commercial watercraft from the GSA schedule is not a viable nor cost-effective option.

RECOMMENDATION:

(1) The forward vents be moved to the rear of the pilothouse.

(2) The forward and after vents have louvers installed that traps the water and drains it to the outside to preclude its entry into the engine room.

FAILURE ANALYSIS REPORT NO. 9

DATE: March 1992

ITEM: Starboard Transmission Rear Seal

FAILURE/PROBLEM: Seal leaking

FAILURE OPERATING HOURS: Approximately 100 engine operating hours.

INSPECTION/CORRECTION: The seal was replaced by the engine manufacturer as a warranty item.

FAILURE ANALYSIS: The seal failure can be attributed to a manufacturing or installation defect.

RECOMMENDATION: N/A, repaired under warranty claim.

FAILURE ANALYSIS REPORT NO. 10

DATE: April 1992

ITEM: Global Positioning System (GPS) Antenna Coupler Box (P/N 17320-00, Ser. No. 3120A10358)

FAILURE/PROBLEM: GPS inoperative (Trimble Navigation, NAVTRAC, P/N 14400-61, Ser. No. 31331.06399)

FAILURE OPERATING HOURS: Approximately 100 engine operating hours.

INSPECTION/CORRECTION: Box was removed, repaired, and reinstalled as a warranty item.

FAILURE ANALYSIS: Reported failure was a shorted circuit board.

RECOMMENDATION: N/A, repaired as a warranty item.

FAILURE ANALYSIS REPORT NO. 11

DATE: 13 May 1992

ITEM: Marine Sanitation Device (MSD), Raritan Model Lectra/San EC

FAILURE/PROBLEM: MSD trips the circuit breaker.

FAILURE OPERATING HOURS: MSD was in operation approximately 1/2 hour processing solid human waste.

INSPECTION/CORRECTION:

(1) MSD had a NEWMAR, single pole, 30A, circuit breaker installed.

(2) The MSD manufacturer's installation instruction specify a 60A fuse/circuit breaker.

(3) Wiring from the circuit breaker panel to the MSD is sized correctly.

(4) A replacement circuit breaker was purchased by the Government and installed by the crew. The replacement consisted of two 30A breakers connected in parallel to provide the 60A protection. This circuit breaker was recommended by and purchased from NEWMAR, the manufacturer of the circuit breaker panel.

FAILURE ANALYSIS: Failure is attributed to the boat manufacturer not following the MSD manufacturer's installation instructions. This is indicative of a limited quality control program during construction.

RECOMMENDATION: A Government marine inspector/surveyor should be present during construction of the production CHI Service Boat.

FAILURE ANALYSIS REPORT NO. 12

DATE: 2-5 June 1992

ITEM: Pilothouse Windshield Washdown System

FAILURE/PROBLEM: During operation in heavy seas, the pilothouse windows become covered with salt from the spray, the windshield wipers will not remove the salt. Visibility is severely restricted which presents a safety hazard.

FAILURE OPERATING HOURS: Approximately 238 engine operating hours.

INSPECTION/CORRECTION:

(1) Problem developed during the extended operating hours of Operation Ocean Venture, North Carolina Segment, (the CHI-64 first major operation).

(2) Crew used onboard potable water and rags to clean the windshield. This presented a personal safety hazard because of the heavy seas and there being no place for the crew member to hold onto during the cleaning.

(3) A washdown system was installed by the Government on 22-26 June 1992. The system is controlled from the pilothouse and uses onboard potable water. However, the 30-gallon potable capacity is not sufficient for personnel and washdown system use on an extended mission.

FAILURE ANALYSIS:

(1) No system was installed by the manufacturer because it was not required under the GSA schedule procurement.

(2) This has been a continual problem for the smaller Army watercraft. It must be resolved for the production CHI Service Boat to meet mission requirements in a safe manner.

RECOMMENDATION:

(1) The system be tested to determine the maximum continuous operating time based on the 30-gallon potable water capacity. The information be added to the CHI-64 Operator Instructions and thoroughly discussed with the crews. The coxswain would have to determine the quantity of water available for personal use based on mission requirements.

(2) Increase the potable water capacity to meet personal and washdown system requirement for extended missions. The increased capacity would be based on information from paragraph (1) and projected CHI-64 mission requirements.

FAILURE ANALYSIS REPORT NO. 13

DATE: 9 June 1992

ITEM: Potable Water Pump, PAR-MATE 2.5 GPM Automatic Water Pressure Pump, Model 44010-0000

FAILURE/PROBLEM: Pump inoperative.

FAILURE OPERATING HOURS: Operating hours are estimated at: original pump, 2.4 hours, replacement pump, 1.0 hour.

INSPECTION/CORRECTION:

(1) The original pump was disassembled:

(a) The interior of the housing was corroded, wobble plate sized onto motor shaft.

(b) Shaft seal leaking.

(c) The pump manufacturer was contacted for warranty work. The pump was manufactured in Dec 1988 and out of warranty. They stated that the pump model had been updated to correct a shaft seal problem.

(2) A replacement pump was purchased by the Government and installed by the crew in May 1992. Its manufacture date was December 1992.

(3) This replacement pump overloaded and burnt out the fuse after approximately 1 hour total operation. It was repaired under warranty by the manufactured by replacing the woven packing shaft seal.

FAILURE ANALYSIS:

(1) Original Pump:

(a) The pump was manufactured in 1988, installed by the boat manufacturer during construction in 1991.

(b) The pump was operated and tested before delivery to the Government on 14 November 1991.

(c) The pump was operated on several occasions before delivery to Fort Eustis on 1 April 92.

(d) The pump was operated by the crew until failure in May 92. Total operating hours estimated at 2.3 hours.

(e) Failure of the pump is attributed to the shaft seal problem.

(2) Replacement Pump:

(a) Pump was manufactured in December 1991 and installed in May 1992.

(b) Pump was operated until failure in May 1992. Estimated operating hours 1.0.

(c) Pump was repaired by replacing the shaft seal.

(d) Failure is attributed to the shaft seal problem which indicates corrective action by the manufacturer is insufficient.

RECOMMENDATION:

(1) Track operating hours of the pumps to establish mean time between failure.

(2) With repeat failure/low mean time between failures replace pump with alternate manufactured/model. See Report Number 22.

FAILURE ANALYSIS REPORT NO. 14

DATE: 22-26 June 1992

ITEM: Hull Damage

FAILURE/PROBLEM: Damage during Operation Ocean Venture, North Carolina Segment, (May 92) (first CHI-64 mission).

FAILURE OPERATING HOURS: Approximately 238 engine operating hours.

INSPECTION/CORRECTION:

(1) The CHI-64 hull damage was inspected 2-5 June 1992. The damage consisted of:

(a) Bow stanchion bent rearward.
(b) Stanchions on the port and starboard side bent inward, cracked at the base.
(c) Cracks in the outboard seams of the port and starboard storage lockers.
(d) Cracks in the port and starboard rubrail.
(e) Starboard side hull midships, 3 circular indentations that partially penetrated the hull plate.

(2) The sea action slammed the CHI-64 into ships and/or watercraft equipment during personnel/cargo transfers which bent/cracked the stanchions and rubrail.

(3) The circular indentations were from protruding fitting on watercraft equipment the CHI-64 had to dock alongside to perform its mission.

(4) Repairs were completed at a commercial shipyard by the Government and included the enlargement and repositioning of the rear engine hatch frame drains.

FAILURE ANALYSIS:

(1) The damage was the result of an inadequate fendering system to protect the CHI-64 while loading/unloading personnel and cargo.

(2) This is one of numerous problems with the prototype CHI Service Boat that indicates procurement of commercial watercraft from the GSA schedule is not a viable nor cost-effective option.

RECOMMENDATION:

(1) A thorough review be made of the CHI Service Boat mission to identify the most effective fendering system to prevent future hull damage.

(2) The identified fendering system be installed on the CHI-64.

FAILURE ANALYSIS REPORT NO. 15

DATE: 30 June 1992

ITEM: Automatic Waterlight, Jim Buoy Model 1820

FAILURE/PROBLEM: Light inoperative.

FAILURE OPERATING HOURS: The light only operates when in emergency use or during testing, operation time is estimated at 10 minutes.

INSPECTION/CORRECTION:

(1) The light was opened to change the batteries. No damage or corrosion was visible. The light would not operate with the new batteries.

(2) The bulb is part of the upper cap and lens assembly. It cannot be changed by the operator.

(3) The light was returned to its manufacturer for repair as a warranty item.

FAILURE ANALYSIS: The manufacturer returned the repaired light but did not identify the reason for failure.

Probable cause of failure: the bulb was damaged when the light was dropped onto the deck. The mounting bracket support arms appear to have lost their holding tension, this allowed the light to drop onto the deck.

RECOMMENDATION: If the damage occurs again, the automatic waterlight mounting bracket be replaced.

FAILURE ANALYSIS REPORT NO. 16

DATE: June 1992

ITEM: Alternators/Batteries

FAILURE/PROBLEM: Alternators overcharging the batteries.

FAILURE OPERATING HOURS: Approximately 238 engine operating hours.

INSPECTION/CORRECTION:

(1) The alternators were inspected by Carter Machinery (CAT). Their report stated the electrical systems were grounded directly to the hull which is causing the overcharging.

(2) Information was relayed to the boat manufacturer. The electrical systems were inspected and partially rewired to eliminate various grounds in the 12 VDC, 120 VAC, and 240 VAC circuits.

FAILURE ANALYSIS: The overcharging is attributed to incorrectly grounded electrical systems installed during construction.

RECOMMENDATION: Corrected electrical drawings be provided to the CH-64.

FAILURE ANALYSIS REPORT NO. 17

DATE: June 1992

ITEM: Starboard Transmission Oil Pressure Switch Fitting, Aeroequip #2092-4-4S

FAILURE/PROBLEM: Fitting leaking.

FAILURE OPERATING HOURS: The fitting was replaced twice, at approximately 238 and 300 engine operating hours.

INSPECTION/CORRECTION:

(1) In both cases, the fitting was cracked at the external threaded connection. The fitting extends 7-1/2" from the rear of the transmission and presents the possibility of being stepped on during operation and maintenance of the starboard engine.

(2) The fitting was replaced by the Government on both occasions.

(3) There is very limited space in the engine room to perform operational/maintenance checks and services. Additionally, to perform these checks and services, the crew member must climb over or under components and often times, step into the bilge area. This is a personnel safety hazard to the crew member.

(4) Step platforms must be installed to provide access for checks and services. Additionally, this would prevent damage to components and eliminate a personnel safety hazard.

FAILURE ANALYSIS: The fitting failure can be attributed to having been stepped on by a crew member. Additional failures can be expected during operation and maintenance of the CHI-64 until step platforms are installed.

RECOMMENDATION: Install step platforms to provide safe access to components during operation and maintenance.

FAILURE ANALYSIS REPORT NO. 18

DATE: August 1992

ITEM: Radar, Ratheon, Model R40X, Raster Scan

FAILURE/PROBLEM: Radar inoperative.

FAILURE OPERATING HOURS: Approximately 250 engine operating hours, during Operation Ocean Venture, Florida Segment.

INSPECTION/CORRECTION: Radar was inspected and repaired as a warranty item. Failed part was power supply board CDB-1028.

FAILURE ANALYSIS: No information was provided for probable cause of failure by the repair activity.

RECOMMENDATION: N/A, repaired as a warranty item.

FAILURE ANALYSIS REPORT NO. 19

DATE: 6 August 1992

ITEM: Port Windshield Wiper, American Foreign Industries, Model MRV, Two Speed

FAILURE/PROBLEM: Sized, will not operate.

FAILURE OPERATING HOURS: Estimated at 11 hours.

INSPECTION/CORRECTION:

(1) A replacement windshield wiper was purchased by the Government and installed by the crew.

(2) Inspection cover was removed from the sized windshield wiper gear box housing. The gear box interior components were corroded by sea water/saltwater that entered through a leaking shaft seal.

(3) The sized windshield wiper was returned to its manufacturer for replacement as a warranty item.

(4) The starboard windshield water gear box interior was inspected, a small amount of rust and moisture was present. This was reported to the manufacturer.

FAILURE ANALYSIS:

(1) The windshield wiper manufacturer stated that the cause of failure was a bad gasket seal.

(2) No information was provided for replacement of the starboard unit or acknowledgement that a seal problem does exist with the model of windshield wiper.

(3) This failure is attributed to this commercial design windshield wiper which is not designed to withstand the extended arduous duty experienced in military operations.

RECOMMENDATION:

(1) The replacement windshield wiper be carried as a repair part to keep the CHI-64 operational until testing is completed.

(2) The CHI-64 windshield wipers be replaced with a design that can withstand the arduous duty of military operations.

FAILURE ANALYSIS REPORT NO. 20

DATE: August 1992

ITEM: Trim Tab Actuator

FAILURE/PROBLEM: Trim tab actuator shaft broken.

FAILURE OPERATING HOURS: Approximately 250 engine operating hours.

INSPECTION/CORRECTION:

(1) An actuator was purchased by the Government and installed by the crew.

(2) Failed actuator was returned to manufacturer for repair/replacement as a warranty item.

FAILURE ANALYSIS:

(1) The actuator failure is attributed to fatigue of the plastic actuator shaft.

(2) The trim tab actuator is not designed or constructed to withstand the extended arduous duty of military operations.

RECOMMENDATION: N/A, item repaired as a warranty claim.

FAILURE ANALYSIS REPORT NO. 21

DATE: 25 September 1992

ITEM: Hull Damage

FAILURE/PROBLEM: Damage during Operation Ocean Venture, Florida Segment, (August 1992) (Second CHI-64 Mission), See Report 14

FAILURE OPERATING HOURS: Approximately 385 engine operating hours.

INSPECTION/CORRECTION:

(1) The bow stanchion bent inward.

(2) The #4 stanchions on the port and starboard side bent inward, bases cracked.

(3) No corrections made at this time. Repairs to be discussed for possible repair by Army maintenance personnel.

FAILURE ANALYSIS:

(1) The damage is the result of the inadequate fendering system to protect the CHI-64 when docking with watercraft equipment. In this case, the equipment was the Navy modular causeway system. The sea action allowed the CHI-64 to ride under the fendering system on the modular causeway system, this bent the stanchions.

(2) This is the second mission for the CHI-64 and the second time damage has been caused by the inadequate fendering system.

RECOMMENDATION: See Report No. 14.

NOTE: Repairs were completed by Army personnel during 18/19 November, 1992.

FAILURE ANALYSIS REPORT NO. 22

DATE: 28 September 1992

ITEM: Potable Water Pump, Par-Mate 2.5 GPM Automatic Water Pressure Pump, Model 44010-0000, 12 VDC 6 AMP Fuse, 3.2 AMPS

FAILURE/PROBLEM: Pump overloads and burns out fuses.

FAILURE OPERATING HOURS: Estimated at 2.7 operating hours.

INSPECTION/CORRECTION:

(1) The pump was not inspected. It was returned to the manufacturer for repair as a warranty claim.

(2) The manufacturer replaced the pump because of a grounded motor. Probable cause of failure was a shorted pressure switch that caused the motor to overheat and ground out.

FAILURE ANALYSIS: The failure is attributed to damage of the pressure switch during installation. However, numerous problems have been experienced with this model potable water pump. The problems indicate that the pump is not designed or built to withstand the arduous duty of military operations.

RECOMMENDATION:

(1) Install the new pump in a vertical position (completed).

(2) Closely track operation time to develop mean time between failures. Since the potable water system only operates on demand, mean time between failure should be relatively high.

(3) With a repeat failure, this model pump should be replaced.

FAILURE ANALYSIS REPORT NO. 23

DATE: September 1992

ITEM: Alternators/Batteries (See Report No. 16)

FAILURE/PROBLEM: Alternators overcharging the batteries.

FAILURE OPERATING HOURS: Approximately 385 engine operating hours.

INSPECTION/CORRECTION:

(1) During the return trip from the Floridian Operation, the alternators started charging the batteries at maximum voltage (16 volts). This situation existed for approximately one hour until the CHI-64 could be docked at Fort Eustis.

(2) The CHI-64 was operated on 5 November 1992 for approximately 2 hours. Both alternators operated correctly. The operation included approximately 40 minutes underway time at 2400 RPM.

FAILURE ANALYSIS:

(1) The intermittent overcharging indicates additional electrical problems or that previous repair were inadequate. Until the overcharging is resolved, the CHI-64 should not be committed to extended missions.

(2) The recurring electrical problems on the CHI-64 provides further evidence that procurement from the GSA schedule not be considered for the CHI Service Boat.

RECOMMENDATION: That the electrical systems be inspected/tested by the boat manufacturer and the deficiencies correct to provide reliable electrical systems.

FAILURE ANALYSIS REPORT NO. 24

DATE: September 1992

ITEM: Marine Toilet, Raritan Model PH-IL

FAILURE/PROBLEM: Unit will not pump out bowl.

FAILURE OPERATING HOURS: Approximately 300 engine operating hours.

INSPECTION/CORRECTION:

(1) The pump will not provide sufficient water to pump out the bowl. The system valves were positioned correctly, the inlet sea water strainer was clear and the discharge hose from the toilet and MSD into the storage tank was inspected and found to be clear.

(2) The pump was disassembled and shows excessive wear on the pump piston "O" ring and flapper valve system.

(3) A pump repair kit was purchased by the Government and installed by the crew. The toilet now performs satisfactorily.

FAILURE ANALYSIS:

(1) The failure is attributed to worn pump parts from the amount of usage by the crew members during the 24-hour-per-day operations conducted during the two CHI-64 missions.

(2) The commercial design plastic pump is not designed for the quantity of use expected from military operations.

RECOMMENDATION: The marine toilet should be replaced with a unit designed for extensive use.

FAILURE ANALYSIS REPORT NO. 25

DATE: September 1992

ITEM: Mid (Engine Room) Bilge Pump Float Switch (Mayfair Automatic Float Switch, Model M26012)

FAILURE/PROBLEM: Switch inoperative, bilge pump will not operate in automatic position.

FAILURE OPERATING HOURS: Approximately 385 engine operating hours.

INSPECTION/CORRECTION:

(1) A replacement switch was purchased by the Government and installed. Bilge pump automatic operation tested satisfactory.

(2) The switch was returned to the manufacturer for repair as a warranty item.

FAILURE ANALYSIS: No probable cause for failure was provided.

RECOMMENDATION: N/A. Repaired as a warranty item.

FAILURE ANALYSIS REPORT NO. 26

DATE: 18-20 November 1992, 5 and 22 January 1993

ITEM: Alternators/Batteries (See Report Nos. 16 and 23)

FAILURE/PROBLEM: Alternators overcharging the batteries.

FAILURE OPERATING HOURS: Approximately 389 engine hours, approximately 404 engine hours.

INSPECTION/CORRECTION:

(1) The CHI-64 was operated at Fort Eustis to train a new coxswain. During the morning session, no overcharging was observed. However, overcharging started on both alternators shortly into the after session.

(2) The crew stated that when only one engine was operated, the overcharging did not occur. This was checked for the port and starboard engine. However, when the second engine was started, both would overcharge.

(3) The boat manufacturer's representative, Marine Services, was contacted and the information provided. A date for their inspection/testing of the electrical system was not established.

(4) CHI-64 was operated on 5 Jan 1993 to adjust engine idle speed and verify overcharging. Overcharging now occurs shortly after either engine or both engines are started. Additionally, Marine Services requested a sketch of the 12 VDC charging circuits, all connections and voltage readings at various points in the charging systems. This information was provided to Marine Services on 6 Jan.

(5) On 22 January 1993, Marine Services replaced both alternators and regulators, rewired the regulators sensing wires to the respective battery bank terminals on the diode bank. The engines were operated at various speeds and electrical loads. Both charging systems operated satisfactorily. Additionally, Marine Services will document and provide to Sea Ark the rewiring of the electrical systems (12 VDC/24 VDC, 12 VDC charging system, 120/240 VAC) for correction of the electrical drawings for CHI-64.

FAILURE ANALYSIS: See Report No. 23.

RECOMMENDATION: The Government follow up with Sea Ark to insure corrected electrical drawings are provided for CHI-64.

FAILURE ANALYSIS REPORT NO. 27

DATE: 14 December 1992

ITEM: Engine Room CO_2 System

FAILURE/PROBLEM: Quantity of CO_2 is inadequate for engine room.

FAILURE OPERATING HOURS: Approximately 404 engine hours.

INSPECTION/CORRECTION:

(1) An evaluation of the CO_2 system was conducted based on a recommendation from SSG Lyons (Coxswain, CHI-64) to increase the CO_2 capacity.

(2) The Draft Revised Required Operational Capability (DRROC), dated 20 March 1992, identified 46 CFR Subchapter C, titled: Uninspected Vessels, as one of the design standards. In Subpart 25.30-15, titled: Fixed Fire Extinguishing System, of Subchapter C, it identifies Subpart 76.15, of Subpart H, for the design and installation provisions of the system. A copy of the applicable pages of Subchapter C and a copy of Subpart 76.15, of Subchapter H, are attached to support this statement.

(3) The engine room CO_2 system on CHI-64 does not meet the provisions of Subpart 76.15 of Subchapter H:

(a) The engine room and lazarette spaces must be included in the calculations because of the innerconnecting valve and the engine room bilge pump system can discharge into the lazarette bilge; see Subpart 76.15-5(e). Their gross volume has a requirement of 66.9 lbs of CO_2, the installed system contains 35 lbs of CO_2. Calculations for the CO_2 requirement are attached.

(b) The lazarette has no installed CO_2 protection.

(c) Based on Subpart 76.15-10(f), page 109, the engine room CO_2 system must have a delayed discharge.

(d) The engine room vents have no easy means to secure them, Subpart 76.15-35(c), page 111.

(4) The engine room CO_2 system was inspected by USA Services on 5 January 1993. During this inspection, it was determined that the installed system contained only 35 lbs of CO_2 and that a 50 lb or 75 lb CO_2 bottle could not be installed in the engine room or lazarette because of its size and the limited space available. The aft, starboard corner of the pilothouse provides the only usable space for installation of larger or additional CO_2 cylinders. Installing the larger 50 lb or 75 lb cylinder would block the coxswain view through the aft, starboard window. Installing two 35 lb cylinders would meet the CO_2 quantity requirements without blocking the coxswain's view. The two 35 lb CO_2 cylinder system was recommended.

(5) The boat manufacturer disagreed with the engine room volume calculation and including the lazarette volume to determine the CO_2 required. Therefore, using their calculations requiring 35 lbs of CO_2 for the engine room and the Government's calculations of 10 lbs of CO_2 for the lazarette, a total of 45 lbs of CO_2 is required.

(6) The most cost effective method (using most existing equipment) and to resolving the operation concern (not blocking the aft port window) would be to install the recommended two 35 lb bottle CO_2 system. The Government has agreed to the recommendation and plans to have the systems installed to meet CFR requirements.

FAILURE ANALYSIS: The problem is attributed to faulty design/installation, a limited quality control program during construction, and a limited/lack of design standards enforcement during construction.

RECOMMENDATION: The CO_2 system be modified/upgraded to meet CFR requirements. This must be accomplished in an expeditious manner to eliminate a serious safety deficiency.

CHAPTER I—COAST GUARD, DEPARTMENT OF TRANSPORTATION

SUBCHAPTER A—PROCEDURES APPLICABLE TO THE PUBLIC

SUBCHAPTER B—MERCHANT MARINE OFFICERS AND SEAMEN

SUBCHAPTER C—UNINSPECTED VESSELS

SUBCHAPTER C—UNINSPECTED VESSELS

PART 24—GENERAL PROVISIONS

Subpart 24.01—Authority and Purpose

Sec.
24.01–1 Purpose of regulations.
24.01–5 Assignment of functions.
24.01–7 Right of appeal.

Subpart 24.05—Application

24.05–1 Vessels subject to the requirements of this subchapter.
24.05–5 Specific application noted in text.

Subpart 24.10—Definition of Terms Used in This subchapter

24.10–1 Approved.
24.10–2 Barge.
24.10–3 Carrying passengers for hire.
24.10–5 Carrying freight for hire.
24.10–7 Commandant.
24.10–9 Coast Guard District Commander.
24.10–11 Headquarters.
24.10–13 International voyage.
24.10–15 Marine inspector or inspector.
24.10–17 Motorboat.
24.10–19 Motor vessel.
24.10–20 Oceanographic research vessel.
24.10–21 Officer in Charge, Marine Inspection.
24.10–23 Passenger.
24.10–27 Vessel.

Subpart 24.15—Equivalents

24.15–1 Conditions under which equivalents may be used.
24.15–5 Canadian pleasure craft temporarily using navigable waters of the United States.

Subpart 24.20—General Marine Engineering Requirements

24.20–1 Marine engineering details.

AUTHORITY: 46 U.S.C. 2113, 3306, 4104, 4302; E.O. 12234, 45 FR 58801, 3 CFR, 1980 Comp., p. 277; 49 CFR 1.46.

SOURCE: CGFR 65–50, 30 FR 16650, Dec. 30, 1965, unless otherwise noted.

Subpart 24.01—Authority and Purpose

§ 24.01–1 Purpose of regulations.

The purpose of the regulations in this subchapter is to set forth uniform minimum requirements for uninspected commercial vessels, certain motor vessels, vessels propelled by said carrying passenger for hire, and barges carrying passengers for hire in accordance with the intent of the Motorboat Act of 1940, as amended (54 Stat. 163; 46 U.S.C. 526–526t) and the Federal Boat Safety Act of 1971 (85 Stat. 213; 46 U.S.C. 1451–1489). The regulations are necessary to carry out the provisions of the Motorboat Act of 1940, and the Federal Boat Safety Act of 1971 and such regulations have the force of law.

[CGD 72-172R, 38 FR 8116, Mar. 28, 1973]

§ 24.01–5 Assignment of functions.

(a) The Department of Transportation Act (Pub. L. 89–670, 80 Stat. 931–950, 49 U.S.C. 1651–1659), transferred to and vested in the Secretary of Transportation "* * * all functions, powers, and duties, relating to the Coast Guard, of the Secretary of the Treasury and of other officers and offices of the Department of the Treasury" (subsection 6(b) (1), 49 U.S.C. 1655(b)). This transfer is subject to certain conditions, modifications, and exceptions as set forth in such act. By rule in 49 CFR 1.4(a), the Secretary of Transportation delegated to the Commandant, U.S. Coast Guard, authority to exercise certain functions, powers, and duties as set forth in subsections 6(a) (4), 6(b) (1), and 6(g) of such act (49 U.S.C. 1655), subject to conditions, exceptions and modifications as described in 49 CFR part 1. By a rule in 49 CFR 1.9 the Secretary of Transportation continued in effect actions taken prior to April 1, 1967.

(b) The Commandant, U.S. Coast Guard, in a notice dated March 31, 1967, and effective April 1, 1967 (32 FR 5611), approved the continuation of orders, rules, regulations, policies, procedures, privileges, waivers, and other actions, which had been made, allowed, granted, or issued prior to April 1, 1967, and provided that they shall continue in effect according to their terms until modified, terminated, repealed, superseded, or set aside by appropriate authority.

[CGFR 68–32, 33 FR 5711, Apr. 12, 1968]

or carried in a vessel, or that any particular provision shall be made or arrangement shall be adopted, the Commandant may accept in substitution therefor any other fitting, material, apparatus, or equipment, or type thereof, or any other arrangement: *Provided*, That he shall have been satisfied by suitable trials that the fitting, material, appliance, apparatus, or equipment, or type thereof, or the provision or arrangement is at least as effective as that specified in this subchapter.

(b) In any case where it is shown to the satisfaction of the Commandant that the use of any particular equipment, apparatus, or arrangement not specifically required by law is unreasonable or impracticable, the Commandant may permit the use of alternate equipment, apparatus, or arrangement to such an extent and upon such conditions as will insure to his satisfaction, a degree of safety consistent with the minimum standards set forth in this subchapter.

§ 24.15-5 Canadian pleasure craft temporarily using navigable waters of the United States.

(a) Uninspected Canadian pleasure craft (uninspected vessels) temporarily using navigable waters of the United States may carry in lieu of the equipment required by the Motorboat Act of 1940 (46 U.S.C. 526-526u) and the regulations in this subchapter, the equipment as required by the laws of the Dominion of Canada and the regulations of the Department of Transport, Ottawa, Canada.

Subpart 24.20—General Marine Engineering Requirements

§ 24.20-1 Marine engineering details.

(a) All marine engineering details relative to the design, construction, and testing of boilers and machinery on steam-propelled motorboats of over 40 feet in length will be found in subchapter F (Marine Engineering) of this chapter.

PART 25—REQUIREMENTS

Subpart 25.01—Application

Sec.

Subpart 25.25—Life Preservers and Other Lifesaving Equipment

Subpart 25.26—Emergency Position Indicating Radio Beacons

Subpart 25.30—Fire Extinguishing Equipment

Subpart 25.35—Backfire Flame Control

Subpart 25.40—Ventilation

Subpart 25.45—Cooking, Heating, and Lighting Systems

Subpart 25.50—Garbage Retention

AUTHORITY: 33 U.S.C. 1903(b), 46 U.S.C. 3306, 4104, and 4302; 49 CFR 1.46.

Subpart 25.30—Fire Extinguishing Equipment

§ 25.30–1 Application.

(a) The provisions of this subpart, with the exception of § 25.30–90, shall apply to all vessels contracted for on or after November 19, 1952. Vessels contracted for prior to that date shall meet the requirements of § 25.30–90.

§ 25.30–5 General provisions.

(a) Where equipment in this subpart is required to be of an approved type, such equipment requires the specific approval of the Commandant. Such approvals are published in the FEDERAL REGISTER, and in addition, are contained in Coast Guard publication CG–190, *Equipment Lists*.

(b) All hand portable fire extinguishers, semiportable fire extinguishing systems, and fixed fire extinguishing systems shall be of an approved type.

§ 25.30–10 Hand portable fire extinguishers and semiportable fire extinguishing systems.

(a) Hand portable fire extinguishers and semiportable fire extinguishing systems are classified by a combination letter and number symbol. The letter indicating the type of fire which the unit could be expected to extinguish, and the number indicating the relative size of the unit.

(b) For the purpose of this subchapter, all required hand portable fire extinguishers and semiportable fire extinguishing systems are of the "B" type; i.e., suitable for extinguishing fires involving flammable liquids, greases, etc.

(c) The number designations for size will start with "I" for the smallest to "V" for the largest. For the purpose of this subchapter, only sizes I through III will be considered. Sizes I and II are considered hand portable fire extinguishers and sizes III, IV, and V are considered semiportable fire extinguishing systems which shall be fitted with suitable hose and nozzle or other practicable means so that all portions of the space concerned may be covered. Examples of size graduations for some of the typical hand portable fire extinguishers and semiportable fire extinguishing systems are set forth in Table 25.30–10(c).

TABLE 25.30–10(c)

Classification		Foam, gallons	Carbon Dioxide, pounds	Dry chemical, pounds
Type	Size			
B	I	1¼	4	2
B	II	2½	15	10
B	III	12	35	20

(d) All hand portable fire extinguishers and semiportable fire extinguishing systems shall have permanently attached thereto a metallic name plate giving the name of the item, the rated capacity in gallons, quarts, or pounds, the name and address of the person or firm for whom approved, and the identifying mark of the actual manufacturer.

(e) Vaporizing-liquid type fire extinguishers containing carbon tetrachloride or chlorobromomethane or other toxic vaporizing liquids are not acceptable as equipment required by this subchapter.

(f) Hand portable or semiportable extinguishers which are required on their name plates to be protected from freezing shall not be located where freezing temperatures may be expected.

(g) The use of dry chemical, stored pressure, fire extinguishers not fitted with pressure gauges or indicating devices, manufactured prior to January 1, 1965, may be permitted on motorboats and other vessels so long as such extinguishers are maintained in good and serviceable condition. The following maintenance and inspections are required for such extinguishers:

(1) When the date on the inspection record tag on the extinguishers shows that 6 months have elapsed since last weight check ashore, then such extinguisher is no longer accepted as meeting required maintenance conditions until reweighed ashore and found to be in a serviceable condition and within required weight conditions.

(2) If the weight of the container is ¼ ounce less than that stamped on container, it shall be serviced.

(3) If the outer seal or seals (which indicate tampering or use when broken) are not intact, the boarding

officer or marine inspector will inspect such extinguisher to see that the frangible disc in neck of the container is intact; and if such disc is not intact, the container shall be serviced.

(4) If there is evidence of damage, use, or leakage, such as dry chemical powder observed in the nozzle or elsewhere on the extinguisher, the container shall be replaced with a new one and the extinguisher properly serviced or the extinguisher replaced with another approved extinguisher.

(h) The dry chemical, stored pressure, fire extinguishers without pressure gauges or indicating devices manufactured after January 1, 1965, shall not be labeled with the marine type label bed in § 162.028–4 of this title nor shall such extinguishers manufactured after January 1, 1965, be carried on board motorboats or other vessels as required equipment.

[CGFR 65–50, 30 FR 16653, Dec. 30, 1965, as amended by CGFR 68–32, 33 FR 5711, Apr. 12, 1968; CGFR 69–18, 34 FR 5723, Mar. 27, 1969]

§ 25.30–15 Fixed fire extinguishing systems.

(a) When a fixed fire extinguishing system is installed, it shall be of an approved carbon dioxide type, designed and installed in agreement with the applicable provisions of subpart 76.15 of subchapter H (Passenger Vessels) of this chapter.

§ 25.30–20 Fire extinguishing equipment required.

(a) *Motorboats.* (1) All motorboats shall carry at least the minimum number of hand portable fire extinguishers set forth in Table 25.30–20(a)(1), except that motorboats less than 26 feet in length, propelled by outboard motors and not carrying passengers for hire, need not carry such portable fire extinguishers if the construction of such motorboats will not permit the entrapment of explosive or flammable gases or vapors.

TABLE 25.30–20(a)(1)

Class of motor boat	Length, feet	Minimum number of B–I hand portable fire extinguishers required [1]	
		No fixed fire extinguishing system in machinery space	Fixed fire extinguishing system in machinery space
A	Under 16	1	0
1	16 and over, but under 26	1	0
2	26 and over, but under 40	2	1
3	40 and over, but not over 65	3	2

[1] One B–II hand portable fire extinguisher may be substituted for two B–I hand portable fire extinguishers.

(2) The intent of this regulation is illustrated in Figure 25.30–20(a1) where fire extinguishers are required if any one or more of the specified conditions exist, and in Figure 25.30–20(a2) where specified conditions do not, in themselves, require that fire extinguishers be carried.

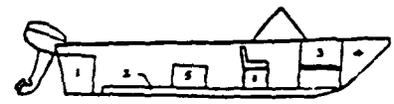

FIGURE 25.30–20(a1)

Fire extinguishers are required if any one or more of the following conditions exist (numbers identifying conditions are the same as those placed in Figure 25.30–20 (a1)):

1. Closed compartment under thwarts and seats wherein portable fuel tanks may be stored.
2. Double bottoms not sealed to the hull or which are not completely filled with flotation material.
3. Close living spaces.
4. Closed stowage compartments in which combustible or flammable materials are stowed.
5. Permanently installed fuel tanks.

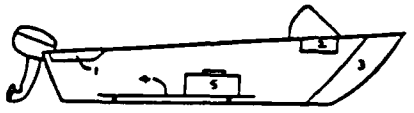

FIGURE 25.30–20(a2).

The following conditions do not, in themselves, require that fire extinguishers be carried (numbers identifying conditions are the same as those placed in Figure 25.30–20(a2)):

1. Bait wells.
2. Glove compartments.
3. Buoyant flotation material.
4. Open slatted flooring.
5. Ice chests.

(b) *Motor vessels.* (1) All motor vessels shall carry at least the minimum number of hand portable fire extinguishers set forth in Table 25.30–20(b)(1).

TABLE 25.30–20(b)(1)

Gross tonnage—		Minimum number of B–II hand portable fire extinguishers
Over	Not over	
	50	1
50	100	2
100	500	3
500	1,000	6
1,000		8

(2) In addition to the hand portable fire extinguishers required by paragraph (b)(1) of this section, the following fire-extinguishing equipment shall be fitted in the machinery space:

(i) One Type B–II hand portable fire extinguisher shall be carried for each 1,000 B. H. P. of the main engines or fraction thereof. However, not more than 6 such extinguishers need be carried.

(ii) On motor vessels of over 300 gross tons, either one Type B–III semiportable fire-extinguishing system shall be fitted, or alternatively, a fixed fire-extinguishing system shall be fitted in the machinery space.

(3) The frame or support of each Type B–III fire extinguisher required by paragraph (b)(2)(ii) of this section must be welded or otherwise permanently attached to a bulkhead or deck.

(4) If an approved semiportable fire extinguisher has wheels and is not required by this section, it must be securely stowed when not in use to prevent it from rolling out of control under heavy sea conditions.

(c) *Barges carrying passengers.* (1) Every barge of 65 feet in length or less while carrying passengers when towed or pushed by a motorboat, motor vessel, or steam vessel shall be fitted with hand portable fire extinguishers as required by Table 25.30–20(a)(1), depending upon the length of the barge.

(2) Every barge of over 65 feet in length while carrying passengers when towed or pushed by a motorboat, motor vessel, or steam vessel shall be fitted with hand portable fire extinguishers as required by Table 25.30–20(b)(1), depending upon the gross tonnage of the barge.

[CGFR 65–50, 30 FR 16653, Dec. 30, 1965, as amended by CGD 77–039, 44 FR 34132, June 14, 1979]

§ 25.30–90 Vessels contracted for prior to November 19, 1952.

(a) Vessels contracted for prior to November 19, 1952, shall meet the applicable provisions of §§ 25.30–5 through 25.30–20 insofar as the number and general type of equipment is concerned. Existing items of equipment and installations previously approved but not meeting the applicable requirements for type approval may be continued in service so long as they are in good condition. All new installations and replacements shall meet the requirements of §§ 25.30–5 through 25.30–20.

Subpart 25.35—Backfire Flame Control

§ 25.35–1 Requirements.

(a) Every gasoline engine installed in a motorboat or motor vessel after April 25, 1940, except outboard motors, shall be equipped with an acceptable means of backfire flame control.

(b) Installations made before November 19, 1952, need not meet the detailed requirements of this subpart and may be continued in use as long as they are serviceable and in good condition. Replacements shall meet the applicable conditions in this section.

CHAPTER I—COAST GUARD, DEPARTMENT OF TRANSPORTATION (Continued)

EDITORIAL NOTE: For nomenclature changes to Chapter I, see CGD 82-072, 47 FR 28677, July 1, 1982.

SUBCHAPTER H—PASSENGER VESSELS

gator's bridge, twelve approved handheld red flare distress signals contained in a portable watertight container, constructed in accordance with subpart 160.021 or subpart 160.023 of subchapter Q (Specifications) of this chapter. The service use of the distress signals shall be limited to a period of three years from date of manufacture, and replacement shall be made no later than the first annual inspection of the vessel after the date of expiration.

PART 76—FIRE PROTECTION EQUIPMENT

Subpart 76.01—Application

Sec.
76.01-1 General.
76.01-2 Incorporation by reference.
76.01-5 Equipment installed but not required.

Subpart 76.05—Fire Detecting and Extinguishing Equipment, Where Required

76.05-1 Fire detecting systems.
76.05-5 Manual alarm system.
76.05-10 Supervised patrol system.
76.05-15 Fire main system.
76.05-20 Fixed fire extinguishing systems.
76.05-25 Hand portable fire extinguishers and semiportable fire extinguishing systems.
76.05-30 Sand.

Subpart 76.10—Fire Main System, Details

76.10-1 Application.
76.10-3 Water availability.
76.10-5 Fire pumps.
76.10-10 Fire hydrants and hose.
76.10-15 Piping.
76.10-90 Installations contracted for prior to May 26, 1965.

Subpart 76.13—Steam Smothering System, Details

76.13-1 Application.
76.13-90 Installations contracted for prior to January 1, 1962.

Subpart 76.15—Carbon Dioxide Extinguishing Systems, Details

76.15-1 Application.
76.15-5 Quantity, pipe sizes, and discharge rate.
76.15-10 Controls.
76.15-15 Piping

Sec.
76.15-20 Carbon dioxide storage.
76.15-25 Discharge outlets.
76.15-30 Alarms.
76.15-35 Enclosure openings.
76.15-40 Pressure relief.
76.15-90 Installations contracted for prior to November 19, 1952.

Subpart 76.17—Foam Extinguishing Systems, Details

76.17-1 Application.
76.17-5 Quantity of foam required.
76.17-10 Controls.
76.17-15 Piping.
76.17-20 Discharge outlets.
76.17-25 Additional protection required.
76.17-90 Installations contracted for prior to November 19, 1952.

Subpart 76.23—Manual Sprinkling System, Details

76.23-1 Application.
76.23-5 Zoning.
76.23-10 Quantity, pipe sizes, and discharge rates.
76.23-15 Controls.
76.23-20 Piping.
76.23-25 Sprinkler heads.
76.23-90 Installations contracted for prior to November 19, 1952.

Subpart 76.25—Automatic Sprinkling System, Details

76.25-1 Application.
76.25-5 Zoning.
76.25-10 Size and arrangement of sprinkler heads and pipe sizes.
76.25-15 Pumps and water supply.
76.25-20 Pressure tank.
76.25-25 Controls.
76.25-30 Piping.
76.25-35 Operation and installation.
76.25-90 Installations contracted for prior to November 19, 1952.

Subpart 76.27—Electric Fire Detecting System, Details

76.27-1 Application.
76.27-5 Zoning.
76.27-10 Location and spacing of detectors.
76.27-15 Operation and installation.
76.27-90 Installations contracted for prior to November 19, 1952.

Subpart 76.30—Pneumatic Fire Detecting System, Details

76.30-1 Application.
76.30-5 Zoning.
76.30-10 Location and spacing of tubing.
76.30-15 Operation and installation.

(4) A steam pressure of at least 100 p.s.i. shall be available unless specifically approved otherwise.

(5) All piping, valves, and fittings shall meet the applicable requirements of subchapter F (Marine Engineering) of this chapter.

(6) The distribution piping shall emanate from not more than three stations in easily accessible locations on the weather deck, and shall lead to the lower portion of each cargo hold, cargo 'tween deck, and other compartments protected. However, lines to paint lockers and similar small spaces may be taken from the nearest steam supply line.

(7) The distribution line to each compartment shall be fitted with a shutoff valve. The valve shall be marked as required by § 78.47-15 of this subchapter.

(8) The manifold steam supply line shall be fitted with a master valve at the manifold.

(9) Provisions shall be made for draining the manifold and distribution lines to prevent them from freezing.

(10) If located on the open deck, the distribution manifolds shall be suitably protected by an enclosing cabinet or casing. In any case, it shall be marked as required by § 78.47-17 of this subchapter.

(11) Piping shall not be led into or through spaces accessible to the passengers or crew while the vessel is being navigated, with the exception of machinery spaces and corridors. However, in special cases, arrangements to run piping through such spaces may be specifically approved by the Commandant, provided all joints are welded, suitable expansion bends are provided, and all piping is extra heavy.

(12) Piping shall be used for no other purpose except that it may be incorporated with the fire detecting system, and where suitable provisions are made, it may be used for steaming out tanks.

(13) The minimum size and number of branches to the various spaces shall be as given in Table 76.13-90(c)(13). The distribution piping from the manifold to the branch lines shall have an area approximately equal to the combined areas of the branch lines served.

Subpart 76.15—Carbon Dioxide Extinguishing Systems, Details

§ 76.15-1 Application.

(a) Where a carbon dioxide extinguishing system is installed, the provisions of this subpart, with the exception of § 76.15-90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 76.15-90.

(b) The requirements of this subpart are based on a "high pressure system", i.e., one in which the carbon dioxide is stored in liquid form at atmospheric temperature. Details for "low pressure systems", i.e., those in which the carbon dioxide is stored in liquid form at a continuously controlled low temperature, may be specifically approved by the Commandant where it is demonstrated that a comparable degree of safety and fire extinguishing ability is achieved.

§ 76.15-5 Quantity, pipe sizes, and discharge rate.

(a) *General.* The amount of carbon dioxide required for each space shall be as determined by the following paragraphs in this section.

(b) *Total available supply.* A separate supply of carbon dioxide need not

be provided for each space protected. The total available supply shall be at least sufficient for the space requiring the greatest amount.

(c) *Cargo spaces.* (1) The number of pounds of carbon dioxide required for each space in cubic feet shall be equal to the gross volume of the space in cubic feet divided by 30.

(2) Although separate piping shall be led to each cargo hold and 'tween deck, for the purpose of determining the amount of carbon dioxide required, a cargo compartment will be considered as the space between adjacent watertight or firescreen bulkheads and from the tank top or lowest deck to the deck head of the uppermost space on which cargo may be carried. If a trunk extends beyond such deck, the trunk volume shall be included. Tonnage openings shall be considered as sealed for this purpose.

(3) Branch lines to the various cargo holds and 'tween decks shall not be less than ¾ inch standard pipe size.

(4) No specific discharge rate need be applied to such systems.

(d) *Enclosed ventilation systems for rotating electrical propulsion equipment.* (1) The number of pounds of carbon dioxide required for the initial charge shall be equal to the gross volume of the system divided by 10 for systems having a volume of less than 2,000 cubic feet, and divided by 12 for systems having a volume of 2,000 cubic feet or more.

(2) The piping for the initial charge shall be in accordance with Table 76.15-5 (e)(4), and the discharge of the required amount shall be completed within two minutes.

(3) In addition to the above there shall be sufficient carbon dioxide available to permit delayed discharges of such quantity as to maintain at least a 25 percent concentration until the equipment can be stopped. If the initial discharge is such as to achieve this concentration until the equipment is stopped, no delayed discharge need be provided.

(4) The piping for the delayed discharge shall not be less than ⅛ inch standard pipe size, and no specific discharge rate need be applied to such systems. On small systems, this pipe may be incorporated with the initial discharge piping.

(e) *Machinery spaces, paint lockers, tanks, and similar spaces.* (1) Except as provided in paragraph (e)(3) of this section, the number of pounds of carbon dioxide required for each space shall be equal to the gross volume of the space divided by the appropriate factor noted in Table 76.15-5(e)(1). If fuel can drain from the compartment being protected to an adjacent compartment, or if the compartments are not entirely separate, the requirements for both compartments shall be used to determine the amount of carbon dioxide to be provided. The carbon dioxide shall be arranged to discharge into both such compartments simultaneously.

TABLE 76.15-5(e)(1)

Gross volume of compartment, cubic feet		Factor
Over	Not over	
	500	15
500	1,600	16
1,600	4,500	18
4,500	50,000	20
50,000		22

(2) For the purpose of the above requirement of this paragraph, the volume of a machinery space shall be taken as exclusive of the normal machinery casing unless the boiler, internal combustion machinery, or fuel oil installations extend into such space in which case the volume shall be taken to the top of the casing or the next material reduction in casing area, whichever is lower. For installations contracted for on or after October 1, 1959, "normal machinery casing" and "material reduction in casing area" shall be defined as follows:

(i) By "normal machinery casing" shall be meant a casing the area of which is not more than 40 percent of the maximum area of the machinery space.

(ii) By "material reduction in casing area" shall be meant a reduction to at least 40 percent of the casing area.

(3) For vessels on an international voyage contracted for on or after May 26, 1965, the amount of carbon dioxide required for a space containing propul-

sion boilers or internal combustion propulsion machinery shall be as given by paragraphs (e)(1) and (2) of this section or by dividing the entire volume, including the casing, by a factor of 25, whichever is the larger.

(4) Branch lines to the various spaces shall be as noted in Table 76.15–5(e)(4).

TABLE 76.15–5(e)(4)

Maximum quantity of carbon dioxide required, pounds	Minimum nominal pipe size, inches	Maximum quantity of carbon dioxide required, pounds	Minimum nominal pipe size, inches
100	½	2,500	2½
225	¾	4,450	3
300	1	7,100	3½
600	1¼	10,450	4
1,000	1½	15,000	4½
2,450	2		

(5) Distribution piping within the space shall be proportioned from the supply line to give proper distribution to the outlets without throttling.

(6) The number, type, and location of discharge outlets shall be such as to give a uniform distribution throughout the space.

(7) The total area of all discharge outlets shall not exceed 85 percent nor be less than 35 percent of the nominal cylinder outlet area or the area of the supply pipe, whichever is smaller. The nominal cylinder outlet area in square inches shall be determined by multiplying the factor 0.0022 by the number of pounds of carbon dioxide required, except that in no case shall this outlet area be less than 0.110 square inch.

(8) The discharge of at least 85 percent of the required amount of carbon dioxide shall be complete within 2 minutes.

(f) *Spaces specially suitable for vehicles.* (1) The number of pounds of carbon dioxide required shall be equal to the gross volume of the largest "tight" space divided by 22. In no case, however, shall it be less than that required by paragraph (c) of this section.

(2) The arrangement of valves and piping shall be such that the required quantity of carbon dioxide may be discharged into any "tight" space. The discharge of the required quantity of carbon dioxide shall be completed within 2 minutes.

(3) Except as noted in paragraphs (f)(1) and (2) of this section, the requirements of paragraph (e) of this section shall apply.

[CGFR 65–50, 30 FR 16940, Dec. 30, 1965, as amended by CGFR, 66–33, 31 FR 15283, Dec. 6, 1966]

§ 76.15–10 Controls.

(a) Except as noted in § 76.15–20(b), all controls and valves for the operation of the system shall be outside the space protected, and shall not be located in any space that might be cut off or made inaccessible in the event of fire in any of the spaces protected.

(b) If the same cylinders are used to protect more than one hazard, a manifold with normally closed stop valves shall be used to direct the carbon dioxide into the proper space. If cylinders are used to protect only one hazard, a normally closed stop valve shall be installed between the cylinders and the hazard except for systems of the type indicated in § 76.15–5(e) which contain not more than 300 pounds of carbon dioxide.

(c) Distribution piping to the various cargo spaces shall be controlled from not more than two stations. One of the stations controlling the system for the main machinery space shall be located as convenient as practicable to one of the main escapes from the space. All control stations and the individual valves and controls shall be marked as required by §§ 78.47–15 and 78.47–17 of this subchapter.

(d) Systems of the type indicated in § 76.15–5(e) shall be actuated by one control operating the valve to the space and a separate control releasing at least the required amount of carbon dioxide. These two controls shall be located in a box or other enclosure clearly identified for the particular space. Those systems installed without a stop valve shall be operated by one control releasing at least the required amount of carbon dioxide.

(e) Where provisions are made for the simultaneous release of a given amount of carbon dioxide by operation

of a remote control, provisions shall also be made for manual control at the cylinders. Where gas pressure from pilot cylinders is used as a means for releasing the remaining cylinders, not less than two pilot cylinders shall be used for systems consisting of more than two cylinders. Each of the pilot cylinders shall be capable of manual control at the cylinder, but the remaining cylinders need not be capable of individual manual control.

(f) Systems of the type indicated in § 76.15-5(e), other than systems for tanks, which are of more than 300 pounds of carbon dioxide, shall be fitted with an approved delayed discharge so arranged that the alarm will be sounded for at least 20 seconds before the carbon dioxide is released into the space. Such systems of not more than 300 pounds of carbon dioxide shall also have a similar delayed discharge, except for those systems for tanks and for spaces which have a suitable horizontal escape. This paragraph shall be applicable only to systems installed on or after July 1, 1957.

(g) All distribution valves and controls shall be of an approved type. All controls shall be suitably protected.

(h) Complete but simple instructions for the operation of the systems must be located in a conspicuous place at or near all pull boxes, stop valve controls and in the CO_2 cylinder storage room. On systems in which the CO_2 cylinders are not within the protected space, these instructions must also include a schematic diagram of the system and instructions detailing alternate methods of discharging the system should the manual release or stop valve controls fail to operate. Each control valve to branch lines must be marked to indicate the related space served.

(i) If the space or enclosure containing the carbon dioxide supply or controls is to be locked, a key to the space or enclosure shall be in a break-glass-type box conspicuously located adjacent to the opening.

[CG FR 65-60, 30 FR 16940, Dec. 30, 1965, as amended by CGD 74-100R, 40 FR 6209, Feb. 10, 1975]

§ 76.15-15 Piping.

(a) The piping, valves, and fittings shall have a bursting pressure of not less than 6,000 p.s.i.

(b) All piping, in nominal sizes not over ¾ inch, shall be at least Schedule 40 (standard weight), and in nominal sizes over ¾ inch, shall be at least Schedule 80 (extra heavy).

(c) All piping, valves, and fittings of ferrous materials shall be protected inside and outside against corrosion unless specifically approved otherwise by the Commandant.

(d) A pressure relief valve or equivalent set to relieve between 2,400 and 2,800 p.s.i. shall be installed in the distributing manifold or such other location as to protect the piping in the event that all branch line shut-off valves are closed.

(e) All dead end lines shall extend at least 2 inches beyond the last orifice and shall be closed with cap or plug.

(f) All piping, valves, and fittings shall be securely supported, and where necessary, protected against injury.

(g) Drains and dirt traps shall be fitted where necessary to prevent the accumulation of dirt or moisture. Drains and dirt traps shall be located in accessible locations where possible.

(h) Piping shall be used for no other purpose except that it may be incorporated with the fire detecting system.

(i) Piping passing through living quarters shall not be fitted with drains or other openings within such spaces.

(j) Installation test requirements:

(1) Upon completion of the piping installation, and before the cylinders are connected, a pressure test shall be applied as set forth in this paragraph. Only carbon dioxide or other inert gas shall be used for this test.

(2) The piping from the cylinders to the stop valves in the manifold shall be subjected to a pressure of 1,000 p.s.i. With no additional gas being introduced to the system, it shall be demonstrated that the leakage of the system is such as not to permit a pressure drop of more than 150 p.s.i. per minute for a 2-minute period.

(3) The individual branch lines to the various spaces protected shall be subjected to a test similar to that described in the preceding paragraph

with the exception that the pressure used shall be 600 p.s.i. in lieu of 1,000 p.s.i. For the purpose of this test, the distribution piping shall be capped within the space protected at the first joint ahead of the nozzles.

(4) In lieu of the tests prescribed in the preceding paragraphs in this section, small independent systems protecting spaces such as emergency generator rooms, lamp lockers, etc., may be tested by blowing out the piping with air at a pressure of at least 100 p.s.i.

§ 76.15–20 Carbon dioxide storage.

(a) Except as provided in paragraph (b) of this section, the cylinders shall be located outside the spaces protected, and shall not be located in any space that might be cut off or made inaccessible in the event of a fire in any of the spaces protected.

(b) Systems of the type indicated in § 76.15–5(e), consisting of not more than 300 pounds of carbon dioxide, may have the cylinders located within the space protected. If the cylinder stowage is within the space protected, the system shall be arranged in an approved manner to be automatically operated by a heat actuator within the space in addition to the regular remote and local controls.

(c) The space containing the cylinders shall be properly ventilated and designed to preclude an anticipated ambient temperature in excess of 130 degrees F.

(d) Cylinders shall be securely fastened and supported, and, where necessary, protected against injury.

(e) Cylinders shall be so mounted as to be readily accessible and capable of easy removal for recharging and inspection. Provisions shall be available for weighing the cylinders.

(f) Where subject to moisture, cylinders shall be so installed as to provide a space of at least 2 inches between the flooring and the bottom of the cylinders.

(g) Cylinders shall be mounted in an upright position or inclined not more than 30 degrees from the vertical. However, cylinders which are fitted with flexible or bent syphon tubes may be inclined not more than 80 degrees from the vertical.

(h) Where check valves are not fitted on each independent cylinder discharge, plugs or caps shall be provided for closing outlets when cylinders are removed for inspection or refilling.

(i) All cylinders used for storing carbon dioxide must be fabricated, tested, and marked in accordance with §§ 147.60 and 147.65 of this chapter.

[CGFR 65–50, 30 FR 16940, Dec. 30, 1965, as amended by CGD 84–044, 53 FR 7748, Mar. 10, 1988]

§ 76.15–25 Discharge outlets.

(a) Discharge outlets shall be of an approved type.

§ 76.15–30 Alarms.

(a) Spaces which are protected by a carbon dioxide extinguishing system and are normally accessible to persons on board while the vessel is being navigated, other than paint and lamp lockers and similar small spaces, shall be fitted with an approved audible alarm in such spaces which will be automatically sounded when the carbon dioxide is admitted to the space. The alarm shall be conspicuously and centrally located and shall be marked as required by § 78.47–9 of this subchapter. For systems installed on or after July 1, 1957, alarms will be mandatory only for systems required to be fitted with a delayed discharge. Such alarms shall be so arranged as to sound during the 20 second delay period prior to the discharge of carbon dioxide into the space, and the alarm shall depend on no source of power other than the carbon dioxide.

§ 76.15–35 Enclosure openings.

(a) Where mechanical ventilation is provided for spaces other than cargo and similar spaces which are protected by a carbon dioxide extinguishing system, provisions shall be made so that the ventilation system is automatically shut down with the operation of the system to that space.

(b) Where natural ventilation is provided for spaces protected by a carbon dioxide extinguishing system, provisions shall be made for easily and effectively closing off the ventilation.

(c) Means shall be provided for closing all openings to the space protected from outside such space. In this respect, relatively tight doors, shutters, or dampers shall be provided for openings in the lower portion of the space. The construction shall be such that openings in the upper portion of the space can be closed off either by permanently installed means or by the use of canvas or other material which is normally carried by the vessel.

§ 76.15-40 Pressure relief.

(a) Where necessary, relatively tight compartments such as refrigeration spaces, paint lockers, etc., shall be provided with suitable means for relieving excessive pressure accumulating within the compartment when the carbon dioxide is injected.

[CGFR 65-50, 30 FR 16940, Dec. 30, 1965, as amended by CGFR 66-33, 31 FR 15283, Dec. 6, 1966]

§ 76.15-90 Installations contracted for prior to November 19, 1952.

(a) Installations contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Existing arrangements, materials, and facilities previously approved shall be considered satisfactory so long as they meet the minimum requirements of this paragraph and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original installation.

(2) The details of the systems shall be in general agreement with §§ 76.15-5 through 76.15-40 insofar as is reasonable and practicable, with the exception of § 76.15-5(e) (1) through (3) covering spaces other than cargo spaces, which systems may be installed in accordance with paragraphs (a) (3) through (6) of this section. However, the foregoing exception shall not be permitted for vessels on an international voyage.

(3) In boilerrooms, the bilges shall be protected by a system discharging principally below the floor plates. Perforated pipe may be used in lieu of discharge nozzles for such systems. The number of pounds of carbon dioxide shall be equal to the gross volume of the boiler room taken to the top of the boilers divided by 36. In the event of an elevated boilerroom which drains to the machinery space, the system shall be installed in the engine room bilge and the gross volume shall be taken to the flat on which the boilers are installed.

(4) In machinery spaces where main propulsion internal combustion machinery is installed, the number of pounds of carbon dioxide required shall be equal to the gross volume of the space taken to the underside of the deck forming the hatch opening divided by 22.

(5) In miscellaneous spaces other than cargo or main machinery spaces, the number of pounds of carbon dioxide required shall be equal to the gross volume of the space divided by 22.

(6) Branch lines to the various spaces other than cargo and similar spaces, shall be as noted in Table 76.15-90(a) (6). This table is based on cylinders having discharge outlets and siphon tubes of ⅜-inch diameter.

TABLE 76.15-90(a)(6)

Number of cylinders		Nominal pipe size	
Over	Not over	Inches	Type
	2	½	Standard.
2	4	¾	Do.
4	6	1	Extra heavy.
6	12	1¼	Do.
12	18	1½	Do.
18	27	2	Do.
27	39	2½	Do.
39	60	3	Do.
60	80	3½	Do.
80	104	4	Do.
104	165	5	Do.

[CGFR 65-50, 30 FR 16940, Dec. 30, 1965, as amended by CGFR 67-87, 32 FR 19181, Dec. 20, 1967]

Subpart 76.17—Foam Extinguishing Systems, Details

§ 76.17-1 Application.

(a) Where a foam extinguishing system is installed, the provisions of this subpart, with the exception of § 76.17-90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952,

SUBJECT: CHI-64

REFERENCE: CHI-64 Arrangement and Profile Drawing

- Length = 36'
- Number of Frames = 13
- Distance Between Frames = 2.77'

• Engine Room:	5 Frames Long x 2.77'	=	13.85 (L)
	Depth	=	5.375' (H)
	Breadth (Beam)	=	12' (W)
	Volume = L x W x H	=	893.3 cu ft
• Lazarette:	1 Frame	=	2.77' (L)
	Depth	=	5.375 (H)
	Breadth (Beam)	=	12' (W)
	Volume = L x W x H	=	178.6 cu ft
• Gross Volume Total (would be somewhat less because of installed equipment and hull shape)		=	1071.9 cu ft

See page 107 of Subpart 76.15. Gross volume divided by the appropriate factor from Table 76.15(e)(1) = pounds of CO^2 required.

- 1071.9 ÷ 16 = 66.9 lbs CO^2 Required

NOTE: The actual volume of the spaces was not determined onboard the CHI-64 for these calculations. The above dimensions were taken from the CHI-64 Arrangement and Profile Drawing provided with the boat.