E-CRRC-PRF-0001
1 Dec 2020

PERFORMANCE SPECIFICATION

FOR THE

ENHANCED COMBAT RUBBER RECONNAISSANCE CRAFT

Version 1.0

Page Intentionally Left Blank

PREPARED BY:

FEENEY.JON.K.1023891707 Digitally signed by FEENEY.JON.K.1023891707 Date: 2020.12.18 11:05:10 -05'00'

Jake Feeney
Engineer, Air and Amphibious Systems
PM Infantry Combat Equipment
PfM Ground Combat Element Systems
Marine Corps Systems Command

CONCURRENCE:

O'BRIEN.JOHN.LAWRENCE.1030510573 Digitally signed by O'BRIEN.JOHN.LAWRENCE.1030510573 Date: 2020.12.22 06:13:00 -05'00'

John O'Brien
Team Leader, Air and Amphibious Systems
PM Infantry Combat Equipment
PfM Ground Combat Element Systems
Marine Corps Systems Command

CONCURRENCE:

MACDONALD.PATRICIA.MARLENE.1135684291 Digitally signed by MACDONALD.PATRICIA.MARLENE.1135684291 Date: 2020.12.22 08:03:58 -05'00'

Patricia MacDonald
Assistant Program/Portfolio Manager - Engineering
PM Infantry Combat Equipment
PfM Ground Combat Element Systems
Marine Corps Systems Command

APPROVAL:

KONICKI.ANDREW.JASON.1239444675 Digitally signed by KONICKI.ANDREW.JASON.1239444675 Date: 2020.12.23 07:38:44 -05'00'

LtCol A.J. Konicki
Program Manager, Infantry Combat Equipment
PfM Ground Combat Element Systems
Marine Corps Systems Command

Record of Changes

Document Revision	Effective Date	Description/Paragraphs Affected	ECP/Prepared By
1.0	1 Dec 2020	Final Draft	J. Feeney

Table of Contents

SCOPE

1.1 Scope

This specification describes the functional and performance requirements for the Enhanced Combat Rubber Reconnaissance Craft (E-CRRC) which is the next generation inflatable raiding craft. Marine Corps reconnaissance personnel are in need of an improved inflatable craft used in conjunction with the fielded 55 hp Non-Gasoline Burning Outboard Engine (NBOE) in order to effectively execute amphibious reconnaissance missions. The E-CRRC will be used for insertion/recovery of personnel and the performance of related amphibious reconnaissance activities in a prospective landing area. It is essential to Marine Corps reconnaissance operations that a clandestine delivery means to enable personnel to cover extended distances across the ocean from the launch/recovery point to the objective area is provided. The newly designed craft must be capable of air drop by rotor wing aircraft and should be air delivered by parachute insertion in the execution of this primary mission of tactical insertion of small reconnaissance teams.

1.2 System Description

The E-CRRC will have increased load carrying capacity as well as improved ride quality, speed, stability and seakeeping in heavy seas over the legacy CRRC. The improved ride quality will deliver Reconnaissance Marines to the objective with reduced fatigue and strain after long distance offshore transits.

1.3 Mission Profiles

The E-CRRC will be used to support Marine Corps reconnaissance missions to conduct amphibious raids. This involves swift incursions into hostile territory, conduct of the raid mission, and a planned withdrawal. Insertion into the mission area will be by ship, helicopter and fixed-wing aircraft. The system will operate across the spectrum of day and night, and in all climates and terrain in which the Marine Air-Ground Task Force is employed.

1.4 Use of “Shall” and “Should”

The structure of this specification states requirements using two distinct language provisions: 1) Binding provisions use the term “shall” to represent the threshold values and is the mandatory requirement, and 2) Non-mandatory provisions use the term “should” to represent the objective values and represents the desired operational performance.

2 APPLICABLE DOCUMENTS

2.1 General

This section provides a list of documents referenced throughout Sections 3 and 4 of this specification. Although this is a comprehensive list, it is not all-inclusive; therefore, users of this document are cautioned to communicate with the appropriate technical experts to verify compliance with all additional policies and regulations that may be applicable to a given situation or scenario.

2.2 Government Documents

2.2.1 Specifications, Standards, and Handbooks

The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

a. MIL-STD-810H, w/Ch 1, (31 Jan 2019), Environmental Engineering Considerations and Laboratory Tests
b. MIL-STD-1472H, Human Engineering
c. 10 U.S.C § 2533a, Requirement to Buy Certain Articles from American Sources
d. FED-STD-191, Textile Test Methods
e. MIL-STD-129, Military Marking for Shipment and Storage
f. MIL-STD-130, Identification Markings of U.S. Military Property

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government Documents, Drawings, and Publications

g. Program Unique Specification for the Non-Gasoline Burning Outboard Engine, 16 March 2009
h. MCO P5215.17C The Marine Corps Technical Publications System

2.3 Order of Precedence

In the event of a conflict between the text of this document and the references cited herein (except for associated detail specifications, specification sheets, or Military Specification standards), the text of this specification shall take precedence. Nothing in this document shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3 REQUIREMENTS

3.1 Design

3.1.1 Materials.

3.1.1.1 Berry Amendment.

All materials used in construction of the E-CRRC shall be in compliance with the Berry Amendment (10 U.S.C 2533a)

3.1.1.2 Fabric.

The coated fabric used in the construction of E-CRRC inflatable buoyancy chambers shall have a base fabric of polyester, nylon or Kevlar with a coating of polyurethane, neoprene, or chlorosulfonated-polyethylene (CSM) rubber.
PVC coated fabrics are not acceptable.

3.1.1.3 Resiliency. OSA 1.

The E-CRRC shall be constructed of material resistant to the effects of puncture caused by coral and other jagged obstacles. The E-CRRC shall have a puncture resistance of 360 N (81 lbs) when tested per Method 5120 of FED-STD-191, in Section 0.

3.1.1.4 Environmental.

The E-CRRC shall be constructed of material not adversely affected by oil, fungal attack or exposure to sunlight such as may be encountered and applied during its life cycle.

3.1.2 Weight. KSA 2.

3.1.2.1 A fully inflated E-CRRC without equipment, engine, or fuel shall be man portable by six Marines (T), four Marines (O).

3.1.2.2 The E-CRRC shall not exceed 360 (T), 325 (O) pounds empty weight. Weight is exclusive of engine, fuel, equipment, inflation cylinders and supply system responsibility items (SSRI).

3.1.3 Deck.

3.1.3.1 The deck shall be inflatable to minimize injuries to crew and passengers.

3.1.3.2 The deck shall be removable from the E-CRRC without special tools for repair and replacement.

3.1.3.3 The deck shall be collapsible and remain within the E-CRRC during rolled storage.

3.1.3.4 The deck shall be constructed of a nonskid material or coating on the top layer.

3.1.3.5 The deck shall extend from the transom to the bow of the E-CRRC.

3.1.3.6 The deck shall incorporate a minimum of 12 equipment securing points distributed evenly along the length of the E-CRRC deck.

3.1.3.7 Equipment securing points shall have a minimum pull strength of 250 lbs.

3.1.3.8 The deck shall be isolated from the E-CRRC main buoyancy chambers in case of puncture.

3.1.3.9 The E-CRRC shall be capable of a minimum speed of 6 knots, at full combat load, in the event of deck puncture and deflation.

3.1.4 Transom.

3.1.4.1 The transom shall be sized for use with the USMC 55 HP Non-Gasoline Burning Outboard Engine (NBOE).

The NBOE is a single long shaft (20”) Evinrude outboard engine with pump-jet weighing 270 lbs.

3.1.4.2 The transom shall incorporate a hardened corrosion resistant faceplate and lip.

3.1.4.3 The transom shall have bolts or pins included which the NBOE to be bolted or pinned through the transom to prevent the engine from falling off in the event that the transom clamps loosen.

3.1.4.4 The transom angle shall be -14° ± 2° for mounting of the NBOE.

3.1.5 Inflation. APA 1.

3.1.5.1 The E-CRRC shall be inflatable via manual foot pumps.

3.1.5.2 The E-CRRC shall be inflatable via standard SCUBA tanks.

3.1.5.2.1 The inflation hose(s) assembly shall attach to the inboard side of the E-CRRC in the aft of the E-CRRC using quick-disconnect fittings capable of preventing air loss when the automatic inflation system is not used.

3.1.5.2.2 Yoke style connection valves for a Self-Contained Underwater Breathing Apparatus (SCUBA) tank shall be provided for inflation of the E-CRRC.

3.1.5.2.3 The E-CRRC shall be fully inflated using no more than two 100 ft^3 SCUBA bottles at 3000 psi.

3.1.5.3 The E-CRRC inflation chambers shall be fitted with valves capable of transferring the inflation air from one chamber to an adjacent chamber of the same pressure.

3.1.6 Inflation/deflation valves.

3.1.6.1 Inflation/deflation valves shall be provided on each inflatable chamber of the E-CRRC.

3.1.6.2 To prevent entry of sand or debris, the valves shall be equipped with a protective non-corrosive or coated metal cover attached by a lanyard or tether.

3.1.6.3 The valves shall be capable of being locked in an open position to facilitate deflation and shall be marked to indicate instructions for their proper operation.

3.1.6.4 Two (2) additional valves, one each port and starboard on the top side of the main buoyancy tube aft chamber end cones just forward of the end caps shall be provided and designated as dump valves.

3.1.6.5 A single dump valve shall be located near the bow for deflation during cache.

3.1.7 Relief Valves.

3.1.7.1 A system of relief valves shall be installed in the E-CRRC tube chambers to protect from inadvertent overpressure.

3.1.7.2 The relief valves shall be installed and located in a manner which avoids damage by E-CRRC personnel or their equipment.

3.1.7.3 The relief valve shall relieve at a pressure no greater than 190 percent (%) of the designed working pressure and reseat at 120 percent (±10%) of the designed working pressure.

3.1.7.4 Relief valves shall be capable of being rendered inoperable by design or poppet retainer.

3.1.7.5 All metal parts which can cause damage to the E-CRRC fabric shall be protected.

3.1.8 Grab Lines.

3.1.8.1 A minimum of one grab line on the E-CRRC interior perimeter shall be included.

3.1.8.2 Interior grab line must be reachable by a Marine seated in the E-CRRC.

3.1.8.3 A minimum of one grab line on the E-CRRC exterior perimeter shall be included.

3.1.8.4 Exterior grab line must be reachable by a Marine in the water.

3.1.8.5 Grab lines shall be a minimum ½ inch diameter, double braided black nylon rope.

3.1.9 Tie-Down Points.

3.1.9.1 The E-CRRC shall have a minimum of fifteen equipment tie-down points on the interior of the E-CRRC.

3.1.9.2 Individual equipment tie-down points shall have a minimum pull strength of 500 lbs.

3.1.9.3 Tie-down points shall accommodate a ¾ inch line.

3.1.10 Towing Points.

3.1.10.1 The E-CRRC shall be equipped with a towing bridle.

3.1.10.2 The E-CRRC shall be equipped with attachment points at the bow allowing the E-CRRC to be towed.

3.1.10.3 The E-CRRC shall be equipped with attachment points at the stern allowing the E-CRRC to tow

3.1.11 Rubbing Strips.

Rubbing strips shall be installed on areas subject to abrasion. These areas shall include at a minimum, the keel and perimeter of the main buoyancy tubes.

3.1.12 Multifunctional Lifting Points.

3.1.12.1 The E-CRRC shall have lift points capable of supporting the weight of the E-CRRC, motor(s), fuel and 800 pounds of gear on a level plane without damage.

3.1.12.2 Lifting points shall be accessible at all times and shall not interfere with the loading/distribution of equipment on the deck.

3.1.13 Carry Handles.

3.1.13.1 The E-CRRC exterior shall have a minimum of eight carry handles (4 on each side) located on the outboard sides of the E-CRRC main buoyancy tubes.

3.1.13.2 Carry handles shall be capable of use with a 7 mm neoprene dive gloved hand.

3.1.13.3 Carry handles shall be located on the same plane of the E-CRRC exterior so that the carry height is the same for all operators.

3.2 Supply System Responsibility Items (SSRI)

3.2.1 Manual Inflation Pumps.

3.2.1.1 Two, foot-operated pumps capable of inflation and deflation of all chambers shall be provided with each E-CRRC.

3.2.1.2 A hose assembly adaptable to the pump on one end and a locking fitting compatible with the E-CRRC inflation valve on the other end shall be provided with each pump.

3.2.2 Hoisting Sling.

3.2.2.1 A hoisting sling manufactured from non-metallic rope or flat webbing shall be provided with the E-CRRC, as required.

3.2.2.2 One end of the legs of the sling shall be attached to a common link by means of eye splices.

3.2.2.3 The E-CRRC end of the legs shall be equipped with safety snap hook end fittings on each leg.

3.2.2.4 The legs of the sling shall be of a length to allow hoisting of the E-CRRC in a level plane when configured with the NBOE on the transom, fuel in the bow and 800 pounds of gear evenly distributed.

3.2.2.5 The hoisting sling shall be designed with a safety factor of six on the hoisting weight of the craft. The hoisting weight is defined as the craft, NBOE, fuel, and 800 pounds of evenly distributed gear.

3.2.2.6 The legs of the hoisting sling shall be statically tested to twice the rated working load in each leg of the sling.

3.2.3 Paddles.

Eight (8) paddles shall be provided with each E-CRRC.

3.2.4 Paddle stowage.

3.2.4.1 The craft shall be provided with a paddle bag(s) capable of accommodating the eight (8) supplied paddles.

3.2.4.2 The paddle bag(s) shall have a method of attaching to the E-CRRC.

3.2.5 Fuel Bladders.

3.2.5.1 The E-CRRC shall be equipped with collapsible fuel bladder(s), the number and capacity of which shall be determined by the OEM in order to meet the range requirement in 3.3.2. All supplied fuel bladders shall be the same capacity, with individual capacity not to exceed not exceed 18 gallons.

3.2.5.2 The fuel bladders shall be secured in the bow of the E-CRRC and designed to maximize deck space.

3.2.5.3 The fuel bladders shall be resistant to gasoline, JP-5, and JP-8.

3.2.5.4 The fuel bladders shall be securable with quick release disconnects and removable within one (1) minute fully loaded.

3.2.5.5 The fuel bladder shall have a connector which mates with the supplied fuel line.

3.2.5.6 The fuel bladders shall have a carry handle(s), rated to the weight of the fuel bladder while fully loaded, for transport on land.

3.2.6 Fuel line.

3.2.6.1 The E-CRRC shall be equipped with a fuel line sized to reach from the fuel bladder(s) in the bow to the NBOE attached on the transom, routed around the perimeter of the E-CRRC.

3.2.6.2 Each fuel line shall have corrosion-resistant, quick-disconnect fittings on each end.

3.2.6.3 The fuel line and fittings shall be compatible with gasoline, JP-5, and JP-8.

3.2.6.4 An automatic check valve shall be provided in the quick-disconnect fittings to close the fuel line when the line is disconnected.

3.2.6.5 The fuel line shall have a manual mechanism (squeeze bulb) for priming the fuel line, which can be operated with one hand.

3.2.6.6 This priming mechanism shall be located within 3 to 4 feet of the engine end of the fuel line.

3.2.7 Spare Valve Kit.

A spare valve kit containing one (1) pressure relief valve, one (1) lock open inflation/deflation valve, two (2) blanking plugs, and two (2) relief valve poppet retainers shall be provided.

3.2.8 Craft Tool Kit.

A craft tool kit, containerized in a non-metallic buoyant hard case, containing all tools required to assemble, disassemble, and operate the craft shall be provided.

3.2.9 Onboard Repair Kit.

3.2.9.1 An onboard repair kit, containerized in a non-metallic buoyant hard case, shall include all necessary repair material, adhesive, patches, emergency repair clamps, tools, and instructions necessary to make a minimum of five repairs to the E-CRRC. Patches shall be of sufficient size to repair a 2” sized puncture or laceration.

3.2.9.2 The repair kit shall include at least two field-expedient types of patches in the event the craft is damaged while on a mission or on the water.

3.2.10 Tow Bridle.

A double braided black polyester rope towing bridle with 15-foot legs shall be provided for the E-CRRC, as required.

3.2.11 Valve Wrench.

If required for the maintenance of the E-CRRC valves, a valve wrench shall be provided with each craft.

3.2.12 Pressure Gauge.

3.2.12.1 A minimum of one pressure gauge shall be provided with each craft.

3.2.12.2 Pressure gauge shall be compatible with all manual inflation system valves on the E-CRRC.

3.2.12.3 Pressure gauge shall cover the range of working pressures found on the E-CRRC.

Table 1. Supply System Responsibility Items kit.

	Supply System Responsibility Item	**QTY**
a.	Manual foot inflation pump with hose and inflation valve adapter end fitting	2
b.	Hoisting Sling	As required
c.	Paddles	8
d.	Paddle Bag (s)	As Required
e.	Spare valve kit containing, one (1) pressure relief valve, one (1) lock open inflation/deflation valve, two (2) blanking plugs, and two (2) relief valve poppet retainers	1
f.	Craft tool kit (consisting of all tools required to operate the craft)	1
g.	Onboard repair kit	1
h.	Tow Bridle	As required
i.	Valve wrench (if required)	1
j.	Pressure Gauge	1
k.	Fuel Bladder(s)	TBD on OEM determined range requirements
l.	Fuel Line	1

3.3 Performance.

3.3.1 Payload. KPP 2.

When powered by the Marine Corps Non-Gasoline Burning Outboard Engine (NBOE), the combat-loaded E-CRRC shall be capable of carrying eight combat-loaded Marines and equipment having a total weight of 2400 pounds (T), 2800 (O).
The payload is personnel and gear only, and does not include craft, NBOE, fuel and supply system responsibility items (SSRI).

Table 2. Payload Weight Definitions.

Item	Weight Definition
Combat-Loaded Marine	Individual Marine and equipment totaling 300 lbs
Combat-Loaded E-CRRC	Craft, eight combat loaded Marines (2400 lbs), NBOE (270 lbs),fuel for defined range, SSRI
Fuel	Determined by manufacturer as defined in 3.3.2 Range

3.3.2 Range. KPP 2.

The combat-loaded E-CRRC, when powered by the NBOE in Sea State 2, shall be capable of a 50 NM insert (T), 100 NM (O), five hours loiter at idle, and 50 NM extract (T), 100 NM (O) with a 10% fuel reserve while running on gasoline, JP-5 or JP-8. (Total range 100 NM insert/extract (T) 200 NM insert/extract (O) w 5 hour loiter at idle + 10% reserve)
Fuel is independent of the defined payload and shall be determined by the manufacturer in order to meet the range requirement.

3.3.3 Speed. KSA 13.

A combat-loaded E-CRRC shall provide a minimum top speed of 18 kts (T), 24 kts (O) in Sea State 2, when powered by the NBOE.

3.3.4 Shock. KPP 6.

The combat-loaded E-CRRC shall have at least a 1/3 reduction (T), ½ reduction (O), in vertical accelerations, when compared to the current combat-loaded USMC CRRC with hard deck plates, in any sea state and direction at maximum speed. The accelerations shall be measured in units of "g" (acceleration due to gravity), determined as the average of the 1/10 highest peak vertical accelerations. Accelerations shall be measured just aft of the fuel bladders, which is the most forward position personnel would be located as to record the most severe vertical accelerations that personnel on board would experience.

3.4 Self-Recovery. KSA 6.

3.4.1 Towing.

A combat-loaded E-CRRC shall be able to tow another combat-loaded E-CRRC in sea state 2 at 4 knots (T), 8 knots (O).

3.4.2 Towed.

A combat-loaded E-CRRC shall be capable of being towed by another combat-loaded E-CRRC in sea state 2 at 4 knots (T), 8 knots (O).

3.5 System Survivability.

3.5.1 Surf Passage. KPP 5.

A combat-loaded E-CRRC shall be capable of transit through plunging surf with a six-foot wave height (T), ten-foot wave height (O).

3.5.2 Self-bailing.

The combat-loaded E-CRRC shall have the ability to self-bail in the event of being fully flooded by a wave during surf passage in less than two minutes (Threshold), 60 seconds (O).

3.5.3 Puncture. KPP 5.

3.5.3.1 Interconnection valves shall be installed between each chamber of the E-CRRC and be capable of being closed to isolate the chamber in the event of damage or failure of an adjacent chamber (T=O).

3.5.3.2 With one chamber deflated, the combat-loaded E-CRRC shall remain capable of non-planing operation at the maximum payload (T=O).

3.5.3.3 With two chambers deflated, the combat-loaded E-CRRC shall remain capable of maintaining level floatation at the maximum payload (T=O).

3.6 Operation.

3.6.1 Broaching. KSA 4.

The combat-loaded E-CRRC shall be capable of being broached by four Marines (T), three Marines (O).

3.6.2 Operation. KSA 5.

The combat-loaded E-CRRC shall be operable by personnel wearing Mission Essential Protective Posture (MOPP) Level IV equipment (T=O).

3.7 Launch and Recovery. KPP 1.

3.7.1 L-class Amphibious Shipping.

The combat-loaded E-CRRC shall be capable of launch and recovery from L-class amphibious shipping equipped with well decks without mechanical aid (T=O).

3.7.2 Landing Craft Utility.

The combat-loaded E-CRRC shall be capable of launch and recovery from the bow ramp of a Landing Craft Utility (LCU) without mechanical aid (T=O).

3.7.3 Landing Craft Air Cushion.

The combat-loaded E-CRRC shall be capable of launch and recovery from a Landing Craft Air Cushion (LCAC) without mechanical aid (T=O).

3.7.4 CH-53.

The combat-loaded E-CRRC shall be helocast deployable from the CH-53 without mechanical aide. Partial deflation of the E-CRRC is acceptable (T). Helocast configuration shall be defined as craft, NBOE, fuel and eight rucksacks with a combined weight of 800 lbs.

3.7.5 CH-47.

The combat-loaded E-CRRC shall be helocast deployable from the CH-47 without mechanical aide. Partial deflation of the E-CRRC is acceptable (T). Helocast configuration shall be defined as craft, NBOE, fuel and eight rucksacks with a combined weight of 800 lbs.

3.7.6 H-60.

The combat loaded E-CRRC shall be helocast deployable by under-fuselage sling (K-Duck) from the H-60 helicopter (T). Partial deflation of the E-CRRC is acceptable. Removal of the NBOE from the transom and packaged inside of the E-CRRC is acceptable.

3.7.7 U.S. Troop Transport Tilt/Rotor Wing Aircraft.

The E-CRRC should be helocast deployable from all U.S. troop transport tilt/rotor wing aircraft without mechanical aide. Partial deflation of the E-CRRC is acceptable (O).

3.8 Submarine Deployment. APA 3.

The E-CRRC should be capable of deployment and recovery aboard current US Navy submarines (O). The E-CRRC may be disassembled into individual sub-systems in order to facilitate deployment and recovery.

3.9 Parachute Insertion. APA 4.

The combat-loaded E-CRRC should be capable of parachute insertion onto a water surface via rotary and fixed-wing aircraft, without compromising its structural integrity or mission performance (O).

3.10 Signature. KSA 9.

3.10.1 Color.

The color of the craft shall be non-reflective when wet to reduce visual detection in the operational environment.

3.10.2 Metallic Components.

All exposed metallic components shall be non-reflective to reduce visual detection.

3.10.3 Spray Reduction.

The craft shall incorporate methods to mitigate visual signature through the reduction of water spray.

3.11 Inflation/Configuration Time.

3.11.1 Manual Inflation.

The E-CRRC shall be capable of being manually inflated, using up to two pumps, to the designed working pressure within 15 minutes.

3.11.2 SCUBA Inflation.

The E-CRRC shall be capable of being inflated using two 100 ft3 SCUBA cylinders at 3000 psi within 5 minutes.

3.12 Storage.

3.12.1 Storage Bag.

A bag shall be provided when the craft is rolled for storage.

3.12.2 Stored Dimensions.

The stored dimensions of the E-CRRC shall not exceed Length 90” X Width 48” X Height 24” (T), Length 78” X Width 36” X Height 12” (O).

3.12.3 Storage Temperature.

The E-CRRC shall not be damaged in storage throughout an air temperature range of -33°C (-28°F) to + 71°C (160°F). The craft fabric shall not crack or distort in any way when stored in these conditions for a period of two years.

3.13 Sustainment.

3.13.1 Materiel Availability. KPP3.

Materiel availability of the E-CRRC and engine as a system shall be 78% (T), 90% (O). The threshold material availability of the E-CRRC or engine as an individual sub-system shall be at least 92%.

3.13.2 Operational Availability. KPP4.

The operational availability of the E-CRRC and engine as a system shall be at least 80% (T), 90% (O). The threshold operational availability of the E-CRRC or engine as an individual sub-system shall be at least 94%.

3.14 Reliability. KSA 11.

The Mean Time Between Operational Mission Failure (MTBOMF) of the E-CRRC and engine as a system shall be at least 170 hours (T), 350 hours (O). The threshold MTBOMF of the E-CRRC or engine as an individual sub-system shall be 340 hours. E-CRRC configuration items that could deadline the craft include inflation chamber punctures, fuel bladder and fuel line leaks and transom failure.

3.15 Maintainability. KSA 12.

3.15.1 Field Repair.

The E-CRRC shall be field repairable by a single Marine in the event of a puncture or leak, 2” in size or less, in less than 15 minutes (T), ten minutes (O) with a provided onboard repair kit, defined in 3.2.9.

3.15.2 Mean Time to Repair (MTTR).

The mean time to repair the E-CRRC or engine shall be no more than 2.5 hours (T), one hour (O) at the operational level by a USMC Military Occupational Specialty 1342, Small Craft Mechanic.

3.16 Interchangeability. KSA 7.

All E-CRRC components that are replaceable at the organizational level shall be interchangeable (identical replacement requiring zero adjustments).

3.17 Transportability. KSA 8.

The E-CRRC, including the floor, shall be inflatable, and collapsible, and small enough to embark four aboard a single MV-22 (T), small enough to embark aboard current US Navy submarines (O).

3.18 Operating and Support Cost. APA 5.

The operations and maintenance cost/Annual Per Unit Cost for the E-CRRC shall be no more than $6000 per system per year (T), $4000 (O).

3.19 Service life.

3.19.1 Operational Service Life.

The operational service life shall be a minimum of five years (T), seven years (O).

3.19.2 Storage Life.

The storage life shall be a minimum of two years in climate-controlled storage.

3.20 Identification.

3.20.1 Nameplate.

The E-CRRC shall have a metal nameplate, attached to the starboard side of the transom. The nameplate shall contain the following information:

Enhanced Combat Rubber Raiding Craft (E-CRRC)
NSN_____Built for the United States Marine Corps
by (Contractor, city, state, Cage code)
Date of Mfg., month, year
Contract No. _
Serial No. _
Operating Inflation Pressure: (TBD) mbar ((TBD) psi)
Bare Weight:
Maximum Horsepower: _
Maximum Capacity:
Item Unique Identification (IUID)

3.20.2 Serial numbers.

The Contractor shall assign a unique serial number to each E-CRRC. The E-CRRC shall have a unique, systematic serial number regardless of contracts or purchase orders.

3.21 Training and Manuals.

3.21.1 Training and maintenance instructions.

The Contractor shall provide training material and maintenance instructions in English.

3.21.2 Service manual.

The contractor of the E-CRRC will prepare a commercial manual, including instruction for opening, inspecting, testing, repairing, and repacking the E-CRRC, in accordance with MCO P5215.17C.

3.22 Requirements Matrix and Verification Cross Reference Table

Requirement Number	Requirement Title	Verification Number	Method			
			I	A	D	T
3.1	**Design**	**4.3**				
3.1.1	Materials	4.3.1				
3.1.1.1	Berry Amendment	4.3.1.1		X		
3.1.1.2	Fabric	4.3.1.2		X		
3.1.1.3	Resiliency (OSA 1)	4.3.1.3		X		
3.1.1.4	Environmental	4.3.1.4			X	
	Oil	4.3.1.4.1			X	
		4.3.1.4.1.a-g				X
	Fungus	4.3.1.4.2			X	
	Sunlight	4.3.1.4.3			X	
3.1.2	Weight	4.3.2				
3.1.2.1	Weight (KSA 2)	4.3.2.1			X	
3.1.2.2	Empty Weight	4.3.2.2			X	
3.1.3	Deck	4.3.3				
3.1.3.1	Inflatability	4.3.3.1	X			
3.1.3.2	Removability	4.3.3.2			X	
3.1.3.3	Collapsibility	4.3.3.3			X	
3.1.3.4	Construction	4.3.3.4			X	
3.1.3.5	Extension	4.3.3.5	X			
3.1.3.6	Securing Points	4.3.3.6	X			
3.1.3.7	Pull Strength	4.3.3.7		X		
3.1.3.8	Isolation	4.3.3.8			X	
3.1.3.9	Minimum Speed	4.3.3.9			X	
3.1.4	Transom	4.3.4				
3.1.4.1	Size	4.3.4.1			X	
3.1.4.2	Faceplate	4.3.4.2	X			
3.1.4.3	Engine Security	4.3.4.3			X	
3.1.4.4	Transom Angle	4.3.4.4			X	
3.1.5	Inflation (APA 1)	4.3.5				
3.1.5.1	Foot Pumps	4.3.5.1			X	
3.1.5.2	SCUBA Tanks	4.3.5.2			X	
3.1.5.2.1	Inflation Hose Assembly	4.3.5.2.1			X	
3.1.5.2.2	SCUBA Tank Connection	4.3.5.2.2			X	
3.1.5.2.3	SCUBA Tank Inflation	4.3.5.2.3			X	
3.1.5.3	Inflation Chambers	4.3.5.3			X	
3.1.6	Inflation/Deflation Valves	4.3.6				
3.1.6.1	Inflatable Chambers	4.3.6.1	X			
3.1.6.2	Valve Protective Cover	4.3.6.2	X			
3.1.6.3	Valve Lock Position	4.3.6.3			X	
3.1.6.4	Dump Valves	4.3.6.4			X	
3.1.6.5	Cache Dump Valve	4.3.6.5			X	
3.1.7	Relief Valves	4.3.7				
3.1.7.1	Overpressure Protection	4.3.7.1	X			
3.1.7.2	Relief Valve Location	4.3.7.2	X			
3.1.7.3	Relief Valve Working Pressure	4.3.7.3			X	
3.1.7.4	Relief Valve Operability	4.3.7.4			X	
3.1.7.5	Craft Fabric Protection	4.3.7.5	X			
3.1.8	Grab Lines	4.3.8				
3.1.8.1	Interior Minimum	4.3.8.1	X			
3.1.8.2	Interior Reach	4.3.8.2			X	
3.1.8.3	Exterior Minimum	4.3.8.3	X			
3.1.8.4	Exterior Reach	4.3.8.4			X	
3.1.8.5	Diameter and Material	4.3.8.5	X			
3.1.9	Tie-Down Points	4.3.9				

Requirement Number	Requirement Title	Verification Number	Method			
			I	A	D	T
3.1.9.1	Minimum Tie-down Points	4.3.9.1	X			
3.1.9.2	Pull Strength	4.3.9.2		X		
3.1.9.3	Line Diameter	4.3.9.3			X	
3.1.10	Towing Points	4.3.10				
3.1.10.1	Bridle	4.3.10.1	X			
3.1.10.2	Bow Attachment Points	4.3.10.2			X	
3.1.10.3	Stern Attachment Points	4.3.10.3			X	
3.1.11	Rubbing Strips	4.3.11	X			
3.1.12	Multifunctional Lifting Points	4.3.12				
3.1.12.1	Weight Capability	4.3.12.1			X	
3.1.12.2	Accessibility	4.3.12.2	X			
3.1.13	Carry Handles	4.3.13				
3.1.13.1	Exterior Minimum	4.3.13.1	X			
3.1.13.2	Gloved Hand Capability	4.3.13.2			X	
3.1.13.3	Exterior Plane Location	4.3.13.3			X	
3.2	**Supply System Responsibility Items (SSRI)**	**4.4**				
3.2.1	Manual Inflation Pumps	4.4.1				
3.2.1.1	Provision Number	4.4.1.1			X	
3.2.1.2	Hose Assembly	4.4.1.2			X	
3.2.2	Hoisting Sling	4.4.2				
3.2.2.1	Sling Construction	4.4.2.1	X			
3.2.2.2	Sling Leg Attachment	4.4.2.2	X			
3.2.2.3	Safety Fittings	4.4.2.3			X	
3.2.2.4	Sling Leg Length	4.4.2.4			X	
3.2.2.5	Hoisting Safety Factor	4.4.2.5		X		
3.2.2.6	Sling Static Test	4.4.2.6		X		
3.2.3	Paddles	4.4.3	X			
3.2.4	Paddle Stowage	4.4.4				
3.2.4.1	Paddle Bag Accommodation	4.4.4.1	X			
3.2.4.2	Paddle Bag Attachment	4.4.4.2			X	
3.2.5	Fuel Bladders	4.4.5				
3.2.5.1	Capacity	4.4.5.1	X			
3.2.5.2	Location	4.4.5.2			X	
3.2.5.3	Fuel Resistance	4.4.5.3		X		
3.2.5.4	Securability/Removability	4.4.5.4			X	
3.2.5.5	Connector	4.4.5.5			X	
3.2.5.6	Carry Handles	4.4.5.6			X	
3.2.6	Fuel Line	4.4.6				
3.2.6.1	Size	4.4.6.1			X	
3.2.6.2	Connections	4.4.6.2			X	
3.2.6.3	Fuel Compatibility	4.4.6.3			X	
3.2.6.4	Check Valve	4.4.6.4	X		X	
3.2.6.5	Priming Mechanism	4.4.6.5	X		X	
3.2.6.6	Priming Mechanism Location	4.4.6.6	X			
3.2.7	Spare Valve Kit	4.4.7	X			
3.2.8	Craft Tool Kit	4.4.8	X			
3.2.9	Onboard Repair Kit	4.4.9				
3.2.9.1	Contents	4.4.9.1	X			
3.2.9.2	Patches	4.4.9.2	X			
3.2.10	Tow Bridle	4.4.10	X			
3.2.11	Valve Wrench	4.4.11	X			
3.2.12	Pressure Gauge	4.4.12				
3.2.12.1	Minimum Number	4.4.12.1	X			
3.2.12.2	Gauge Compatibility	4.4.12.2			X	
3.2.12.3	Pressure Range	4.4.12.3			X	
3.3	**Performance**	**4.5**				

Requirement Number	Requirement Title	Verification Number	Method			
			I	A	D	T
3.3.1	Payload (KPP 2)	4.5.1				X
3.3.2	Range (KPP 2)	4.5.2			X	
3.3.3	Speed (KSA 13)	4.5.3				X
3.3.4	Shock (KPP 6)	4.5.4				X
3.4	**Self-Recovery (KSA 6)**	**4.6**				
3.4.1	Towing	4.6.1			X	
3.4.2	Towability	4.6.1			X	
3.5	**System Survivability**	**4.7**				
3.5.1	Surf Passage (KPP 6)	4.7.1			X	
3.5.2	Self-bailing	4.7.2			X	
3.5.3	Puncture (KPP 5)	4.7.3			X	
3.5.3.2	Interconnection Valves	4.7.3.1				X
3.5.3.3	Non-Planing Operation	4.7.3.2				X
3.5.3.4	Level Flotation	4.7.3.3				X
3.6	**Operation**	**4.8**				
3.6.1	Broaching (KSA 4)	4.8.1			X	
3.6.2	Operation (KSA 5)	4.8.2			X	
3.7	**Launch and Recovery (L&R) (KPP 1)**	**4.9**				
3.7.1	L-class Amphibious L&R	4.9.1			X	
3.7.2	LCU L&R	4.9.2			X	
3.7.3	LCAC L&R	4.9.3			X	
3.7.4	CH-53 L&R	4.9.4			X	
3.7.5	CH-47 L&R	4.9.5			X	
3.7.6	H-60 L&R	4.9.6			X	
3.7.7	Aircraft L&R	4.9.7			X	
3.8	**Submarine Deployment (APA 3)**	**4.10**			X	
3.9	**Parachute Insertion (APA 4)**	**4.11**			X	
3.10	**Signature (KSA 9)**	**4.12**				
3.10.1	Color	4.12.1	X			
3.10.2	Metallic Components	4.12.2	X			
3.10.3	Visual Signature	4.12.3	X			
3.11	**Inflation/Configuration Time**	**4.13**				
3.11.1	Manual Inflation	4.13.1			X	
3.11.2	SCUBA Cylinder Inflation	4.13.2			X	
3.12	**Storage**	**4.14**				
3.12.1	Storage Bag	4.14.1	X			
3.12.2	Stored Dimensions	4.14.2			X	
3.12.3	Storage Temperature	4.14.3		X		
3.13	**Sustainment**	**4.15**				
3.13.1	Materiel Availability (KPP 3)	4.15.1		X		
3.13.2	Operational Availability (KPP 4)	4.15.2		X		
3.14	**Reliability (KSA 11)**	**4.16**		X		
3.15	**Maintainability (KSA 12)**	**4.17**				
3.15.1	Field Repair	4.17.1			X	
3.15.2	Mean Time to Repair	4.17.2		X		
3.16	**Interchangeability (KSA 7)**	**4.18**		X		
3.17	**Transportability (KSA 8)**	**4.19**		X	X	
3.18	**Operating and Support Cost (APA 5)**	**4.20**		X		
3.19	**Service Life**	**4.21**				
3.19.1	Operational	4.21.1		X		
3.19.2	Storage	4.21.2		X		
3.20	**Identification**	**4.22**				
3.20.1	Nameplate	4.22.1	X			
3.20.2	Serial Numbers	4.22.2	X			
3.21	**Training and Manuals**	**4.23**				
3.21.1	Training and Maintenance Instructions	4.23.1	X			

Requirement Number	Requirement Title	Verification Number	Method			
			I	A	D	T
3.21.2	Service Manual	4.23.2	X			

4 Verification.

4.1 General.

The contractor shall provide documentation, procedures, and test results that certify the requirements of Section 3 have been met with responsible party signatures and in accordance with section 4 verification methods. If unique inspection equipment is required, the contractor shall submit designs of all inspection and test equipment used to perform inspections and tests for Government concurrence of methodology. The Government reserves the right to witness or separately perform any or all tests.

4.1.1 Analysis.

Analysis is an element of verification that uses established technical or mathematical models or simulations, algorithms, charts, graphs, circuit diagrams, or other scientific principles and procedures in combination with human analytical thought processes to structure and interpret test data to predict the design compliance and provide evidence that stated requirements in Sections are met.

4.1.2 Demonstration.

An element of verification which generally denotes the actual operation, adjustment, or re-configuration of items to provide evidence that the designed functions were accomplished under specific scenarios. The items may be instrumented and quantitative limits of performance monitored.

4.1.3 Inspection.

An element of verification and inspection consisting of investigation, without the use of special laboratory appliances or procedures, of items to determine conformance to specific requirements. Inspection is generally non-destructive and typically includes the use of sight, hearing, smell, and touch; simple physical manipulation; mechanical and electrical gauging and measurement; and other forms of investigation.

4.1.4 Test.

An element of verification and inspection that generally denotes the determination, by technical means, of the properties or elements of items, including functional operation, and involves the application of established scientific principles and procedures. Test of one or more of the following test types are applicable:

Acceptance Test.

Acceptance tests are conducted prior to delivery to verify that the system conforms to the requirements contained in the appropriate engineering drawings and specifications. Acceptance tests are performed on every delivered unit and/or subsystem.

Conformance Test.

Conformance tests are contractor-conducted events, which demonstrate compliance with requirements herein. These tests are performed on production representative hardware.

4.2 Pre-Production Qualification Testing.

Submission of Certificate of Conformance (COC). COCs shall contain the following information.

Name of company providing the COC and the date of submittal.
Contract number and DFP paragraph number that the COC applies to.
A brief description of the item for which the COC is being provided.
The test standard used to certify the requirement.
The signature and title of the certifying official.

4.3 Design.

4.3.1 Materials.

4.3.1.1 Berry Amendment.

Through a certificate of conformance, the manufacturer shall provide verification that the materials used in construction of the E-CRRC are in compliance with the Berry Amendment (10 U.S.C § 2533a).

4.3.1.2 Fabric.

Through a certificate of conformance, the manufacturer shall provide verification that the E-CRRC base fabric is constructed of polyester, nylon or Kevlar with a coating of polyurethane, neoprene, or chlorosulfonated-polyethylene (CSM) rubber and that PVC coated fabrics were not used in construction.

4.3.1.3 Resiliency. OSA 1.

Through a certificate of conformance, the manufacturer shall provide verification that the E-CRRC was tested in accordance with Method 5120 of FED-STD-191 for puncture resistance. Method 5120 of FED-STD-191 applies except that the ring clamp mechanism shall have an internal diameter of 76 millimeters, and the ball shall be replaced by a piercing instrument shaped like a flared, flat-tip screwdriver, having a width of 7.93 ±.250 millimeters, and a thickness of 0.79 ±.10 millimeters, at the extreme tip. The piercing tip edges shall be rounded to a 0.25-millimeter radius. The piercing instrument shall be oriented to intercept the warp and fill threads at an angle of approximately 45°. The average of three test specimens shall be reported. Non-conformance to 3.1.1.3 shall constitute failure of this test.

4.3.1.4 Environmental.

Through a certificate of conformance, the manufacturer shall provide verification that the E-CRRC material is not adversely affected by oil, fungal attack or exposure to sunlight such as may be encountered and applied during its life cycle as follows:

4.3.1.4.1 Oil.

Through a certificate of conformance, the manufacturer shall provide results of the fabric to oil resistance. Failure to meet the oil resistance standard shall constitute non-conformance. The specimen shall be tested as follows:
a. Disk specimen for testing shall be at least 70 millimeters in diameter. A typical apparatus required is shown in Figure 1. It consists of a base-plate (A) and an open-ended cylindrical chamber (B) which is held tightly against the test specimen (C) by wing nut (D), the wing nuts are mounted on bolts (E). A hole of diameter approximately 30 millimeters shall be made in the

base plate for the examination of the surface not in contact with the liquid. During the test, a close-fitting plug (P) closes the opening in the top of the chamber.
b. Test specimens in the "As Received" condition shall be conditioned for not less than three hours at 20 ±2°C immediately before testing.
c. The test specimens shall be placed in the apparatus as indicated in figure 5. The chamber of the apparatus is then filled with the test liquid to a depth of approximately
20 millimeters and the plug (P) inserted. The required temperature and the duration shall be 20 ±2°C for 22 hours.
d. At the end of the contact period the test liquid is removed and the test specimen released. Any surplus liquid is removed from the surface of the test specimen by blotting with filter paper or a textile fabric which does not deposit lint.
e. The test specimen shall be folded over so that the surfaces are pressed together to see if there are any signs of residual tackiness.
f. With the test specimen opened out, a single pass of the finger over the exposed surface shall not produce smearing.
g. The liquid to be used as a standard test oil shall be ASTM #1 Oil.

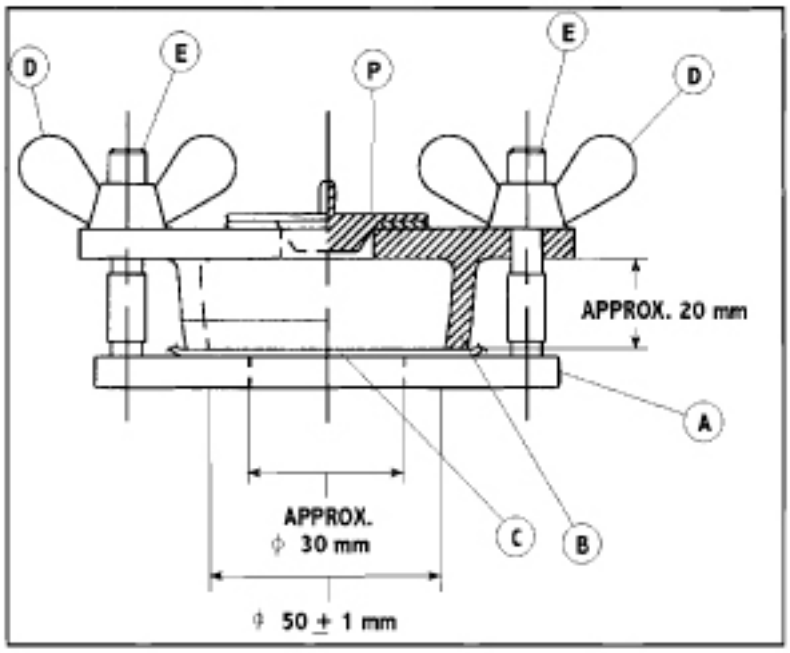

Figure 1. Apparatus for test with liquid on one surface only.

4.3.1.4.2 Fungus.

Through a certificate of conformance, the manufacturer shall provide results showing the coated fabric is not adversely affected by fungal attack. The fabric shall be tested in accordance with MIL-STD-810, Method 508.6, except test specimen shall not be sterilized before being subjected to the fungus. The coated fabric shall maintain a minimum of 50 percent of original breaking strength. Failure to meet MIL-STD-810, Method 508.6 for resistance to fungal attack shall constitute non-compliance.

4.3.1.4.3 Sunlight.

Through a certificate of conformance, the manufacturer shall provide results showing the coated fabric is not adversely affected by long term exposure of sunlight. The fabric shall be tested in

accordance with MIL-STD-810, Method 505.7, Procedure II. Failure to meet MIL-STD-810, Method 505.7, Procedure II for resistance to the effects of long term exposure to sunlight shall constitute non-compliance.

4.3.2 Weight. KSA 2.

4.3.2.1 Demonstrate that a fully inflated E-CRRC without equipment, engine, or fuel is man-portable by six Marines (T), four Marines (O). Failure to be man-portable by six Marines in accordance with Mil-Std-1472H, Table XLVII shall constitute non-compliance. In the event of the E-CRRC being non-compliant with the lifting standards defined in Mil-Std-1472H, Table XLVII, the program management office may notify the Ground Combat Element Division, Capabilities Development Directorate, Capabilties Integration Officer in writing that a clear operational need for the design to exceed the anthropometric or lifting requirements for an identified task and duty position exists.

4.3.2.2 Using a scale, weigh the empty E-CRRC. A weight which exceeds 360 pounds shall constitute non-compliance.

4.3.3 Deck.

4.3.3.1 Inspect the E-CRRC deck to verify that it is inflatable. A non-inflatable deck shall constitute non-compliance.

4.3.3.2 Demonstrate that the E-CRRC deck is removable from the E-CRRC without special tools. Failure to remove the deck without special tools shall constitute non-compliance.

4.3.3.3 Deflate the E-CRRC and roll the E-CRRC for storage. Demonstrate that the deck can remain within the E-CRRC during storage and does not require removal. Being unable to roll the E-CRRC for storage with the deck installed shall constitute non-compliance. Removing the deck for rolled storage shall constitute non-compliance.

4.3.3.4 Inspect the deck for the presence of a non-skid coating. Wet the deck, and while wearing USMC combat boots, demonstrate that the deck is not slippery. Verification of how slippery the deck is shall be subjective. Absence of a non-skid coating or determination that the deck is slippery when wet shall constitute non-compliance.

4.3.3.5 Inspect the E-CRRC to verify that the deck extends from the transom to the bow of the E-CRRC. A deck which does not extend from the transom to the bow of the E-CRRC shall constitute non-compliance.

4.3.3.6 Inspect the deck to verify there is a minimum of 12 equipment securing points distributed evenly along the length of the E-CRRC deck. Having fewer than 12 equipment securing points on the deck shall constitute non-compliance.

4.3.3.7 Through a certificate of conformance, the manufacturer shall provide test results verifying that equipment securing points have a minimum pull strength of 250 lbs. Equipment securing points shall be tested for tensile and shear strength. The direction of the pull in the tensile test shall be perpendicular to the equipment securing points. The direction of the pull in the shear test shall be parallel to the equipment securing points. A pull test of less than 250 lbs shall constitute non-conformance.

4.3.3.8 Inspect the deck inflation system for a valve or other method of isolating the deck air chamber from the rest of the E-CRRC. Isolate the deck valve and deflate the deck to

demonstrate that the rest of the E-CRRC does not deflate when the deck is deflated. Not having a means to isolate the E-CRRC deck and deflation of the E-CRRC when the deck is deflated shall constitute non-compliance.

4.3.3.9 Deflate the E-CRRC deck and with a full combat load, demonstrate that the E-CRRC is capable of operating at a minimum of 6 knots. Failure to operate at a minimum of 6 knots with a deflated deck shall constitute non-compliance.

4.3.4 Transom.

4.3.4.1 Inspect the E-CRRC to verify that the attached U.S. Coast Guard capacity plate rates the E-CRRC for a minimum 55 horsepower outboard engine. Demonstrate that the NBOE can be mounted onto the transom and mounting clamps tightened. Demonstrate that the engine can be turned fully left and right without interference. Demonstrate that the engine can be adjusted through each trim position without interference. Having a horsepower capacity rating of less than 55 horsepower, being unable to attach and tighten the NBOE to the transom, or interference in turning or trim positions shall constitute non-compliance.

4.3.4.2 Inspect the transom for a hardened corrosion-resistant faceplate and lip. The absence of a hardened corrosion-resistant faceplate shall constitute non-compliance.

4.3.4.3 Inspect the transom to verify that bolts or pins are included for holes for bolting or pinning the NBOE to the E-CRRC transom. Using the included bolts or pins, demonstrate that the NBOE can be bolted or pinned to the E-CRRC transom. Bolts or pins not being included or not being able to secure the NBOE to the transom using the bolts or pins shall constitute non-compliance.

4.3.4.4 Measure the angle of the transom relative to the keel of the E-CRRC. A transom angle that is not between -16° and -12° shall constitute non-compliance.

4.3.5 Inflation. APA 1.

4.3.5.1 Using the included foot pumps, demonstrate that the E-CRRC can be inflated to the required working pressures. Failure to inflate the E-CRRC to the working pressures shall constitute non-compliance.

4.3.5.2 The E-CRRC shall be inflatable via standard SCUBA tanks.

4.3.5.2.1 Inspect the E-CRRC for inflation hose(s) on the inboard side of the E-CRRC. Inspect the inflation hoses for the presence of quick disconnect fittings. With the E-CRRC inflated, demonstrate that the E-CRRC does not lose air when the automatic inflation system is disconnected. The absence of inflation hoses in the specified locations, quick disconnect fittings, or loss of air when disconnected shall constitute non-compliance.

4.3.5.2.2 Inspect the E-CRRC for yoke-style connection valves for connection to a SCUBA tank. Demonstrate that the yoke style connection valves can be attached to a SCUBA tank. The absence of yoke connection valves or the inability to connect to a SCUBA tank shall constitute non-compliance.

4.3.5.2.3 With the E-CRRC completely deflated, demonstrate that the E-CRRC can be fully inflated to working pressure using no more than two 100 ft^3 SCUBA bottles at 3000

psi. Failure to fully inflate the E-CRRC to working pressure with no more than two 100 ft^3 shall constitute non-compliance.

4.3.5.3 Inspect the E-CRRC for interconnection valves between inflation chambers of equal pressure. While inflating the E-CRRC from a single point, demonstrate that air transfers between each of the inflation chambers. Failure for air to transfer between chambers shall constitute non-compliance.

4.3.6 Inflation/deflation valves.

4.3.6.1 Inspect the E-CRRC for inflation/deflation valves on each inflatable chamber of the E-CRRC. Absence of inflation/deflation valves on each inflatable chamber shall constitute non-compliance.

4.3.6.2 Inspect the inflation/deflation valves for non-corrosive or coated protective metal covers attached by a lanyard or tether. Absence of a protective metal cover for each valve shall constitute non-compliance.

4.3.6.3 Inspect the inflation/deflation valves for markings indicating operation instructions (i.e. inflate/operate). With the E-CRRC fully inflated, open the valves and deflate the E-CRRC. Failure to lock the valves open and deflate the E-CRRC shall constitute non-compliance.

4.3.6.4 Inspect the top, aft main buoyancy tube end cones on the port and starboard side for two deflation/dump valves. With the E-CRRC fully inflated, demonstrate that the E-CRRC can be deflated using the two dump valves. Absence of the two dump valves or failure to deflate the E-CRRC using the dump valves shall constitute non-compliance.

4.3.6.5 Inspect the bow for a dump valve to deflate the E-CRRC. With the E-CRRC fully inflated, demonstrate that the E-CRRC can be deflated using the single bow dump valve. Absence of a bow dump valve or failure to deflate the E-CRRC using the dump valve shall constitute non-compliance.

4.3.7 Relief Valves.

4.3.7.1 Inspect the E-CRRC air chambers for the presence of relief valves. Absence of relief valves in the air chambers shall constitute non-compliance.

4.3.7.2 Inspect the relief valve location and installation. The relief valves should be recessed and in locations that avoid damage or snagging by personnel, equipment, or lines. Relief valves that are not recessed, in locations where personnel may sit or lean, have sharp edges or other design features which may cause damage or snagging shall constitute non-compliance.

4.3.7.3 Using a manual pump, SCUBA tank, or air compressor, and a pressure gauge, inflate the E-CRRC until a pressure relief valve relieves pressure. Note the pressure on the gauge when this occurs. Pressures greater than 190% of the designed working pressure shall constitute non-compliance. Note the pressure when the valve re-seats and is no longer relieving pressure. Pressures outside of 120 % (±10%) of the designed working pressure shall constitute non-compliance. Repeat for all air chambers that have different working pressure requirements.

4.3.7.4 Using a poppet retainer or other method for rendering the relief valves inoperable, and a pressure gauge, inflate the E-CRRC to 200% of working pressure. Any relief of pressure by the inoperable relief valve shall constitute non-compliance.

4.3.7.5 Inspect all metal parts in the E-CRRC for sharp edges or other characteristics which can cause damage to the E-CRRC fabric. Any metal parts which may cause damage to the E-CRRC shall constitute non-compliance.

4.3.8 Grab Lines.

4.3.8.1 Inspect that a minimum of one grab line on the E-CRRC interior perimeter is included with the E-CRRC. The absence of an interior grab line shall constitute non-compliance.

4.3.8.2 Demonstrate that the interior grab line is reachable from any position within the E-CRRC by a Marine seated in the E-CRRC. Failure to be able to reach the interior grab line when seated in any position of the E-CRRC shall constitute non-compliance.

4.3.8.3 Inspect that a minimum of one grab line on the E-CRRC exterior perimeter is included with the E-CRRC. The absence of an exterior grab line shall constitute non-compliance.

4.3.8.4 Demonstrate that the exterior grab line is reachable by a Marine in the water. Failure to be able to reach the exterior grab line by a Marine in the water shall constitute non-compliance.

4.3.8.5 Inspect the interior and exterior grab lines to verify that they are double-braided black nylon rope. Measure the interior and exterior E-CRRC grab line diameters. Any grab lines that are not double braided black nylon rope and having a diameter of at least ½" shall constitute non-compliance.

4.3.9 Tie-Down Points.

4.3.9.1 Inspect the interior of the E-CRRC for a minimum of fifteen equipment tie-down points. Tie-down points are independent of the tie-down points located on the E-CRRC deck. Having less than fifteen equipment tie-down points shall constitute non-compliance.

4.3.9.2 Through a certificate of conformance, the manufacturer shall provide test results verifying that individual equipment tie-down points have a minimum pull strength of 500 lbs. Equipment tie-down points shall be tested for tensile and shear strength. The direction of the pull in the tensile test shall be perpendicular to the tie-down points. The direction of the pull in the shear test shall be parallel to the tie-down points. Each equipment securing line point must be capable of withstanding a minimum pull of 500 lbs. A pull test of less than 500 lbs shall constitute non-conformance.

4.3.9.3 Demonstrate that a ¾" line can be passed through the equipment tie-down points. Failure to pass a ¾" line through the equipment tie-down points shall constitute non-compliance.

4.3.10 Towing Points.

4.3.10.1 Inspect the E-CRRC SSRI kit for inclusion of a towing bridle. Failure of a towing bridle to be included in the SSRI kit shall constitute non-compliance.

4.3.10.2 Inspect the bow of the E-CRRC for tow attachment points. Demonstrate that the supplied towing bridle can be attached to the towing points. Absence of towing points

or failure to attach the supplied towing bridle to the tow attachment points shall constitute non-compliance. Verification of the E-CRRC capable of being towed is in section 4.6.1.

4.3.10.3 Inspect the stern of the E-CRRC for tow attachment points. Demonstrate that the supplied towing bridle can be attached to the towing points. Absence of towing points or failure to attach the supplied towing bridle to the tow attachment points shall constitute non-compliance. Verification of the E-CRRC capable of towing is in section 4.6.1.

4.3.11 Rubbing Strips.

Inspect the E-CRRC for rubbing strips installed on areas subject to abrasion. These areas shall include at a minimum, the keel, and perimeter of the main buoyancy tubes. An absence of rubbing strips in areas subject to abrasion shall constitute non-compliance.

4.3.12 Multifunctional Lifting Points.

4.3.12.1 Configure the E-CRRC with the NBOE, fuel, and 800 pounds of equipment or other weight, such as sandbags. The 800 pounds of equipment shall be evenly distributed inside of the E-CRRC. Attach the supplied hoisting sling to the multifunctional lifting points of the E-CRRC. Using an overhead hoist, crane, or other means of lifting, suspend the E-CRRC in the air to demonstrate that the multifunctional lifting points can support the E-CRRC as configured. Inspect the lifting points for damage. Inspect that the E-CRRC is suspended in a level plane without distortion or excessive sagging of the E-CRRC. Failure to lift the E-CRRC, damage to the multifunctional lifting points, excessive distortion, or sagging of the E-CRRC while suspended shall constitute non-compliance.

4.3.12.2 With the E-CRRC configured for lifting as discussed in 4.3.12.1, inspect that the multifunctional lifting points are accessible at all times and not obstructed by the engine, fuel bladders, equipment, or other items. Obstruction of the multifunctional lifting points shall constitute non-compliance.

4.3.13 Carry Handles.

4.3.13.1 Inspect the outboard sides of the main buoyancy tubes for carry handles. Failure to have a minimum of eight carry handles (4 on each side) located on the outboard sides of the main buoyancy tubes shall constitute non-compliance.

4.3.13.2 While wearing 7 mm neoprene dive gloves, demonstrate that the carry handles can be securely gripped for lifting the E-CRRC. Failure to use the carry handles with a gloved hand shall constitute non-compliance.

4.3.13.3 Inspect that the E-CRRC carry handles are located on the same plane of the E-CRRC exterior. With the E-CRRC empty and using six Marines, lift the E-CRRC and demonstrate that the carry height is the same for all operators. Repeat for all carry handle locations. Alternatively, use a straight edge or taut string between the most

forward and most aft carry handles to verify the carry handles are in the same plane. Failure of all carry handles to be in the same plane shall constitute non-compliance.

4.4 Supply System Responsibility Items (SSRI).

4.4.1 Manual Inflation Pumps.

4.4.1.1 Inspect the E-CRRC SSRI for the presence of two, foot-operated pumps. Using the hose assembly in 4.4.1.1 Demonstrate that the E-CRRC can be inflated and deflated using the foot-operated pumps. The absence of two foot-operated pumps or the inability to inflate and deflate using the pumps shall constitute non-compliance.

4.4.1.2 Inspect the E-CRRC SSRI for a hose assembly adaptable to the manual foot pump on one end and a fitting compatible with the E-CRRC inflation valves which locks to prevent disconnection during inflation. Demonstrate that the hose assembly can be attached to both the manual foot pump and E-CRRC inflation valves. Demonstrate that the E-CRRC end of the hose assembly can be locked to prevent disconnection during inflation. Failure to attach the hose to either the foot pump or E-CRRC inflation valves or being unable to lock E-CRRC side hose fitting shall constitute non-compliance.

4.4.2 Hoisting Sling.

4.4.2.1 Inspect the SSRI kit for the presence of a hoisting sling. Inspect that the hoisting sling is manufactured from non-metallic rope or flat webbing. The absence of a hoisting sling or a hoisting sling made of materials other than non-metallic rope or flat webbing shall constitute non-compliance.

4.4.2.2 Inspect the hoisting sling for the presence of a common link to which each leg of the hoisting sling is attached by means of eye splices. The absence of a common link or means of attaching the hoisting sling legs other than eye splices shall constitute non-compliance.

4.4.2.3 Inspect the E-CRRC end legs of the hoisting sling for the presence of a safety snap hook end fitting on each leg. Demonstrate that the safety snap hook end fittings can be connected to the lifting points of the E-CRRC. The absence of safety snap hook end fittings or the inability to attach the fittings to the E-CRRC lifting points shall constitute non-compliance.

4.4.2.4 With the NBOE attached to the transom and fuel in the bow, and 800 pounds of evenly distributed gear, lift the E-CRRC using the hoisting sling. Using a level, or other suitable measuring device on the deck of the E-CRRC, inspect that the E-CRRC is hoisted in a level plane, +/- 10°. Failure of the E-CRRC to be hoisted in a level plane, +/- 10° shall constitute failure.

4.4.2.5 Through a certificate of conformance, the manufacturer shall certify that the hoisting sling is designed with a safety factor of 6 times the hoisting weight of the E-CRRC. The hoisting weight is defined as the E-CRRC, NBOE, fuel, and 800 pounds of gear. Failure to provide verification that the hoisting was tested and certified at 6 times the hoisting weight of the E-CRRC shall constitute non-compliance.

4.4.2.6 Through a certificate of conformance, the manufacturer shall certify that each leg of the hoisting sling was statically tested to twice the rated working load of the leg. Failure to

provide verification that the legs of the hoisting sling were tested and certified at twice the rated working load shall constitute non-compliance.

4.4.3 Paddles.

Inspect the SSRI kit to verify that eight (8) paddles are provided with each E-CRRC. The absence of eight (8) paddles shall constitute non-compliance.

4.4.4 Paddle stowage.

4.4.4.1 Inspect that a paddle bag(s) capable of accommodating the eight (8) supplied paddles is provided with the E-CRRC. Failure to provide a paddle bag(s) with the E-CRRC shall constitute non-compliance.

4.4.4.2 Demonstrate that the paddle bag(s) can be attached to the E-CRRC. Failure to have a method of attaching the paddle bag(s) to the E-CRRC shall constitute non-compliance.

4.4.5 Fuel Bladders.

4.4.5.1 Inspect the SSRI kit for collapsible fuel bladder(s). The absence of collapsible fuel bladders, or individual fuel bladders which exceed 18 gallons shall constitute non-compliance. The number and capacity of the fuel bladders will be verified in 4.5.2.

4.4.5.2 Demonstrate that the fuel bladders can be secured in the bow of the E-CRRC and are shaped to maximize deck space. Failure of the fuel bladders to fit in the bow and be securely fastened shall constitute non-compliance.

4.4.5.3 Through a certificate of conformance, the OEM shall provide verification that the fuel bladder is resistant to gasoline, JP-5, and JP-8. Failure to provide data verifying that the fuel bladder is resistant to gasoline, JP-5, and JP-8 shall constitute non-compliance.

4.4.5.4 Inspect the fuel bladder for quick release disconnects for securing the bladder to the E-CRRC. Demonstrate that a full fuel bladder may be removed from the E-CRRC in less than one minute. The absence of quick disconnects or failure to remove a full fuel bladder within one minute shall constitute non-compliance.

4.4.5.5 Demonstrate that the fuel bladder is capable of connecting to the supplied fuel line in 4.4.6. Failure of the fuel bladder to connect to the supplied fuel line shall constitute non-compliance.

4.4.5.6 Inspect the fuel bladder for carry handle(s), capable of carrying the fuel bladder. Demonstrate that a full fuel bladder can be carried for transport over land. Failure of the fuel bladder to have carry handles, or to be transported using the carry handles, shall constitute non-compliance.

4.4.6 Fuel line.

4.4.6.1 Demonstrate that the E-CRRC fuel line can be connected to the fuel bladder(s) located in the bow, routed around the perimeter of the E-CRRC, and connected to the NBOE

mounted on the transom. Failure to route the fuel line as described shall constitute non-compliance.

4.4.6.2 Demonstrate that the E-CRRC fuel line can be connected to the fuel bladder(s) and the NBOE. Failure to connect to both the fuel bladder and NBOE shall constitute non-compliance.

4.4.6.3 Through a certificate of conformance, verifty that the fuel line is compatible with gasoline, JP-5 and JP-8. Failure of the fuel line to be compatible with gasoline, JP-5 and JP-8 shall constitute non-compliance.

4.4.6.4 Inspect the fuel line for the presence of automatic check valves in the quick-disconnect fittings. Demonstrate that when the fuel line is disconnected from the engine, the fuel line closes and no fuel is lost. The absence of an automatic check valve, or loss of fuel when the fuel line is disconnected from the engine shall constitute non-compliance.

4.4.6.5 Inspect the fuel line for a manual mechanism (squeeze bulb) for priming the fuel line. While hooked to the fuel bladder and NBOE, demonstrate that the priming mechanism is capable of priming the NBOE. Absence of a priming mechanism or failure to prime the NBOE shall constitute non-compliance.

4.4.6.6 Inspect that the priming mechanism is located within 3 to 4 feet of the engine end of the fuel line. Failure of the primining mechanism to be within 3 to 4 feet of the engine shall constitute non-compliance.

4.4.7 Spare Valve Kit.

Inspect that the SSRI kit contains a spare valve kit containing the following: one (1) pressure relief valve, one (1) lock open inflation/deflation valve, two (2) blanking plugs, and two (2) relief valve poppet retainers shall be provided. The absence of a spare valve kit, or omission of the required items within the spare valve kit shall constitute non-compliance.

4.4.8 E-CRRC Tool Kit.

Inspect the E-CRRC for the presence of an E-CRRC tool kit, containerized in a non-metallic buoyant hard case, containing all tools required to assemble, disassemble, and operate the E-CRRC shall be provided. Absence of an E-CRRC took kit shall constitute non-compliance.

4.4.9 Onboard Repair Kit.

4.4.9.1 Inspect that the SSRI kit contains an onboard repair kit, containerized in a non-metallic buoyant hard case, containing the following: all necessary repair material, adhesive, patches, emergency repair clamps, tools, and instructions necessary to make a minimum of five repairs to the E-CRRC. The absence of a spare valve kit, or omission of the required items within the spare valve kit shall constitute non-compliance.

4.4.9.2 Inspect that at least two of the five types patches can be used while on the water. The absence of two field-expedient types of patches shall constitute non-compliance.

4.4.10 Tow Bridle.

Inspect the SSRI kit for a double braided black polyester rope towing bridle with 15-foot legs. Measure the towing bridle legs. The absence of a double braided black polyester rope towing bridle, or legs which are not 15 feet long shall constitute non-compliance.

4.4.11 Valve Wrench.

Inspect the KII kit of the E-CRRC for the presence of a valve wrench (if required). The absence of a required valve wrench shall constitute non-compliance.

4.4.12 Pressure Gauge.

4.4.12.1 Inspect the SSRI kit for a minimum of one pressure gauge. The absence of at least one pressure gauge shall constitute non-compliance.

4.4.12.2 Demonstrate that the pressure gauge can be attached to all manual inflation system valves on the E-CRRC. Failure to be able to attach the pressure gauge to the manual inflation system valves of the E-CRRC shall constitute non-compliance.

4.4.12.3 With the E-CRRC inflated to working pressure, demonstrate that the pressure gauge is capable of reading the range of working pressures found on the E-CRRC. Failure of the pressure gauge to have a range sufficient for reading the range of all pressure on the E-CRRC shall constitute non-compliance.

4.5 Performance

4.5.1 Payload. KPP 2.

Configure the E-CRRC with the NBOE, fuel, and all required SSRI. While in the water, add eight combat-loaded Marines, their rucksacks, and any required ballast needed to total 2400 pounds. The weight of 2400 pounds is Marines, rucksacks, and ballast ONLY, and is exclusive of the E-CRRC, NBOE, fuel and SSRI. This shall define the payload of a combat-loaded E-CRRC. Failure of the E-CRRC to have sufficient space to accommodate the Marines and rucksacks, taking on water, sinking, or excessive distortion (subjective) shall constitute non-compliance.

The payload is Marines and gear only, and does not include E-CRRC, engine, fuel and SSRI.

4.5.2 Range. KPP2.

Configure the E-CRRC as defined in 4.5.1. The manufacturer shall determine the amount of fuel required to achieve the threshold range. The amount of fuel required to achieve the threshold range is independent of the payload weight requirement of 2400 pounds. When powered by the NBOE, demonstrate that a combat-loaded E-CRRC in sea state 2 is capable of conducting a 50 NM insert, five hours loiter at idle, and 50 NM extract with a 10% fuel reserve while running on gasoline, JP-5 or JP-8. Verification of this requirement may be partially done through analysis, determining fuel consumption in the defined configuration and sea state over a shorter distance to determine fuel consumption, and extrapolating the results to determine range. Failure to meet the threshold range, in the defined configuration and sea state with a 10% reserve on gasoline, JP-5 or JP-8 shall constitute non-compliance.
Fuel is independent of the defined payload and range may be achieved with any fuel capacity.

4.5.3 Speed. KSA 13.

Configure the E-CRRC as defined in 4.5.1, with the manufacturer determined fuel capacity (gasoline, JP-5 or JP-8) required to meet the threshold range, and 2400 pounds of Marines and gear. Using a GPS, conduct reciprocal runs in sea state 2, taking the average speed between the two runs to determine the maximum speed. Conduct three reciprocal runs and average the maximum speed of each run. Failure of a combat-loaded E-CRRC to achieve a minimum top

speed of 18 kts in sea state two while running gasoline, JP-5 or JP-8 shall constitute non-compliance.

4.5.4 Shock. KPP 6.

The vertical accelerations of the E-CRRC shall be tested by the Naval Surface Warfare Center, Norfolk Detachment, Combatant Craft Department in accordance with the standards set in *Ride Severity Profile for Evaluating Craft Motions*, technical report NSWCCD-80-TR-2015/002. Using the combat-loaded E-CRRC and combat-loaded legacy CRRC with hard deck, the two craft shall be operated alongside each other at maximum speed to obtain comparative data. Payload for the combat-loaded legacy CRRC shall be 1750 pounds of personnel, gear and any required ballast. Target conditions shall be sea state two, however, due to operating alongside to collect comparative data, sea states of +/- one shall be acceptable. Accelerations shall be measured just aft of the fuel bladders, with the average of the 1/10 highest peak vertical accelerations used to determine the accelerations. A reduction of less than 1/3 of the vertical accelerations experienced by the legacy CRRC shall constitute non-compliance.

4.6 Self-Recovery. KSA 6.

4.6.1 Towing.

Configure two E-CRRC's as defined in 4.5.1, with the manufacturer determined fuel capacity. Using a tow bridle and a GPS, demonstrate that a combat-loaded E-CRRC is able to tow another combat-loaded E-CRRC in sea state 2 at a minimum speed of 4 knots. Towing shall be done in reciprocal directions and the speeds averaged. Failure of a combat-loaded E-CRRC to tow another combat-loaded E-CRRC in sea state 2 at a minimum speed of 4 knots shall constitute non-compliance.

4.6.2 Towed.

Configure two E-CRRC's as defined in 4.5.1, with the manufacturer determined fuel capacity. Using a tow bridle and a GPS, demonstrate that a combat-loaded E-CRRC may be towed by another combat-loaded E-CRRC in sea state 2 at a minimum speed of 4 knots. Tow in reciprocal directions and average the speeds. Failure of a combat-loaded E-CRRC to be towed by another combat-loaded E-CRRC in sea state 2 at a minimum speed of 4 knots shall constitute non-compliance.

4.7 System Survivability.

4.7.1 Surf Passage. KPP 5.

Using a combat-loaded E-CRRC as defined in 4.5.1, demonstrate that the E-CRRC is capable of transiting in and out of a surf zone consisting of plunging surf with a breaker height up to and including 6 feet. Following the transit, inspect the E-CRRC for damage and condition. Deformation of the E-CRRC or components which require corrective action to continue the mission, separation of seams or joints, tearing of fabric, failure of E-CRRC fittings, or damage to equipment stowage shall constitute non-compliance.

4.7.2 Self-bailing.

Using a combat-loaded E-CRRC as defined in 4.5.1, fully flood the E-CRRC using waves during surf passage. Once flooded, demonstrate that the E-CRRC is capable of self-bailing in less than two minutes. Time will start once the E-CRRC is fully flooded and stop when the E-CRRC is capable of getting on plane. The E-CRRC may be operated using the NBOE to facilitate self-

bailing. Failure of the E-CRRC to self-bail in two minutes after being fully flooded shall constitute non-compliance.

4.7.3 Puncture. KPP 5.

4.7.3.1 Inspect the E-CRRC for interconnection valves installed between each inflation chamber. Inflate the E-CRRC to working pressure, close the interconnection valves, then deflate every other inflation chamber to demonstrate the interconnections valve's ability to isolate the adjacent chamber. The absence of interconnection valves between each inflatable chamber or the failure of the interconnection valves to isolate the adjacent chamber from deflation shall constitute non-compliance.

4.7.3.2 Using a combat-loaded E-CRRC as defined in 4.5.1, deflate any one chamber of the E-CRRC. Using the NBOE, demonstrate that the E-CRRC is capable of non-planing operation with one chamber deflated. Inflate the deflated chamber to working pressure, and deflate the next adjacent chamber. Repeat for all chambers on either the port or starboard side of the E-CRRC. Failure of the E-CRRC to operate at non-planing speeds, using the NBOE, with any one chamber deflated shall constitute non-compliance.

4.7.3.3 Using a combat-loaded E-CRRC as defined in 4.5.1, deflate any two chambers of the E-CRRC. With any two chambers deflated, demonstrate that the E-CRRC remains capable of maintaining level floatation. Determine the two-chamber combinations of the E-CRRC that can be deflated, and repeat the procedure for each combination. The procedure only needs to be performed for the port or starboard side since the results will be the same for either side. Failure of the E-CRRC to maintain level floatation with any combination of two chambers deflated shall constitute non-compliance.

4.8 Operation

4.8.1 Broaching. KSA 4.

Using a combat-loaded E-CRRC as defined in 4.5.1, rig the E-CRRC for broaching. Broach the E-CRRC to be upside down. Using four Marines, demonstrate that four Marines can right the combat-loaded E-CRRC. Failure of four Marines to right the combat-loaded E-CRRC after broaching shall constitute non-compliance.

4.8.2 Operation. KSA 5.

With the E-CRRC coxswain wearing MOPP Level IV equipment, demonstrate operation of the E-CRRC by the coxswain. Failure of the coxswain to operate the E-CRRC while wearing MOPP Level IV equipment shall constitute non-compliance.

4.9 Launch and Recovery. KPP 1.

4.9.1 L-Class Amphibious Shipping.

Demonstrate that the combat loaded E-CRRC is capable of launch and recovery from L-class amphibious shipping equipped with well decks without mechanical aid. Failure of the E-CRRC to launch and recover from an L-class ship well deck without mechanical aid shall constitute non-compliance.

4.9.2 Landing Craft Utility.

Demonstrate that the combat loaded E-CRRC is capable of launch and recovery from the bow ramp of a Landing Craft Utility (LCU) without mechanical aid (T=O). Failure of the E-CRRC to be launch and recover from the bow ramp of an LCU without mechanical aid shall constitute non-compliance.

4.9.3 Landing Craft Air Cushion.

Demonstrate that the combat loaded E-CRRC is capable of launch and recovery from a Landing Craft Air Cushion (LCAC) without mechanical aid. Failure of the E-CRRC to be launch and recover from an LCAC without mechanical aid shall constitute non-compliance.

4.9.4 CH-53.

Demonstrate that the combat-loaded E-CRRC can be helocast from a U.S. Marine Corps CH-53 helicopter. Partial deflation of the E-CRRC and/or removal of aircraft seats is acceptable. Nominal conditions for helocast are 10 feet altitude at 10 knots forward speed. Failure of the E-CRRC to fit inside of the specified aircraft, to be tied down securely, exit the aircraft without impacting the aircraft, or damage to the E-CRRC when impacting the water shall constitute non-compliance. Helocast configuration shall be defined as craft, NBOE, fuel and eight rucksacks with a combined weight of 800 lbs.

4.9.5 CH-47.

Demonstrate that the combat-loaded E-CRRC can be helocast from a U.S. Army CH-47 helicopter. Partial deflation of the E-CRRC and/or removal of aircraft seats is acceptable. Nominal conditions for helocast are 10 feet altitude at 10 knots forward speed. Failure of the E-CRRC to fit inside of the specified aircraft, to be securely tied down, exit the aircraft without impacting the aircraft, or damage to the E-CRRC when impacting the water shall constitute non-compliance. Helocast configuration shall be defined as craft, NBOE, fuel and eight rucksacks with a combined weight of 800 lbs.

4.9.6 H-60.

Using a combat-loaded E-CRRC, demonstrate that the E-CRRC can be helocast by under-fuselage sling (K-Duck) from the H-60 helicopter. Nominal conditions for helocast are 10 feet altitude at 10 knots forward speed. Failure of the E-CRRC to fit under the specified aircraft, to be securely tied down, exit the aircraft without impacting the aircraft, or damage to the E-CRRC when impacting the water shall constitute non-compliance. Helocast configuration shall be defined as craft, NBOE, fuel and eight rucksacks with a combined weight of 800 lbs. Partial deflation of the E-CRRC is acceptable. Removal of the NBOE from the transom and packaged inside of the E-CRRC is acceptable.

4.9.7 U.S. Troop Transport Tilt/Rotor Wing Aircraft.

Helocast deployable from all U.S. troop transport tilt/rotor wing aircraft is an objective and shall not be verified during First Article Testing (FAT). Partial deflation of the E-CRRC and/or removal of aircraft seats is acceptable. Nominal conditions for helocast are 10 feet altitude at 10 knots forward speed. Failure of the E-CRRC to fit inside of the specified aircraft, to be securely tied down, exit the aircraft without impacting the aircraft, or damage to the E-CRRC when impacting the water shall constitute non-compliance. Helocast configuration shall be defined as craft, NBOE, fuel and eight rucksacks with a combined weight of 800 lbs.

4.10 Submarine Deployment. APA 3.

Demonstrate that the E-CRRC is capable of deployment from current US Navy submarines. Verify that the E-CRRC boat materials are certified in accordance with OPNAVINST 5100.19 and the requirements outlined in Nuclear Powered Submarine Atmosphere Control Manual S9510-AB-ATM-010(U) Chapter 7. Failure of the E-CRRC to be deployed from current US Navy submarines, or for the material to be certified in accordance with the Nuclear Powered Submarine Atmosphere Control Manual S9510-AB-ATM-010(U) Chapter 7 shall constitute non-compliance.

Submarine deployment of the E-CRRC is an objective requirement and shall not be verified during FAT.

4.11 Parachute Insertion. APA 4.

Using applicable USMC cargo parachutes, demonstrate parachute insertion of a combat loaded E-CRRC onto a water surface via rotary and fixed-wing aircraft, without compromising its structural integrity or mission performance. Being unable to configure the E-CRRC for parachute insertion, or compromised structural integrity or mission performance after parachute insertion shall constitute non-compliance.

Parachute insertion is an objective requirement and shall not be tested during FAT.

4.12 Signature. KSA 9.

4.12.1 Color.

Using a water source such as a hose or bucket, thoroughly wet the exterior of the E-CRRC. Inspect the E-CRRC to verify non-reflectivity of the E-CRRC when wet. Non-reflectivity shall be subjective. Failure of the E-CRRC to be non-reflective when wet shall constitute non-compliance.

4.12.2 Metallic Components.

Inspect all exposed metallic components on the E-CRRC for a coating or other means of being non-reflective. The determination of non-reflective shall be subjective. Failure of exposed metallic components on the E-CRRC shall constitute non-compliance.

4.12.3 Spray Reduction.

The manufacturer shall provide details of the E-CRRC design which reduces water spray when operating, such as spray rails. The E-CRRC shall be inspected to confirm the presence of the manufacturer's spray reducing design features. Failure of the manufacturer to provide details of the spray reducing features or lack of the spray reducing features on the E-CRRC shall constitute non-compliance.

4.13 Inflation/Configuration Time.

4.13.1 Manual Inflation.

Using the two manual foot pumps supplied in the SSRI kit, demonstrate that the E-CRRC is capable of inflation to working pressure within fifteen minutes by two Marines. The E-CRRC shall be deflated, and unrolled, with the pressure gauge(s) attached to monitor the pressure. Using a stopwatch, time how long it takes for two Marines to inflate the E-CRRC to the design working pressure with the manual foot pumps. Failure of the E-CRRC to be inflated to the

design working pressure within 15 minutes, or for the manual foot pumps to achieve working pressure, shall constitute non-compliance.

4.13.2 SCUBA Inflation.

Using two 100 ft^3 SCUBA cylinders at 3000 psi, inflate the E-CRRC to working pressure within 5 minutes. The E-CRRC shall be deflated, and unrolled, with the pressure gauge(s) attached to monitor the pressure. Using a stopwatch, time how long it takes to inflate the E-CRRC to the design working pressure with the SCUBA cylinders. Failure to inflate the E-CRRC to the design working pressure within 5 minutes shall constitute non-compliance.

4.14 Storage.

4.14.1 Storage Bag.

Inspect that a storage bag is provided for when the E-CRRC is rolled for storage. Failure to provide a storage bag with the E-CRRC shall constitute non-compliance.

4.14.2 Stored Dimensions.

With the E-CRRC rolled for storage and in the storage bag, measure the length, width, and height. Failure of the rolled and stored E-CRRC to be less than or equal to 90” (L) x 48” (W) x 24” (H) shall constitute non-compliance.

4.14.3 Storage Temperature.

Through a certificate of conformance, the manufacturer shall provide specifications for the materials used to construct the E-CRRC, certifying that materials can withstand sustained air temperatures between -33°C (-28°F) to + 71°C (160°F) per MIL-STD-810, Part Three, Paragraph 4, Table I, for Basic Cold and Hot Dry, respectively. The E-CRRC fabric shall not crack, or distort in any way when stored in these conditions for a period of two years. Failure of the manufacturer to provide data supporting long term storage in these air temperatures shall constitute non-compliance.

4.15 Sustainment.

4.15.1 Materiel Availability. KPP 3.

Operational hours to calculate system uptime, mission failures, and downtime will be collected during first article testing and after fielding of the system. Sub-system data will be collected to differentiate between E-CRRC and engine for calculating material availability. Failure of the E-CRRC or engine to have sub-system material availability of at least 92%, or of the system to have a materiel availability of 78% shall constitute non-compliance.

Materiel Availability is a measure of the percentage of the total inventory of a system which is operationally capable of performing an assigned mission at a given time, based on its materiel condition. Equivalently, it is the probability that a given system is ready for tasking and is a measure of equipment readiness, defined by system uptime divided by system life cycle.

4.15.2 Operational Availability. KPP 4.

Operational hours, mission failures, time to correct failures and mean logistics delays will be collected during first article testing and after fielding of the system. Sub-system data will be collected to differentiate between E-CRRC and engine for calculating the MTBOMF. Failure of

the E-CRRC or engine to have sub-system operational availability of at least 94%, or of the system to have an operational availability of at least 80% shall constitute non-compliance.

Operational Availability is:

Ao = MTBOMF / (MTBOMF + MTTR + MLDTOMF)

MTBOMF = Mean Time Between Operational Mission Failures, which is the average time between Operational Mission Failures and is defined as Total Operational Time / Operational Mission Failures.

MTTR = See definition in 4.17.2.

MLDTOMF = Mean Logistics Delay Time from Operational Mission Failures is the downtime associated with administrative actions, such as the lead time for ordering replacement items and the time to transport them to the system location. MLDTOMF is the average Logistics Delay Time following Operational Mission Failures.

4.16 Reliability. KSA 11.

Operational hours, mission failures, and time to correct failures will be collected during first article testing and after fielding of the system. Sub-system data will be collected to differentiate between E-CRRC and engine for calculating the MTBOMF. Failure of the E-CRRC or engine to have sub-system MTBOMF of at least 340 hours, or of the system to have a MTBOMF of at least 170 hours shall constitute non-compliance.

The system's MTBOMF is the average time between Operational Mission Failures and defined as Total Operational Time / Operational Mission Failures. An operational mission failure is any failure of the E-CRRC or engine that prevents accomplishment of a mission task.

4.17 Maintainability. KSA 12.

4.17.1 Field Repair.

Using an E-CRRC with a 2” diameter hole and using the supplied on board repair kit, demonstrate that the E-CRRC is field repairable by a single Marine. Repeat the repair for a 1” diameter hole. Failure to perform the repair in less than 15 minutes (per hole) shall constitute non-compliance.

4.17.2 Mean Time to Repair.

The time to perform repairs on the E-CRRC and engine will be collected during first article testing and after fielding of the system. Sub-system data will be collected to differentiate between E-CRRC and engine for calculating the mean time to repair. Failure of the E-CRRC or engine to have a sub-system mean time to repair no more than 2.5 hours shall constitute non-compliance.

MTTR is defined as Repair Time / Number of Repair Incidents. Repair Time is the total number of clock-hours to perform failure isolation, part replacement and verification of all corrective maintenance actions. Mean Time to Repair is measured in clock-hours.

4.18 Interchangeability. KSA 7.

Interchangeability data will be collected during all movements or when stored in a deflated condition. Highlight records to ensure that these components are interchangeable with different inflated skins.

4.19 Transportability. KSA 8.

With the E-CRRC, rolled for storage and without NBOE or fuel, transport four E-CRRCs aboard a single V-22. In the event that a V-22 is not available, using the rolled dimensions of the E-CRRC and interior dimensions of the V-22, verify through analysis the transport of four E-CRRCs aboard a single V-22. Failure to transport four E-CRRCs aboard a single V-22 shall constitute non-compliance.

Without NBOE or fuel, demonstrate that the E-CRRC is small enough to be passed through a 30" diameter submarine hatch. Unrolling of the craft is acceptable. Failure of the E-CRRC to pass through a submarine hatch for embarkation shall constitute non-compliance.

The requirement to transport the E-CRRC aboard current US Navy submarines is an objective requirement and will be verified at a later date.

4.20 Operating and Support Cost. APA 5.

The operations and maintenance cost/Annual Per Unit Cost for the E-CRRC shall be no more than $6000 per system per year (T), $4000 (O).

4.21 Service life.

4.21.1 Operational Service Life.

Through a certificate of conformance, the manufacturer shall provide data on the expected service life of the materials used and construction methods. An expected operational service life of less than five years shall constitute non-compliance.

4.21.2 Storage Life.

Through a certificate of conformance, the manufacturer shall provide data on the expected storage life in climate-controlled storage of the materials used and construction methods. An expected storage life of less than two years shall constitute non-compliance.

4.22 Identification.

4.22.1 Nameplate.

Inspect the E-CRRC for a nameplate attached to the starboard side of the transom containing the following information:

Enhanced Combat Rubber Raiding Craft (E-CRRC)
NSN_ Built for the United States Marine Corps
by (Contractor, city, state, CAGE code)
Date of Mfg., month, year
Contract No. _
Serial No. _
Operating Inflation Pressure: (TBD) mbar ((TBD) psi)
Bare Weight:
Maximum Horsepower: _
Maximum Capacity:
Unique Item Identification (UID)

The absence of a nameplate, nameplate not attached in the specified location, or missing the specified information shall constitute non-compliance.

4.22.2 Serial numbers.

Inspect the E-CRRC for unique serial number. Absence of a unique serial number shall constitute non-compliance.

4.23 Training and Manuals.

4.23.1 Training and maintenance instructions.

Inspect that the contractor provided training material and maintenance instructions in English. Failure to provide training material and maintenance instructions in English shall constitute non-compliance.

4.23.2 Service manual.

Inspect that the contractor prepared a commercial manual, including instruction for opening, inspecting, testing, repairing, and repacking the E-CRRC, in accordance with MCO P5215.17C. Failure to provide a commercial manual, including instruction for opening, inspecting, testing, repairing, and repacking the E-CRRC, in accordance with MCO P52tie dow.17C shall constitute non-compliance.

5 Packaging.

For acquisition purposes, the packaging requirements shall be as specified in the contract or order. When packaging of materiel is to be performed by DoD or in-house Contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Maintain packaging requirements by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6 Notes.

This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.

Materiel Availability: measure of the percentage of the total inventory of a system which is operationally capable of performing an assigned mission at a given time, based on its materiel condition. Equivalently, it is the probability that a given system is ready for tasking and is a measure of equipment readiness. It is the system uptime divided by system life cycle.

Mean Time to Repair (MTTR): defined as Repair Time/Number of Repair Incidents. Repair Time is defined as the total number of clock-hours to perform failure isolation, part replacement and verification of all corrective maintenance actions. Mean Time to Repair is measured in clock-hours.

Operational Availability:

Ao = MTBOMF / (MTBOMF + MTTROMF + MLDTOMF)

MTBOMF = Mean Time Between Operational Mission Failures, which is the average time between Operational Mission Failures and is defined as Total Operational Time / Operational Mission Failures.

MTTROMF = Mean Time To Restore from Operational Mission Failures, defined as the average time to restore the system following an Operational Mission Failure, isolation, part replacement, and verification of all corrective maintenance actions.

MLDTOMF = Mean Logistics Delay Time from Operational Mission Failures is the downtime associated with administrative actions, such as the lead time for ordering replacement items and the time to transport them to the system location. MLDTOMF is the average Logistics Delay Time following Operational Mission Failures.

Payload: personnel and gear only, and does not include craft, engine, fuel and supply system responsibility items (SSRI).

Supply System Responsibility Items (SSRI)

Table 2. Table 1. Supply System Responsibility Items kit.

Supply System Responsibility Item	Quantity
Manual foot inflation pump with hose and inflation valve adapter end fitting	2
Hoisting Sling	As required
Paddles	8
Paddle Bag(s)	As required
Spare valve kit contains one pressure relief valve, one lock open inflation/deflation valve, two blanking plugs, and two relief valve poppet retainers	1
Craft tool kit (consisting of all tools required to operate the craft)	1
Onboard repair kit	1
Tow Bridle	As required
Valve wrench (if required)	1
Pressure Gauge	1
Fuel Bladder(s)	TBD on OEM determined range requirements
Fuel Line	1