DRAFT

UNMANNED INFLUENCE SWEEP SYSTEM - ACAT LEVEL III

SYSTEMS REQUIREMENTS DOCUMENT

VERSION 1.0

DECEMBER 3, 2012

SUBMITTED BY		APPROVED BY	
J. Madaio System Design Manager Unmanned Maritime Vehicles (SEA 05L3)	Date	D. Ashton CAPT, USN Program Manager Unmanned Maritime Systems (PMS 406)	Date

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

CHANGE HISTORY

Change	Version	Date

CONTENTS

1 SCOPE 10
1.1 Introduction. 10
1.2 Description. 10
1.3 UISS Components. 10
1.3.1 Off-board Component. 10
1.3.2 LCS Component 10
1.3.3 MPSF Component. 10
1.4 Capability Overview. 11
1.4.1 Capabilities Supporting Concept. 11
2 APPLICABLE DOCUMENTS 12
2.1 General. 12
2.2 Government Documents. 12
2.2.1 Specifications, Standards, and Handbooks. 12
2.2.2 Other Government Documents, Drawings, and Publications. 13
2.3 Non-Government Publications. 17
2.4 Order of Precedence. 19
2.5 Classified References. 19
3 REQUIREMENTS 19
3.1 General Operations. 19
3.1.1 Depot-Level Overhaul (DLO). 19
3.1.2 Operational Profile. 19
3.1.3 Post Mission Analysis (PMA). 19
3.2 Typical Concept of Operations. 20
3.2.1 Mission Planning. 20
3.2.2 Mission Upload. 20
3.2.3 Pre-Launch. 20
3.2.4 Launch. 20
3.2.5 Transfer of Control. 20

3.2.6 Transit. 20
3.2.7 Sweep System Initialization. 20
3.2.8 Sweeping. 21
3.2.9 Return Transit and Recovery. 21
3.2.10 Post-Mission. 21
3.3 System States and Modes. 21
3.4 Non-Deployed State. 21
3.4.1 Non-Deployed Storage Mode. 21
3.4.2 Non-Deployed Training Mode. 22
3.4.3 Non-Deployed Maintenance Mode. 22
3.4.4 Non-Deployed Transport Mode. 23
3.5 Deployed State. 23
3.5.1 LCS Interface. 23
3.5.2 Deployed Sortie Mode. 23
3.5.3 Deployed Maintenance Mode. 25
3.5.4 Deployed Stowed Mode. 26
3.6 Environmental Parameters. 26
3.6.1 Overall Parameters. 26
3.6.2 Operating Environmental Parameters. 27
3.6.3 Non-Operating Parameters. 29
3.7 Electromagnetic Interference and Electromagnetic Environmental Effects. 30
3.7.1 Electromagnetic Compatibility. 30
3.7.2 Electromagnetic Susceptibility. 30
3.7.3 Electromagnetic Emissions (EME). 30
3.8 Sweep System Performance. 30
3.8.1 Area Coverage Rate-Sustained (ACRS). 30
3.8.2 Effective Influence Depth (EID). 38
3.8.3 Sweep Subsystem Operational Data. 39
3.8.4 Mine Fire Detection. 39

3.9 Hardware Integration Requirements. 40
3.9.1 Launch and Recovery Compatibility with all LCS Configurations. 40
3.9.2 System Weight & Center of Gravity. 40
3.9.3 Transportability. 40
3.9.4 Fire Retardency and Toxicity. 41
3.9.5 Structural Fittings. 42
3.9.6 Propulsion Engine, Marine Gear, & Generator Requirements. 43
3.9.7 Fuel System. 43
3.9.8 Lube Oil Change System. 43
3.9.9 Freshwater Washdown. 43
3.9.10 Shore Power System. 43
3.9.11 Data. 44
3.9.12 Data Storage System. 44
3.9.13 Voice. 44
3.9.14 Multi-Vehicle Communication System (MVCS). 44
3.10 Software Interface Requirements. 44
3.10.1 OIS Software. 45
3.11 Modularity Open Systems Architecture (MOSA)/Open Architecture. 45
3.12 Information Assurance (IA) & Program Protection. 45
3.12.1 IA Certification. 47
3.13 Personnel. 48
3.14 Command, Control, Communication, and Computers (C4) Requirements. 48
3.14.1 C4 Elements. 48
3.14.2 C4 System Requirements. 48
3.14.3 C4SA System. 49
3.14.4 Automatic Identification System (AIS). 49
3.14.5 Navigation. 49
3.14.6 Navigation Rules Compliance. 50
3.14.7 Obstacle Avoidance Capability. 50

3.15 Human Systems Integration 50
3.15.1 Operator Interfaces 50
3.15.2 Health Monitoring 51
3.16 Fault Management (FM) and Fault Localization (FL) 51
3.16.1 FM/FL Capabilities 51
3.16.2 FM/FL Messages 52
3.17 Built-In-Test (BIT) 52
3.17.1 Automatic and Semiautomatic Features 52
3.17.2 Hardware and Software Failures 52
3.17.3 Analysis Tools 52
3.17.4 False Alarm Percentages 53
3.17.5 System Status 53
3.17.6 Test Equipment 53
3.17.7 Procedures 53
3.17.8 Incorporation of COTS 53
3.18 Built-in Test (BIT)/BIT Equipment (BITE) 53
3.19 Manpower 53
3.19.1 Detachment Size 53
3.19.2 Watch Section Size 54
3.19.3 Human-Robot Interaction (HRI) 54
3.19.4 Situational Awareness (SA) 54
3.19.5 Human Factors 54
3.20 System Safety 54
3.20.1 Emergency Operation 55
3.20.2 Emergency Recovery 55
3.20.3 Stopping the Off-board Component 55
3.20.4 Mine Fire Survivability 56
3.20.5 Accelerations Monitoring 56
3.20.6 Stability 56

3.20.7 Fire Suppression 57
3.21 Electrical System. 57
3.21.1 Electrical System Standards. 57
3.21.2 Grounding and Bonding System. 58
3.21.3 Batteries. 58
3.22 Mechanical Systems. 58
3.22.1 Mechanical System Standards. 58
3.22.2 Propulsor Requirements. 58
3.22.3 Bilge System. 58
3.23 Construction Standards. 59
3.23.1 Structural Requirements. 59
3.23.2 Fabrication Requirements. 59
3.23.3 Materials. 59
3.23.4 Corrosion Prevention. 60
3.24 Support Equipment. 60
3.24.1 Diagnostic Support Device. 61
3.24.2 Trailer. 61
3.24.3 Stowage Cradle Bunk Pads. 61
3.24.4 Man-Portable Control Unit (MPCU). 61
3.25 Tools and Test Equipment. 62
3.25.1 Tools and Equipment 62
3.25.2 Special Test Equipment 63
3.26 Logistics Requirements. 63
3.26.1 Operational Availability (A_o). 63
3.26.2 Mean Time Between Failure (MTBF). 64
3.26.3 Mean Time to Repair (MTTR). 65
3.26.4 Supportability. 65
3.26.5 Reliability and Availability. 65
3.26.6 Materiel Availability (A_m). 65

3.26.7 Maintainability. 66
3.26.8 Supply Support. 66
3.27 Training Requirements. 67
3.27.1 Train to Qualify (T2Q). 67
3.27.2 Training to Certify (T2C). 67
3.27.3 Subject Areas. 67
3.27.4 Component Training. 68
3.27.5 Training Curriculum. 68
3.27.6 Training Content. 68
3.27.7 Exams. 69
3.27.8 Training Systems. 69
3.27.9 Training/Instructor Control Station. 69
3.28 Packaging, Handling, Shipping, and Transportation. 70
3.29 Marking. 70
3.29.1 Unique Identification (UID). 70
4 VERIFICATION. 70
4.1 Verifications. 70
4.1.1 Conformance. 70
4.1.2 Methods and Codes. 71
4.1.3 Detailed Verification Requirements. 74
5 REQUIREMENTS TRACEABILITY. 171
6 NOTES. 171
6.1 Government-Furnished Property. 171
6.2 Government-Loaned Property. 171
6.3 Acronyms. 171
APPENDIX A SEA STATE TABLE. 177

TABLES

TABLE I. UISS ENVIRONMENTAL PARAMETERS 28
TABLE II. CONTRACTOR-SPECIFIED PARAMETERS 32
TABLE III. GOVERNMENT-SPECIFIED PARAMETERS 33
TABLE IV. LOADING CONDITIONS 40
TABLE V. SYSTEM REQUIREMENTS VERIFICATION MATRIX (SRVM) 75

FIGURES

FIGURE 1. UISS COMPONENT BLOCK DIAGRAM 11
FIGURE 2. UISS STATES, MODES AND CAPABILITIES 21
FIGURE 3. UISS ENVIRONMENTAL REQUIREMENTS 26
FIGURE 4. OPERATION TIMES 35
FIGURE 5. EFFECT OF DEPTH ON $D_{INFLUENCE}$ 39

EQUATIONS

EQUATION 1 - ACRS 31
EQUATION 2 - $T_{AVAILABLE}$ 34
EQUATION 3 - N_S 34
EQUATION 4 - $AREA_{SORTIE}$ 34
EQUATION 5 - D_{TS} 35
EQUATION 6 - N_T 35
EQUATION 7 - T_{SWEEP} 36
EQUATION 8 - T_{TA} 36
EQUATION 9 - T_{SA} 36
EQUATION 10 - T_{SORTIE} 37
EQUATION 11 – $T_{MISSION\text{-}SYS}$ 37
EQUATION 12 - A_O 64
EQUATION 13 - MTBF 64
EQUATION 14 - A_M 65

1 SCOPE

1.1 Introduction.

This document is the System Requirements Document (SRD) for the Unmanned Influence Sweep System (UISS). It provides all overarching system level performance, interface, and safety requirements. When used in conjunction with the Statement of Work (SOW) and the Contract Data Requirements Lists (CDRLs), this document provides a more complete set of requirements. This document provides top-level requirements. It is the Contractor's responsibility to derive additional requirements as needed to meet the contract requirements. Key Performance Parameters (KPPs) and Key System Attributes (KSAs) of the system can be found in the UISS Capability Description Document (CDD).

1.2 Description.

UISS is a mine countermeasure (MCM) system designed for influence sweeping of magnetic and acoustic mines. It is a high endurance, off-board, unmanned surface sweep system that will be operated and maintained from the Littoral Combat Ship (LCS) as part of the family of systems which comprise the MCM Mission Package (MP).

1.3 UISS Components.

UISS consists of an Off-board Component, LCS Component and Mission Package Support Facility (MPSF) Component. FIGURE I. displays a block diagram of UISS Components.

1.3.1 Off-board Component.

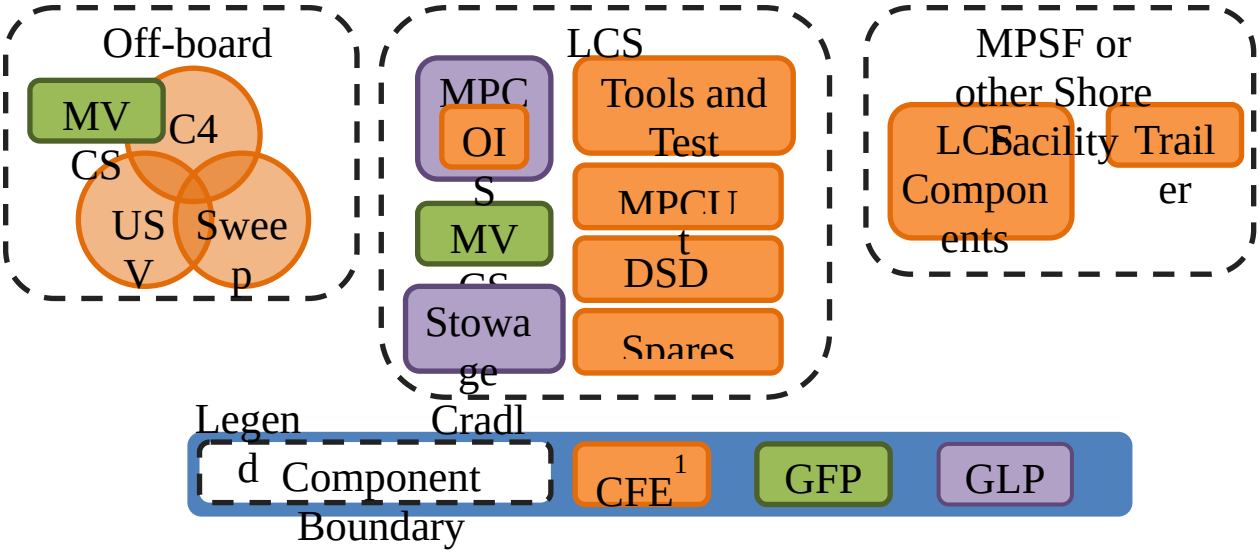
The Off-board Component consists of an unmanned surface vehicle (USV); a Sweep system (which includes magnetic and acoustic emitters); Command, Control, Communications, and Computer (C4) equipment; and part of a Government Furnished Property (GFP) Multi-Vehicle Communication System (MVCS).

1.3.2 LCS Component.

The LCS Component consists of the Operator Interface Software (OIS) integrated into the Mission Package Computing Environment (MPCE) (Government Loaned Property (GLP)), Man Portable Control Unit (MPCU), Stowage Cradle (GLP), Spares, Tools and Test Equipment and Diagnostic Support Device (DSD).

1.3.3 MPSF Component.

The MPSF Components consist of LCS Components and Trailer.



NOTES:
1. CFE-Contractor-Furnished Equipment

FIGURE 1. UISS Component block diagram

1.4 Capability Overview.

UISS is designed to neutralize, through influence sweeping, magnetic and acoustic mines, as directed by the Commanding Officer, without taking a manned ship/small craft into the minefield.

1.4.1 Capabilities Supporting Concept.

a) Off-board, unmanned, semi-autonomous system operation.

b) Track following navigation capability to transit from the launch position to the minefield and back to the planned rendezvous with the host platform, including navigation along the planned sweep pattern until the mission is complete.

c) Mission duration sufficient for transit to and from the minefield, Sweep system engagement, sweeping the assigned section of the minefield, and a loiter capability to meet Area Clearance Rate Sustained (ACRS).

d) Situational awareness (SA) and system monitoring provided by sensors necessary to support safe operation and obstacle avoidance throughout the mission.

e) Ability to counter magnetically and acoustically activated mines as in accordance with (IAW) UISS CDD.

f) Off-board communication capability, which includes interfaces for line of sight (LOS), over-the-horizon (OTH) and Global Positioning System (GPS).

2 APPLICABLE DOCUMENTS

2.1 General.

The references listed in this section are only cited from Sections 3 (Requirements), 4 (Verification), or 5 (Requirements Traceability) of this document. This section does not include documents cited in other sections of this standard or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this standard, whether or not they are listed. References cited in Section 2.2 can be found in the UISS Bidder's Library.

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.

Short Title	**Long Title**
49 CFR 393	Title 49 (Transportation) Chapter III (Federal Motor Carrier Safety Administration, Department of Transportation (DOT)) Part 393 (Parts and Accessories Necessary for Safe Operations)
49 CFR 173.185	Title 49 (Transportation) Part 173 (Shippers-General Requirements for Shipments and Packaging) Section: .185 (Lithium Cells and Batteries)
49 CFR 571	Title 49 (Transportation) Chapter V (National Highway Traffic Safety Administration, Department of Transportation (DOT) Part 571 (Federal Motor Vehicle Safety Standards)
COMDTINST M16672.2D	US Coast Guard Commandant Instruction "Navigation Rules, International/Inland" (25Mar99)
DASD SE PPP O-G	Deputy Assistant Secretary of Defense, Systems Engineering Program Protection Plan Outline and Guidance, Ver1 (Jul11)
DOD 4140.1-R	Supply Chain Materiel Management Regulation (23May03)
DODD 8500.01E	Information Assurance (23Apr07)
DODD 8570.01	Information Assurance Training, Certification, and Workforce Management (23Apr07)
DOD-HDBK 743A	Anthropometry of US Military Personnel (13Feb91)

Short Title	Long Title
DODI 4151.19	Serialized Item Management for Materiel Maintenance (26Dec06)
DODI 4151.22	Condition Based Maintenance Plus for Material Maintenance (02Dec07)
DODI 5000.02	Operation of the Defense Acquisition System (08Dec08)
DODI 5200.39	Critical Program Information Protection within the Department of Defense (28Dec10)
DODI 8510.01	DoD Information Assurance Certification and Accreditation Process (DIACAP) (28Nov07)
DODI 8523.01	Assistant Secretary of Defense for Networks and Information Integration /DoD Chief Information Officer, "Communications Security" (22Apr08)
DTM 09-016	Directive-Type Memorandum (DTM) 09-016 "Supply Chain Risk Management to Improve the Integrity of Components Used in DoD Systems" (16Sep10)
NASA SP-2010-3407	Human Integration Design Handbook (27Jan10)
NAVSAC 11-02	Navigation Safety Advisory Council (NAVSAC) (Task 08-07) Resolution 11-02
SD-22 DMSMS	Diminishing Manufacturing Sources and Material Shortages (DMSMS): A Guidebook of Best Practices and Tools for Implementing a Proactive DMSMS Management Program (Sep10)
Unmanned Systems Safety Guide	OSD Unmanned Systems Safety Guide for DoD Acquisition (Jun07)

2.2.2 Other Government Documents, Drawings, and Publications.

The following other Government documents, drawings, and publications 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.

Short Title	Long Title
DON CIO IAS	Department of Navy (DON) Chief Information Office (CIO) Information Assurance Strategy (IAS) Guidance (15Dec08)
IntRS 1773-C-1250	MPS to MM Integration Requirements Specifications (IntRS) (02May11)

Short Title	Long Title
LCS CDD	LCS CDD Flight 0+ (25Feb10)(CLASSIFIED)
LCS ICD	Interface Control Document (ICD) for the Littoral Combat Ship Flight Zero Reconfigurable Mission Packages Baseline 1.2 Rev A (22Jan10)
LCS LRHS AG	LCS Launch, Recovery, Handling, and Stowage Amplification Guide (01Nov12) (DRAFT)
MIL-DTL-24640	Detail Specification: Cables, Lightweight, Electric, for Shipboard Use (16Dec04)
MIL-DTL-24643	Detail Specification: Cable, Electrical, 600 Volts, Types LSSHOF, LSDHOF, LSTHOF, LSFHOF (22Aug02)
MIL-HDBK-1791	Designing Internal Aerial Delivery (17Feb97)
MIL-HDBK-61A	Configuration Management Guide (07Feb01)
MIL-P-24534A	Planned Maintenance System, Development of Maintenance Requirements Cards, Index Pages, and Associated Documentation (07May85)(Amended)
MIL-S-901D	Shock Tests, High-Impact Shipboard Machinery, Equipment and Systems Requirements (17Mar89)
MIL-STD-130N	DoD Standard Practice Identification Marking of US Military Property (20Dec04)
MIL-STD-1310H	Shipboard Bonding, Grounding and other Techniques for Electro-Magnetic Compatibility, Electromagnetic Pulse Mitigation and Safety (17Sep09)
MIL-STD-1366E	Interface Standard for Transportability Criteria (31Oct06)
MIL-STD-1472G	US DoD Design Criteria Standard Human Engineering (Jan12)
MIL-STD-167-1A	Mechanical Vibrations of Shipboard Equipment (Type 1-Environmental and Type II-Internally Excited) (02Nov05)
MIL-STD-2073-1	DoD Standard Practice for Military Packaging (07Jan11)
MIL-STD-209	Interface Standard for Lifting and Tie-down Provisions (22Feb05)
MIL-STD-3018	Standard Practice Parts Management (27Oct11)
MIL-STD-3034	Reliability Centered Maintenance Process (21Jan11)
MIL-STD-461F	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment (10Dec07)
MIL-STD-464C	Electromagnetic Environmental Effects, Requirements for Systems (01Dec10)

Short Title	Long Title
MIL-STD-46855	Human Engineering Requirements for Military Systems, Equipment, and Facilities (26May94)
MIL-STD-810G	Environmental Engineering Considerations and Laboratory Tests (31Oct08)
MIL-STD-913A	Design Criteria Requirements for the Certification of Sling Loaded Military Equipment for External Transportation by DoD Helicopters (03Feb97)
MPCE ICD	Mission Package Computing Environment Interface Control Document
MVCS ICD	Multi-Vehicle Communication System Interface Control Document
NAVSEA 9400.2-M	NAVSEA Afloat Information Assurance Implementation Manual Ver. 0.99 (Nov11)
NAVSEA DDS-078-1	Composite Materials, Surface Ship, Topside Structural and other Topside Applications- Fire Performance Requirements (11Aug04)
NAVSEA DWG 53711-GEN-300-5107858	Standard Electrical Installation Requirements and Nomenclature (05Oct05)
NAVSEA SG270-BV-SAF-010	High Energy Storage System Safety Manual (DRAFT)
NAVSEA Tech Spec 9090-1500	Provisioning, Allowance, and Fitting Out Support Manual (01Feb90)
NAVSEACOMBATSYSENGSTA Report No. 6660-99	Procedures Manual for Stability Analysis of US Navy Small Craft (May88)
NAVSEAINST 4790.1	Expanded Ship Work Breakdown Structure Hierarchical Structure Codes for Ships, Ship Systems, and Surface Combatant Systems (10Apr07)
NAVSEAINST 5100.12B	System Safety Engineering Policy (03Aug11)
NAVSEAINST 9310.1B	Navy Lithium Battery Safety Program (13Jun91)
NAVSEAINST 9400.2	Implementation of Naval Sea Systems Command (NAVSEA) Afloat Information Assurance (IA) Governance and Guidance (18Aug10)
NAVSOP- 5239-26	DON IA Publication Module “Remanence Security Guidebook” (Sep93)

Short Title	Long Title
NSWC PC-MCM-MPAS-UVMS-IDD	Mission Package Application Software (MPAS) IAW Interface Design Document (IDD) for the Unmanned Vehicle Management System (UVMS)
NSWCPC-MVCS-EIDD	External Interface Design Document (EIDD) for the Littoral Combat Ship (LCS) Multi-Vehicle Communication Systems (MVCS), v.3.2 (28Oct11)
NSWCCD-23-TM-2006/27	USN Bow Eye Design Criteria for USV Launch and Recovery (Oct06)
NSWCCD-23-TM-2009/58	US Navy Boat Electrical Practices RevB (Oct09)
NSWCCD-23-TM-2009/64	Small Craft Transportability Design and Certification Process Guidance (08Nov10)
NSWCCD-23-TM-2009/65	Towing Fitting Design and Certification Process Guidance Rev. C (22Aug12)
NSWCCD-23-TM-2011/38	Mooring Fitting Design and Verification Process Guidance RevA (Nov11)
NSWCCD-23-TM-2012/09	Human-Robot Interaction Function Allocation Analysis (HRI-FAA) Process: USV (Feb12)
NSWCCD-23-TM-2012/20	Methods for Direct Analysis of Hull Loading and Structural Design for UISS (May12)
OPNAVINST 3000.12A	Operational Availability Handbook: A Practical Guide for Military Systems, Subsystems, and Equipment (Jun03)
OPNAVINST 5100.19	Navy Safety and Occupational Health (NAVSOH) Program Manual for Forces Afloat Vols. I/II/III (03May07)
OPNAVINST 5100.24B	Navy System Safety Program Policy (06Feb07)
OPNAVINST 5100.28	Hazardous Materials User's Guide (21Jan05)
OPNAVINST 5239.1C	Navy Information Assurance (IA) Program (20Aug08)
PEO LMW INST 3370.1A	Program Executive Office (PEO), Littoral and Mine Warfare (LMW) Instruction (INST) Standard Mine Warfare Measures of Effectiveness and Measures of Performance (14Nov08)
S9086-RK-STM-010	Navy Ship Technical Manual (NSTM) Chapter 505: Piping Systems (15Jan08)
S9310-AQ-SAF-010	NAVSEA Technical Manual for Batteries, Navy Lithium Safety Program Responsibilities and Procedures (19Aug04)
UISS CDD	UISS Capability Description Document (CDD) (DRAFT) (CLASSIFIED)

Short Title	**Long Title**
USV 11M RHIB Cradle Assembly	Naval Facilities Engineering Service drawing numbers 20053001 thru 20053006
	NSWC CCD Failsafe Plan (under development)

2.3 Non-Government Publications.

The following documents 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. References cited in Section 2.3 are commercially available and will not be provided by the Government. Links to sites where references can be obtained are provided in the UISS Bidder's Library.

Short Title	Long Title
ABS HSNC	American Bureau of Shipping High Speed Naval Craft
ABYC	American Boat & Yacht Council
ANSI/GEIA-STD-0009	Reliability Program Standard for Systems Design, Development and Manufacturing
ASTM B209-10	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B210-04	Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B221-08	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B928/B928M-09	Standard Specification for High Magnesium Aluminum-Alloy Sheet and Plate for Marine Service and Similar Environments
ASTM C364/C364M-07	Standard Test Method for Edgewise Compressive Strength of Sandwich Constructions
ASTM D3410/D3410M-03	Standard Test Method for Compressive Properties of Polymer Matrix Composite Materials with Unsupported Gage Section by Shear Loading (2008)
ASTM D5467/D5467M-97	Standard Test Method for Compressive Properties of Unidirectional Polymer Matrix Composite Materials Using a Sandwich Beam (2010)
ASTM D638-10	Standard Test Method for Tensile Properties of Plastics
ASTM D7249/D7249M-06	Standard Test Method for Facing Properties of Sandwich Constructions by Long Beam Flexure
ASTM D7250/D7250M-06	Standard Practice for Determining Sandwich Beam Flexural and Shear Stiffness

Short Title	Long Title
ASTM D7264/D7264M-07	Standard Test Method for Flexural Properties of Polymer Matrix Composite Materials (Procedure B 8212)
ASTM E 662	Specific Optical Density of Smoke Generated by Solid Materials
ASTM E 84	Surface Burning Characteristics of Building Materials
ASTM E 800	Standard Guide for Measurement of Gases Present or Generated During Fires
NATO STANAG 4194	Standardized Wave and Wind Environments and Shipboard Reporting of Sea Conditions (1983)
NMEA 2000	National Marine Electronics Association Standard 2000
SAE-AS4 JAUS	SAE-AS4 Joint Architecture for Unmanned Systems (JAUS) Standards
UNS A 95083-H111	Unified Numbering System: Aluminum Alloy
UNS A 95083-H116	Unified Numbering System: Aluminum: 5000 Series Aluminum Alloy
UNS A 95083-H321	Unified Numbering System: Aluminum: 5000 Series Aluminum Alloy
UNS A95086-H32	Unified Numbering System: Aluminum: 5000 Series Aluminum Alloy
UNS A95086-H111	Unified Numbering System: Aluminum Alloy
UNS A95086-H116	Unified Numbering System: Aluminum: 5000 Series Aluminum Alloy
UNS A95086-H117	Unified Numbering System: Aluminum Alloy
UNS A96061-T6	Unified Numbering System: Aluminum; 6000 Series Aluminum Alloy
UNS A96061-T52	Unified Numbering System: Aluminum Alloy
UNS A96061-T651	Unified Numbering System: Aluminum; 6000 Series Aluminum Alloy

2.4 Order of Precedence.

In the event of a conflict between the text of this specification and the references cited herein, the text of this specification takes precedence. In cases where additional requirements in references cited herein constitute additional details or features, which do not violate the specified performance, then they shall not be considered conflicts and the more stringent requirement shall apply. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained. In case of conflict between requirements in referenced documents at the same tier, the more stringent requirement shall take precedence. In areas where multiple references apply, the following order of precedence shall be used:

a) Referenced government specifications and standards, Naval Ship Systems Command (NAVSHIP) or Naval Sea Systems Command (NAVSEA) standard and type drawings.
b) Referenced commercial specifications and industry standards (e.g., American Bureau of Shipping High Speed Naval Craft (ABS HSNC), American Boat and Yacht Council (ABYC)).
c) Best marine practice.

2.5 Classified References.

Annex A to UISS SRD addresses all classified values referenced in this document. Where a classified value is indicated, refer to the sections numbers identified in this document in the classified Annex.

3 REQUIREMENTS

3.1 General Operations.

The Off-board Component shall be a self-propelled, unmanned, semi-autonomous surface vehicle capable of operating independently in shallow water regions of the ocean to sweep magnetic and acoustic mines.

3.1.1 Depot-Level Overhaul (DLO).

UISS shall provide the capability to support operations in the specified environment in Section 3.5 Deployed State for five years without failure until DLO.

3.1.2 Operational Profile.

Operation is defined as operating 386 hours in 16 months with the following operation tempo:

a) 10% Idle
b) 25% Transit
c) 65% Sweeping

3.1.3 Post Mission Analysis (PMA).

During operation, the Off-board Component shall record data for analysis during PMA.

3.2 Typical Concept of Operations.

3.2.1 Mission Planning.

The Mission Planner uses Mine Warfare Environmental Decision Aids Library (MEDAL) and Unmanned Vehicle Management System (UVMS) software tools aboard LCS to conduct detailed mission planning and de-confliction, and delivers complete sortie plan.

3.2.2 Mission Upload.

After formulating and receiving approval for the sortie plan, mission parameters are downloaded to the Off-board Component prior to launch.

3.2.3 Pre-Launch.

During launch process, a communications link is established.

3.2.4 Launch.

An MPCU, connected to the ship's local area network (LAN) and MVCS, is used by the Unmanned Vehicle Deck Operator (UVDO) to release the Off-Board Component from the ship's launch and recovery (L&R) equipment and navigate to a safe stand-off position.

3.2.5 Transfer of Control.

The Unmanned Vehicle Operator (UVO) then takes responsibility for control of the Off-board Component.

3.2.6 Transit.

a) Under normal operations, the Off-board Component will navigate to sweep area based on the pre-planned route.
b) The UVO will continually monitor various sensors and systems status aboard Off-board Component to maintain lookout throughout the mission and be capable of taking remote, manual control of system.
c) The Off-board Component location information will periodically transmit back to LCS for auto-forwarding to Link 16 and Navy command and control systems (e.g., Global Command and Control System–Maritime (GCCS-M)).
d) Should circumstances require a change in sortie plan; the UVO can send a new mission plan via MVCS data link for execution.

3.2.7 Sweep System Initialization.

After arrival at sweep area, the UVO will be notified and the Off-board Component will commence engagement/deployment of the Sweep system.

3.2.8 Sweeping.

When the sweep is fully engaged/deployed, the UVO will be notified and the Off-board Component will perform track navigation of the sweep pattern. Securing or retrieving of the Sweep system is done in the same manner in reverse order.

3.2.9 Return Transit and Recovery.

Once sweep equipment is secured, the Off-board Component navigates to the recovery point at which time the UVDO uses the MPCU to recover the system aboard LCS.

3.2.10 Post-Mission.

Post-recovery, the data recorded aboard the Off-board Component hard drive is removed for PMA.

3.3 System States and Modes.

The following sections describe the states, modes and capabilities of the system in the context of how the system will be utilized in a typical mission. FIGURE 2. shows the hierarchical relationship of UISS states, modes and capabilities.

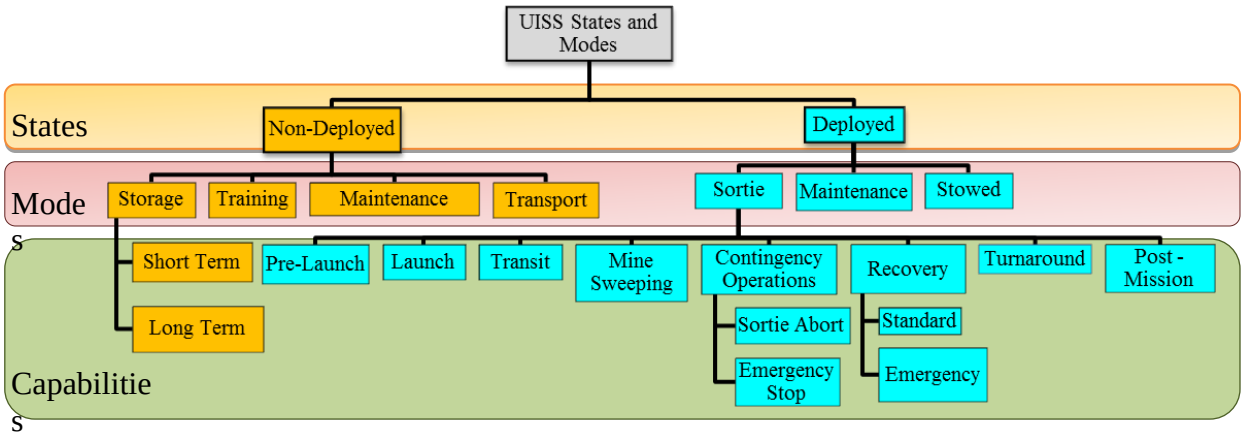


FIGURE 2. UISS states, modes and capabilities

3.4 Non-Deployed State.

In this state the UISS is not deployed on LCS. UISS can be in one of four modes: Storage, Training, Maintenance, and Transport.

3.4.1 Non-Deployed Storage Mode.

UISS shall provide capability to be stored both short-term and long-term, shore-side without system degradation such that the system retains full mission capability after reactivation.

3.4.1.1 Non-Deployed Storage Environment.

UISS shall survive this storage mode in environment specified in Section 3.6.3 Non-Operating Parameters without system performance degradation.

3.4.1.2 Short-Term Storage Capability.

a) Shall be able to be stored in short-term storage for up to 90 days.
b) UISS shall be capable of placement into or taken out of short-term storage in less than 24hrs (THRESHOLD)/12hrs (OBJECTIVE).
c) UISS shall be capable of short-term storage for short periods without special maintenance procedures.
d) UISS shall remain de-energized when in short-term storage, except as required, to support periodic cycles of maintenance.
e) While in short-term storage, the Off-board Component shall be able to perform Built-in-Test (BIT) and Preventive Maintenance (PM)/Fault Detection (FD)/Fault Localization (FL) (PM/FD/FL) to determine the system is functional and can meet required performance tests.

3.4.1.3 Long-Term Storage Capability.

a) UISS shall be able to be stored in long-term storage from 91 days to three years.
b) UISS shall be capable of placement into or taken out of long-term storage in less than 40hrs (THRESHOLD)/24hrs (OBJECTIVE).
c) Procedures and equipment shall be provided for placement and removal of UISS from long-term storage (e.g., remove engine fluids, add protective lubricants).
d) UISS shall remain de-energized during this mode, except as required to support periodic cycles of maintenance.
e) All other equipment comprising UISS shall be packaged IAW DoD Standard Practice for Military Packaging (military standard (MIL-STD)-2073-1) to preserve equipment and prevent degradation or damage.

3.4.2 Non-Deployed Training Mode.

3.4.2.1 Non-Deployed Training Environment.

In this mode, the Off-board and MPSF Components, configured with DSD, shall provide the capability to select and initiate self-paced tutorials embedded within the interactive electronic technical manual to execute playback of recorded mission data and digitally record all training session activity.

3.4.3 Non-Deployed Maintenance Mode.

In this mode, UISS shall be able to undergo routine maintenance, as well as, non-routine troubleshooting and repairs, and periodic overhauls.

3.4.3.1 Non-Deployed Maintenance Environment.

Routine maintenance activities include preparation of UISS for deployment and post-deployment preparation for storage.

3.4.3.2 Diagnosis and Troubleshooting.

This mode shall support diagnosis and troubleshooting of UISS, to include:

a) In-water tests;
b) In-water vehicle operations;
c) Installation of software or firmware upgrades;
d) Application of software security patches and updates.

3.4.4 Non-Deployed Transport Mode.

In this mode, UISS shall be configured for shipment by road, ship, and air as specified in Section 3.9.3 Transportability.

3.4.4.1 Non-Deployed Transport Environment.

UISS shall be capable of transport in all transport configuration(s) in the environment as specified in Section 3.6.3 Non-Operating Parameters without sustaining a level of damage that would degrade the full mission capability or limit use of support equipment.

3.5 Deployed State.

In this state, UISS shall be deployed on the LCS. UISS shall be capable of being in one of three modes: Sortie, Maintenance, and Stowed.

3.5.1 LCS Interface.

The Off-board and LCS Components shall interface with LCS for all necessary interfaces IAW LCS Interface Control Document (ICD) and the LCS Launch, Recovery, Handling, and Stowage (LRHS) Amplification Guide (AG).

3.5.2 Deployed Sortie Mode.

In this mode, the Off-board and LCS Components shall provide the primary operational capability to conduct remote, unmanned mine sweeping operations.

3.5.2.1 Deployed Sortie Environment.

The Sortie Mode environment is specified in Section 3.6.2 Operating Environmental Parameters.

3.5.2.2 Pre-Launch Capability.

a) Off-board and LCS Components shall be capable to perform pre-launch checks on all major subsystems to ensure system readiness immediately prior to launch.
b) Pre-launch checks shall be provided via BIT to the maximum extent practicable.

c) This will be the final opportunity for physical contact with the Off-board Components prior to a sortie or exercise.

3.5.2.3 Launch Capability.

a) The Off-board Components shall be capable for the safe, reliable launching from both LCS variants without any damage or degradation to the system or the ship.
b) No personnel shall be required to be off LCS in support craft, or in the water, to facilitate the launch operation.

3.5.2.4 Transit Capability.

a) The Off-board Component shall be capable of transit from host ship to operation area and vice versa.
b) The Off-board Component shall transit with sweep secured/retrieved, as applicable.

3.5.2.5 Mine Sweeping Capability.

a) Off-board Component shall be capable of full performance influence mine sweeping as specified in Section 3.8 Sweep System Performance.
b) Off-board and LCS Components shall provide the capability to achieve ACRS as specified in Section 3.8.1 ACRS.
c) Off-board Component shall provide the capability to execute sweep tracks in the mission plan.

3.5.2.6 Contingency Operations Capability. Contingency operations consist of two sub-capabilities: Sortie Abort and Emergency Stop.

3.5.2.6.1 Sortie Abort Sub-Capability.

a) Off-board and LCS Components shall provide the capability to allow the UVO to abort a preplanned sortie at anytime during execution of the sortie.
b) Off-board and LCS Components shall provide the capability to, after the SORTIE ABORT command is given, allow the UVO to:
    i. Send and begin a new sortie plan;
    ii. Transit Off-board Component to current LCS position or other location;
    iii. Restart the existing sortie at the point where it was aborted.

3.5.2.6.2 Emergency Stop Sub-Capability.

a) Off-board and LCS Components shall provide the capability to allow the UVO to command an emergency stop at any time to put the Off-board Component into a safe condition.
b) Safe condition shall be defined as one where all moving machinery and components that can pose a threat to equipment or personnel (e.g. rotating machinery, high voltage power) are positively secured and render the system dead in the water.

c) In this condition, the Off-board and LCS Components shall retain as much BIT/built-in test equipment (BITE) functionality and mission capability as possible given possible failure of particular sub-systems to enable the operators to troubleshoot and try to remotely restart the Off-board Component.

3.5.2.7 Recovery Capability.

The Recovery Capability consists of two sub-capabilities: Standard Recovery and Emergency Recovery.

a) Standard Recovery Sub-Capability. No personnel shall be required to be off-board in support craft, or in the water, to assist standard recovery operations to LCS throughout the environment as specified in Section 3.6.2 Operating Environmental Parameters.

b) Emergency Recovery Sub-Capability. Off-board Component shall be capable of emergency recovery during situations of a disabled or inoperable Off-board Component within the capabilities and constraints of LCS IAW LCS ICD and LCS LRHS AG. Personnel may be required to be off-board in support craft to assist with emergency recovery.

3.5.2.8 Turnaround Capability.

a) After recovery aboard LCS, Off-board and LCS Components shall be able to prepare system for a follow-up sortie.

b) Preparation shall include refuel of Off-board Component, off-load mission data from on-board data storage system and subsystem checks on all major subsystems to ensure system availability immediately prior to launch.

c) Pre-launch checks shall be provided via BIT to the maximum extent practicable.

3.5.2.9 Post-Mission Capability.

a) After recovery aboard LCS, Off-board and LCS Components shall be capable of being prepared for stowage.

b) Preparation shall include off-load of mission data from the on-board data storage system, post-recovery checks to determine system status for maintenance and repair planning prior to moving the craft to the stowage location.

3.5.3 Deployed Maintenance Mode.

a) In this mode, Off-board and LCS Components, at a minimum, shall provide the capability to perform Organizational-Level (O-Level) maintenance procedures on subsystems in preparation for sortie.

b) Procedures shall include, at a minimum, performance of BIT and PM/FD/FL to determine system is functional and can meet required performance tests (e.g. battery charging, fluid checks).

3.5.4 Deployed Stowed Mode.

In this mode, the Off-board Component shall be on the stowage cradle, tied down, hatches closed and all necessary electrical and LAN connections made with LCS.

3.6 Environmental Parameters.

The UISS environmental condition requirements are broken into three sections: those requirements which apply to all states and modes; those that apply only to operating modes; and those that apply only to non-operating modes. FIGURE 3. depicts the three aforementioned sections.

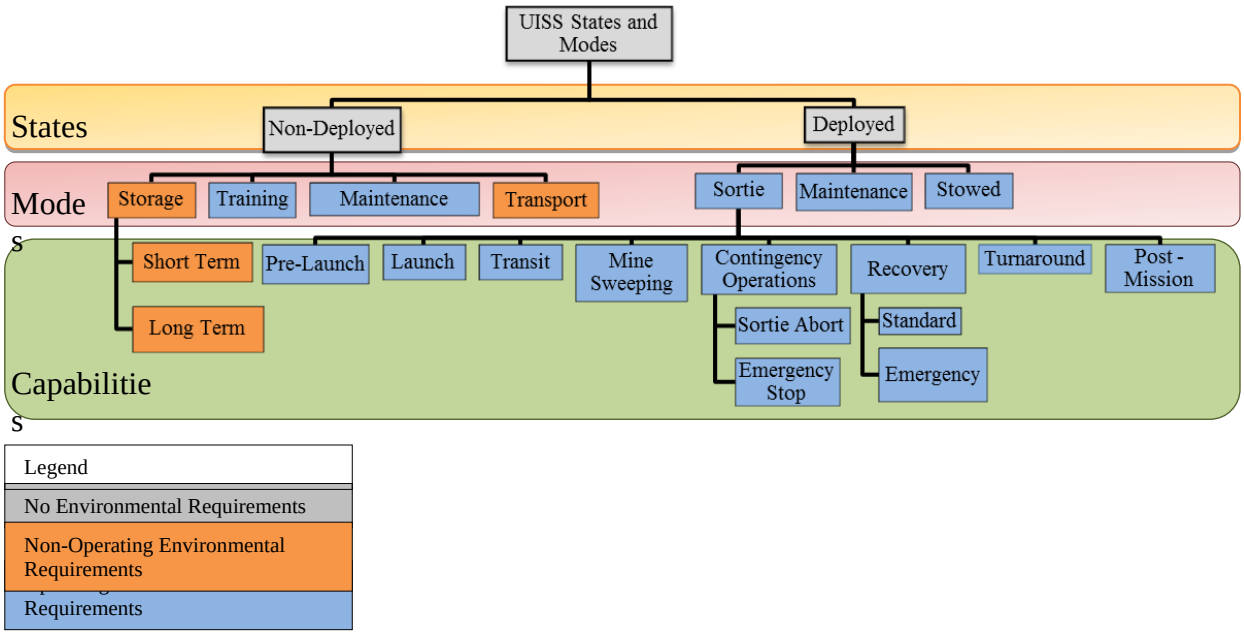


FIGURE 3. UISS environmental requirements

3.6.1 Overall Parameters.

The following environmental parameters apply to all states and modes.

3.6.1.1 Humidity.

UISS shall provide all capabilities as specified in Section 3.5 Deployed and Section 3.4 Non-Deployed States during and after exposure to 0-100% relative humidity conditions IAW Environmental Engineering Considerations and Laboratory Tests (MIL-STD-810G (Section 507.5)).

3.6.1.2 Salt Fog.

UISS shall be capable of all requirements as specified in Section 3.5 Deployed and Section 3.4 Non-Deployed States during and after exposure to salt fog conditions IAW MIL-STD-810G (Section 509.5).

3.6.1.3 Solar Radiation.

UISS shall be capable of all requirements as specified in Section 3.5 Deployed and Section 3.4 Non-Deployed States during and after exposure to solar radiation of sinusoidal variable levels ranging from 0-1120 W/m^2, throughout 16 hours of a 24-hour period.

3.6.2 Operating Environmental Parameters.

UISS shall operate in all Deployed Modes (Section 3.5) and Non-deployed Training (Section 3.4.2) and Non-deployed Maintenance Modes (Section 3.4.3) within environmental ranges specified in subsequent sections.

3.6.2.1 Daylight/Nighttime Operations.

UISS shall be capable of full sweeping and transit operations in bright sunlight to full darkness (moonless night) without use of artificial visible light.

3.6.2.2 Sea State (SS).

Sea State requirement is for three conditions of operation (TABLE I):

3.6.2.2.1 Normal Conditions. (THRESHOLD)

UISS shall maintain full mission capability.

3.6.2.2.2 Degraded Conditions. (OBJECTIVE)

UISS mission capability shall degrade gracefully, such that it may continue sweeping with reduced effectiveness.

a) The Off-board Components shall be able to retrieve any deployed sweep gear, if applicable, transit to a rendezvous point with LCS, and resume normal operation at full mission capability when the environment returns to Normal Conditions.

3.6.2.2.3 Survival Conditions. (THRESHOLD)

The Off-board Components with the sweep gear retrieved and secured, if applicable, shall survive environment and resume operations as the environment improves.

TABLE I. UISS environmental parameters

ENVIRONMENTAL PARAMETERS	THRESHOLD*	OBJECTIVE*
Normal Conditions	SS3	N/A
Degraded Conditions	N/A	SS4
Survival Conditions	SS5	N/A

**Reference Appendix A*

3.6.2.3 Operational Water Temperature.

Off-board Component shall be fully operational in water temperatures 32°F to 100°F without degradation throughout deployment.

3.6.2.4 Operational Air Temperature.

Off-board and LCS Components shall be fully operational in ambient air temperatures from -4°F to 115°F.

3.6.2.5 Icing/Freezing Rain.

Off-board and LCS Components are not intended for operation in icing/freezing rain.

3.6.2.6 Icing Conditions.

Off-board and LCS Components are not intended to operate in conditions that would result in the build-up of ice on the system.

3.6.2.7 Shipboard Shock and Vibration.

a) Off-board Component shall be IAW with Grade B requirements of Shock Tests, High Impact Shipboard Machinery, Equipment and Systems Requirements (MIL-S-901D) when in Stowed Mode on-board LCS.

b) LCS Components shall meet Grade B Class II shock requirements of MIL-S-901D when secured within the mission module (MM).

c) Off-board and LCS Components shall be able to meet shipboard vibration conditions IAW Mechanical Vibrations of Shipboard Equipment (MIL-STD 167-1A) in all states and modes aboard LCS as specified in all Deployed Modes (Section 3.5) and Non-Deployed Training (Section 3.4.2) and Maintenance Modes (Section 3.4.3).

3.6.2.8 Shipboard Red Light Operations.

Off-board Component capabilities shall be able to conduct pre-launch, launch, recovery, post-mission, and turnaround in red light conditions.

3.6.2.9 Salinity.

UISS shall be capable of operations in water with salinity greater than or equal to 20 Practical Salinity Units (PSU) (THRESHOLD)/10 PSU (OBJECTIVE).

3.6.3 Non-Operating Parameters.

Non-operating parameters apply to UISS in Non-Deployed State Storage Mode (Section 3.4.1) and Non-Deployed State Transport Mode (Section 3.4.4).

3.6.3.1 Transportation Altitude.

a) UISS shall withstand rigors (e.g., low pressure, rapid decompression) incurred in transportation by civilian or military aircraft, pressurized and non-pressurized, at a nominal altitude of 40,000 ft IAW MIL-STD-810G (Section 500.5).
b) It is assumed the system shall be defueled for air transport (internal and external).

3.6.3.2 Transportation and Storage Temperatures.

a) UISS shall be able to perform its mission after transport and/or after stored in Non-Deployed State (Section 3.4) in air temperatures from -40°F to 140°F when not affected by solar radiation.
b) UISS shall be able to perform its mission after transport and/or after stored in Non-Deployed State (Section 3.4) in air temperatures from -40°F to 125°F when exposed to solar radiation.

3.6.3.3 Transportation Accelerations and Vibration.

a) UISS shall be fully mission capable after exposure to shock and vibration conditions encountered in transportation by aircraft (internal & external), sea vessels, and over highways, secondary and tertiary roads.
b) Transport loads shall be IAW DoD Interface Standard for Transportability Criteria (MIL-STD-1366E) and Small Craft Transportability Design and Certification Process Guidance (NSWC CCD-23-TM-2009/64).

3.6.3.4 Sand and Dust.

UISS shall be fully operational, without degradation, after exposure to dry, blowing dust (e.g. Red China Clay) and sand conditions IAW MIL-STD-810G (Section 510.5).

3.6.3.5 Icing/Freezing Rain.

UISS shall be fully operational, without degradation, after exposure to freezing rain (glaze ice) or icing from salt water spray (e.g. soft rime ice), and at medium loading thickness conditions IAW MIL-STD-810G (Section 521.3).

3.7 Electromagnetic Interference and Electromagnetic Environmental Effects.

UISS must comply, and be compatible, with electromagnetic environments during operations aboard and around Navy surface ships IAW Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment (MIL-STD-461F) and Electromagnetic Environmental Effects, Requirements for Systems (MIL-STD-464C).

3.7.1 Electromagnetic Compatibility.

UISS shall be capable of operating in its own electromagnetic field.

3.7.2 Electromagnetic Susceptibility.

UISS shall not be affected by electromagnetic susceptibility values as required for Navy Surface Ships by MIL-STD-461F as follows:

a) Test Method RS101, Radiated Susceptibility, Magnetic Field, 30 Hz to 100 KHz.
b) Test Method RS103, Radiated Susceptibility, Electric Field, 2 MHz to 40 GHz.

3.7.3 Electromagnetic Emissions (EME).

a) UISS shall be capable of tactical emissions control IAW MIL-STD-464C when operated onboard LCS.
b) UISS, when it operates at designed capability without sweeping, shall not exceed EME values as required for Navy Surface Ships by MIL-STD-461F as follows:
    i. Test Method RE101, Radiated Emissions, Magnetic Field, 30 Hz to 100 KHz.
    ii. Test Method RE102, Radiated Emissions, Electric Field, 10 KHz to 18 GHz.

3.8 Sweep System Performance.

The following section details the ACRS, Effective Influence Depth (EID) and Influence Field requirements the Off-board Component shall meet.

3.8.1 Area Coverage Rate-Sustained (ACRS).

3.8.1.1 Mission Time Overview.

For purpose of determining the mission time, a mission begins with the initiation of the pre-mission preparations with the Off-board Component positioned in its stowage location on the LCS. After the preparation is completed, the Off-board Component is moved to the launch position. While in the launch position, the final pre-mission checks are performed. The Off-board Component is launched and the sortie starts. During the sortie, the Off-board Component transits to the operational area, deploys the sweep gear (if applicable) and begins sweeping the operational area. After sweeping a preplanned number of tracks, it retrieves the sweep gear (if applicable) and transits to a preplanned staging area where it is recovered by the LCS. Once on the LCS in the launch position, the Off-board Component is either prepared for another sortie

(turnaround) or prepared for moving to the stowage location. After a turnaround, the Off-board Component is launched for another sortie. After the final sortie, the Off-board Component is moved to its stowage location and secured. Post-mission activities are performed to download data and prepare the system for storage and maintenance. At that point, the mission is complete for timing purposes.

3.8.1.2 ACRS Definition.

The primary Measure of Effectiveness (MOE) is the ACRS IAW Standard Mine Warfare MOE and Measures of Performance (MOP) Program Executive Office Littoral Mine Warfare Instruction (PEO LMW INST) 3370.1A.

3.8.1.3 ACRS Value.

UISS shall have a minimum ACRS of [ACRS1] nm^2/day (THRESHOLD)/ [ACRS2] nm^2/day (OBJECTIVE). Values can be found in Annex A to UISS SRD (A-2.1, A-2.2).

a) ACRS is found by using Equation 1:

Equation 1 - ACRS

$$ACRS = \frac{Area_{Mission}}{T_{Mission}/24}$$

where,

$\mathrm{Area}_{\mathrm{Mission}}$ = total area swept in a mission (nm^2).

$\mathrm{T}_{\mathrm{mission}}$ = total time to perform the mission, including downtime for repairs and maintenance (corrective and preventative).

The area to be swept in a mission is defined as a mine danger area which is a rectangular area with dimensions of 4nm by 3nm.

Equations 2 through 11 shall be used to calculate the ACRS of the system. Parameters in TABLE II are specified by the Contractor. Parameters in TABLE III are specified by the Government.

TABLE II. Contractor-specified parameters

PARAMETER	VARIABLE	UNITS
Sortie rate based on system endurance (see limit in TABLE III)	Nsr	Sorties/day
Effective distance of the influence fields	$D_{influence}$	yds
Velocity during sweeping	V_{sweep}	kts
Time to turn at the end of a track	T_{turn}	hr
Velocity of transit to the operational area	V_{ta}	kts
Velocity of transit to the staging area	V_{sa}	kts
Time to deploy the sweep (if applicable)	T_{deploy}	hr
Time to retrieve the sweep (if applicable)	$T_{retrieve}$	hr
Time to perform a system turnaround between sorties	$T_{turnaround}$	hr
Time to perform pre-mission preparations	$T_{pre\text{-}mission\ prep}$	hr
Time to perform pre-mission checkouts in the launch position	$T_{pre\text{-}mission\ checkout}$	hr
Time to perform post-mission preparations in the launch position	$T_{post\text{-}mission\ prep}$	hr
Time to perform post-mission activities in the stowed position	$T_{post\text{-}mission\ activities}$	hr

TABLE III. Government-specified parameters

PARAMETER	VARIABLE	VALUE
Area Coverage Rate Sustained (Values can be found in Annex A to UISS SRD (A-2.1, A-2.2))	ACRS	ACRS1 (THRESHOLD) ACRS2 (OBJECTIVE) nm^2/day
Operational Availability	A_o	0.8 (THRESHOLD) 0.85 (OBJECTIVE)
Total Area to the swept in a mission	$Area_{Mission}$	$12nm^2$
Time to launch Off-board Component	T_{Launch}	45 min (Ref. LCS CDD)
Time to recover Off-board Component	$T_{Recover}$	45 min (Ref. LCS CDD)
Time to position Off-board Component	$T_{Position}$	45 min
Sortie rate	N_{sr}	≤3 sorties/day
Distance to operational area	D_{ta}	20nm
Distance to staging area	D_{sa}	20nm
Track length	L	4nm
Influence field to track spacing coefficient	C_{TS}	0.29

$T_{Mission}$ is found by rearranging Equation 1 to Equation 1b:

Equation 1b – $T_{Mission}$

$$T_{Mission} = \frac{Area_{Mission}}{ACRS} * 24 = \frac{12}{ACRS} * 24$$

Equation 2 relates total time under consideration to the time available for actively performing the mission:

Equation 2 - $T_{available}$

$$T_{available} = T_{Mission} * Ao$$

where,

$T_{available}$ = operational time available for performing the mission, after taking into consideration the system downtime (hr).

Ao = Operational Availability, as specified in Section 3.26.1 Operational Availability.

Equation 3 calculates the number of sorties performed during the mission time:

Equation 3 - N_s

$$N_s = \frac{T_{available}}{24} * N_{sr}$$

where,

Ns = number of sorties performed during the mission.

Nsr = sortie rate, or the number of sorties that can be performed in a day. This does not have to be an integer value.

Equation 4 provides the area that must be covered in a single sortie:

Equation 4 - $Area_{sortie}$

$$Area_{sortie} = \frac{Area_{mission}}{N_s} = \frac{12}{N_s}$$

where,

$Area_{sortie}$ =area to be covered in a single sortie (nm^2).

With the area to be covered in a single sortie determined, the time required to perform a sortie can be found. FIGURE 4. diagrams the various phases of the sortie and their times.

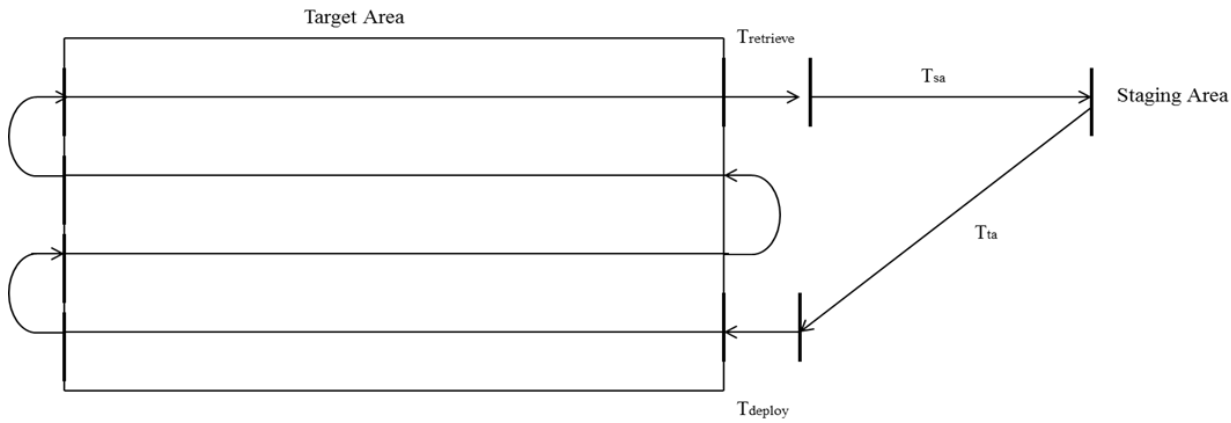


FIGURE 4. Operation times

Equation 5 provides the distance between each track based on the influence field:

Equation 5 - D_{TS}

$$D_{TS} = C_{TS} \times D_{influence}$$

where,

D_{TS} = track spacing distance (yd).

C_{TS} = effective influence field distance to track spacing distance coefficient (value).

$D_{influence}$ = effective distance where both the magnetic and acoustic influence fields satisfy the influence field requirements (yd) at the EID.

Note: The effective influence field distance to track spacing distance coefficient (C_{TS}) accounts for the sweep tactics methodology that takes place during mission planning. The planning derives track spacing for the influence field performance against the anticipated target. The variable, $D_{influence}$, is the effective distance where both the magnetic and acoustic influence fields satisfy the influence field requirements and is equivalent to the outer extent of the probability of actuation vs. lateral range [P(y)] curve. Reference PEO LMW INST 3370.1a for more information on P(y) curves and track spacing.

Equation 6 provides the number of tracks required to cover the defined area:

Equation 6 - N_T

$$N_T = \frac{Area_{sortie}/L}{D_{TS}/2025.4}$$

where,

N_T = number of tracks required to cover the operational area, this is rounded up to the next highest even number so that the Off-board Component returns to the same side of the field that it started on.

L = length of the tracks (nm).

Equation 7 provides the time to sweep the operational area:

Equation 7 - T_{sweep}

$$T_{sweep} = N_T \times \frac{L}{V_{sweep}} + (N_T - 1) \times T_{turn}$$

where,

T_{sweep} = time to sweep the operational area (hr).

V_{sweep} = average speed of the system while performing sweep operations (kts).

T_{turn} = time to turn at the end of each track (hr).

Equation 8 provides the time to transit to the operational area:

Equation 8 - T_{ta}

$$T_{ta} = \frac{D_{ta}}{V_{ta}}$$

where,

T_{ta} = time to transit from the staging area to the operational area (hr).

D_{ta} = distance from the staging area to the operational area (nm).

V_{ta} = average speed from the staging area to the operational area (kts).

Equation 9 provides the time to transit to the staging area:

Equation 9 - T_{sa}

$$\boldsymbol{T_{sa} = \frac{D_{sa}}{V_{sa}}}$$

where,

T_{sa} = time to transit from the operational area to the staging area (hr).

D_{sa} = distance from the operational area to the staging area (nm).

V_{sa} = average speed from the operational area to the staging area (kts).

Equation 10 provides the total time to complete a single sortie, from the departure from the staging area to the return to the staging area:

Equation 10 - T_{sortie}

$$T_{Sortie} = T_{ta} + T_{deploy} + T_{sweep} + T_{retrieve} + T_{sa}$$

where,

T_{Sortie} = total time required to complete a single sortie (hr).

T_{deploy} = time to deploy the sweep gear, if applicable (hr).

$T_{retrieve}$ = time to retrieve the sweep gear, if applicable (hr).

Equation 11 calculates the total time for the system to complete a mission, based on system parameters:

Equation 11 – $T_{Mission\text{-}sys}$

$$\begin{aligned} T_{Mission-sys} = {} & T_{Pre-Mission\ Prep} + T_{Positioning} + T_{Pre-Mission\ Checkout} + N_s T_{Launch} \\ & + N_s T_{Sortie} + N_s T_{Recover} + (N_s - 1) T_{Turnaround} + T_{Post-Mission\ Prep} \\ & + T_{Positioning} + T_{Post-Mission\ Activities} \end{aligned}$$

where,

$T_{\text{Pre-Mission Prep}}$ = time for mission preparation of the Off-board Component in stowage position (hr).

$T_{\text{Positioning}}$ = time to position Off-board Component from the stowage position to the launch position and vice versa (hr). This time is also referred to as “handling time”.

$T_{\text{Pre-Mission Checkout}}$ = time to checkout the Off-board Component prior to launch from LCS (hr).

N_s = number of sorties performed during the mission.

T_{Launch} = time to launch the Off-board Component (hr). This is defined as starting when the LCS slows to launch speed and maintains best heading for launch, and lasts until the Off-board Component releases the tow line and the LCS is free to maneuver.

T_{Sortie} = the time required to perform a sortie (hr).

T_{Recover} = time to recover the Off-board Component (hr). This is defined as starting when the LCS slows to recover speed and maintains best heading for recovery, and lasts until the system is secured in the launch position.

$T_{\text{Turnaround}}$ = time to prepare the Off-board Component for another immediate sortie (hr). This includes all activities between recover and launch, and may include activities also included in the pre-mission check. At a minimum, this shall include refueling and data download. All turnaround activities are performed at the launch position and do not need to include handling times.

$T_{Post-Mission\ Prep}$ = time to prepare the Off-board Component for movement from the launch position to the stowage position (hr).

$T_{Post-Mission\ Activites}$ = time to perform post-mission checks, download data, and prepare for stowage and maintenance (hr).

If $T_{Mission-sys}$ is greater than the $T_{available}$ as calculated in Equation 2, then the design will not meet the ACRS requirements.

The total mission time actually required for this system to cover the area can be found by rearranging Equation 2 to Equation 2b:

Equation 2b – $T_{Total\text{-}sys}$

$$T_{Total-sys} = \frac{T_{Mission-sys}}{Ao}$$

This allows Equation 1 to be used to solve for the system's ACRS:

Equation 1

$$ACRS_{sys} = \frac{Area_{Mission}}{T_{Total-sys}/24} = \frac{12}{T_{Total-sys}/24}$$

3.8.2 Effective Influence Depth (EID).

a) The EID is defined as the depth required for mine actuation at the Effective Influence Distance ($D_{influence}$).

b) EID is measured in feet of depth, from the ocean surface to the mine sensors.

3.8.2.1 Minimum Operating Depth.

The Off-board Component shall be capable of sweep operations in water depths greater than or equal to 40ft.

3.8.2.2 EID Value.

The Off-board Component shall be capable of an EID of a minimum of [EID1] (THRESHOLD)/ [EID2] (OBJECTIVE). Values can be found in Annex A to UISS SRD (A-3.1, A-3.2).

3.8.2.3 Effect of Depth on Influence.

FIGURE 5. illustrates that $D_{influence}$ decreases with increasing depth.

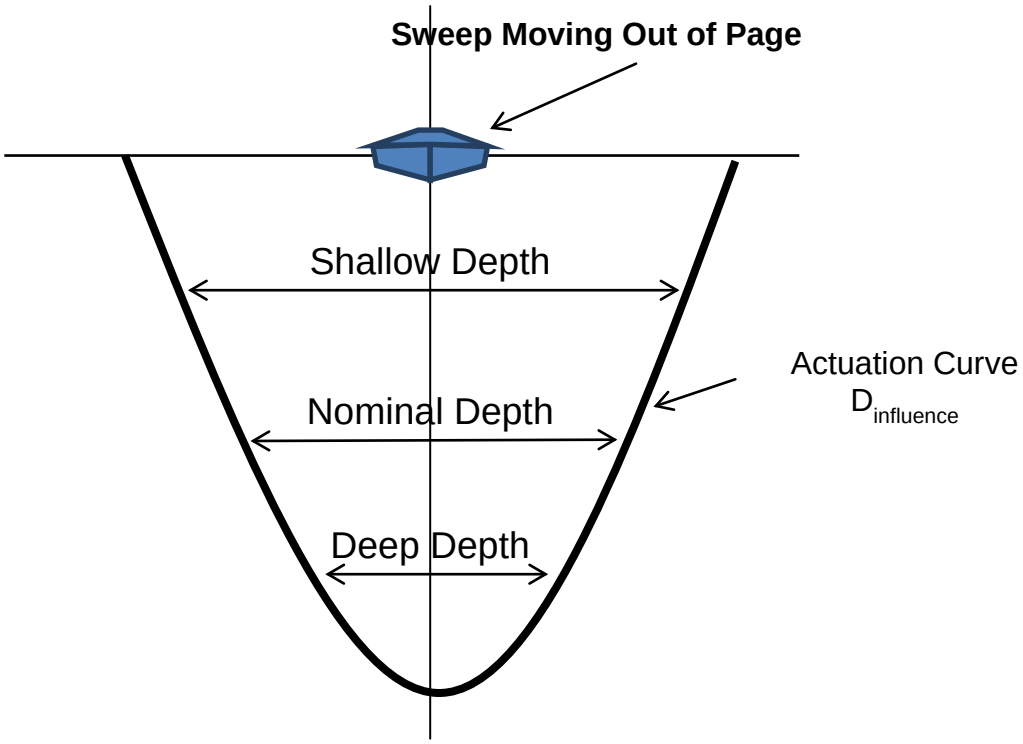


FIGURE 5. Effect of depth on $D_{influence}$

3.8.2.4 Influence Field Requirements.

Sweep system shall produce magnetic and acoustic influence fields with characteristics as specified in Annex A UISS SRD (A-4) to trigger mines.

3.8.3 Sweep Subsystem Operational Data.

a) Sweep system health, status and operation data shall be monitored by the system and reported IAW Human-Robot Interaction (HRI) Functional Area Analysis (FAA) Process: USV (NSWCCD-23-TM-2012/09) to the operator in near real-time.

b) System health data and recording of data shall be as specified in Section 3.15.2 Health Monitoring.

c) The Off-board Component shall be capable to provide the magnitude and location of the magnetic and acoustic fields.

3.8.4 Mine Fire Detection.

a) Off-board Component shall provide the capabilities to detect, record, and report mine detonations as they occur during the mission.

b) Off-board and LCS Components shall correlate detection time with the Off-board Component's position data at time of detection.

3.9 Hardware Integration Requirements.

a) Off-board and LCS Components shall meet LCS ICD and LCS LRHS AG for Sea Type 1 MM for integration with both LCS variants.

b) Overall dimensions of Off-board Component shall fit within LCS Sea Type 1 MM IAW LCS ICD and LCS LRHS AG.

3.9.1 Launch and Recovery Compatibility with all LCS Configurations.

a) Off-board Component shall be capable, in all load conditions, of L&R with both LCS variants IAW LCS ICD and LCSLRHS AG.

b) Off-board Component's hull, appendages, and thru-hulls shall not interfere with LCS L&R equipment.

c) Off-board Component, assuming raw water is available for cooling, shall be able to run indefinitely in the Surface Tow Cradle (STC) and without damaging the STC.

3.9.2 System Weight & Center of Gravity.

a) USV Lightship weight shall include a 2.5% Service life margin at delivery (TABLE IV).

b) Sweep system weight shall include a 2.5% Service life margin at delivery (TABLE IV).

TABLE IV. Loading conditions

LOAD CONDITION	DESCRIPTION
Lightship	USV complete and ready for service with all operating fluids, zero consumables (fuel), and no Sweep system
Full Load (Launch)	Lightship plus Sweep system, all consumables
Minimum Operations	Lightship plus Sweep system and 10% consumables

c) Off-board Component Full Load weight including entrained water shall not exceed LCS L&R capabilities IAW LCS ICD and LCS LRHS AG.

d) Longitudinal Center of Gravity of the vehicle at Full Load and Minimum Operations Load shall be within LCS limits for both variants IAW LCS ICD and LCS LRHS AG.

e) The support container weight shall not exceed the weight limit IAW LCS ICD and LCS LRHS AG.

3.9.3 Transportability.

a) Small Craft Transportability Design and Certification Process Guidance Rev B (NSWCCD-23-TM-2009/64) shall be used for design and certification of transportability.

b) The Off-board Component shall be capable of the following modes of transport IAW MIL-STD-1366E:

   i. Over the road on its trailer.

   ii. It shall not exceed a height of 138in (THRESHOLD)/120in (OBJECTIVE) on its road trailer.

   iii. On a commercial 18-wheel tractor-trailer on its trailer and on the LCS Stowage Cradle.

   iv. On a ship on both its trailer and on the LCS Stowage Cradle.

   v. As internal air cargo onboard C-5 and C-17 on its trailer and on the LCS Stowage Cradle.

3.9.3.1 Helicopter Transport.

The Off-board Component shall be capable of transport as external air cargo via CH-47 helicopter IAW Design Criteria Requirements for the Certification of Sling Loaded Military Equipment for External Transportation by DoD Helicopters (MIL-STD-913).

3.9.3.2 Air Transport.

a) The Off-board Component on its trailer and on LCS Stowage Cradle shall be designed for air transport certification IAW Designing Internal Aerial Delivery (military handbook (MIL-HDBK)-1791).

b) Tie-downs for transport shall be IAW Interface Standard for Lifting and Tie-down Provisions (MIL-STD-209).

3.9.4 Fire Retardency and Toxicity.

Materials used in the Off-board and LCS Components shall meet the fire performance criteria IAW Composite Materials, Surface Ship, Topside Structural and other Topside Applications-Fire Performance Requirements (NAVSEA DDS-078-1):

a) Flame spread index American Society of Testing and Materials (ASTM) E 84 Test Method: 25 max.

b) Smoke index (ASTM E 84 Test Method): 50 max.

c) Fire gas toxicity (ASTM E 662/ASTM E 800): carbon monoxide: 600 parts per million (ppm); hydrogen chloride: 30 ppm; hydrogen cyanide: 30 ppm; Immediate Danger to Life or Health Index: less than one.

3.9.4.1 Non-Commercial Off-the-Shelf (COTS) Cables.

Non- COTS cables used in the Off-board and LCS Components shall comply with Detail Specification: Cables, Lightweight, Electric for Shipboard Use (military detail specification (MIL-DTL)-24640) or Detail Specification: Cable, Electrical, 600 Volts, Types LSSHOF, LSDHOF, LSTHOF, LSFHOF (MIL-DTL-24643).

3.9.5 Structural Fittings.

3.9.5.1 Lifting Fittings.

a) Off-board Component shall be able to be lifted by a crane using a four-leg, single-point lift sling.

b) Sling(s) and lifting fittings shall be designed and built with a Factor of Safety (FOS) of six (6) on the Ultimate Strength of the ultimate material strength IAW Hoisting System Design and Certification Process Guidance Rev B (NSWCCD-23-TM2009/33).

c) Lifting fittings shall be capable of lifting the Off-board Component in the Full Load Condition and trailer or cradle as a unit using the lifting fittings on the craft with an FOS of five (5) on Ultimate Material Strength.

d) Off-board Component shall interface with lifting arrangements identified in LCS ICD and LCS LRHS AG.

e) Use of the LCS spreader bars, as represented in the LCS ICD, to align hoisting loads within LCS to those of the single-point lift sling (THRESHOLD)/No use of the LCS spreader bars (OBJECTIVE).

3.9.5.2 Line Capture Mechanism (LCM).

a) Automated/Automatic LCM shall be provided and installed to interface with LCS tow line IAW LCS ICD and LCS LRHS AG.

b) LCM and its attachment to the hull shall be designed IAW USN Bow Eye Design Criteria for USV Launch and Recovery (NSWCCD-23-TM-2006/27).

c) As a safety release, the LCM shall be set to automatically open below a load that will damage the equipment.

d) LCM shall be able to release the line upon command from any of the operator control interfaces.

3.9.5.3 Mooring and Tow Fittings.

a) Off-board Component shall be equipped with an emergency tow fitting designed for use in high sea states where craft may be disabled and/or it may be unsafe to transfer personnel onboard or pull another vessel along-side to rig a more conventional towing bridle to other deck fittings.

b) Tow fittings shall be designed and installed with a FOS of five (5) on Ultimate Material Strength and shall be installed on the craft IAW Towing Fitting Design and Certification Process Guidance Rev B (NSWCCD-23-TM-2009/65).

c) Off-board Component shall be equipped with mooring fitting to secure the craft to a dock or pier IAW Mooring Fitting Design and Verification Process Guidance (NSWCCD-23-TM-2011/38).

3.9.6 Propulsion Engine, Marine Gear, & Generator Requirements.

a) Off-board Component shall be capable of operating all engines and generators, as applicable, within LCS using cooling water and exhaust interfaces IAW LCS ICD and LCS LRHS AG.

b) Off-board Component shall operate using Diesel Fuel Marine, Distillate Marine Fuel A, and Off Highway Number 2 Diesel (to include ultra low sulfur (less than 15ppm) diesel fuels).

c) Engines and drive systems shall have the capability to run without cooling water (i.e. without external source) for one minute (THRESHOLD)/five minutes (OBJECTIVE).

d) The average fuel consumption of all Off-board Components over the course of one sortie shall be less than 40 gallons per hour (gph) (THRESHOLD)/25gph (OBJECTIVE).

3.9.7 Fuel System.

a) Off-board Component shall be capable of taking on fuel from LCS via connections IAW LCS ICD and LCS LRHS AG.

b) Off-board Component shall be capable of de-fueling/stripping all fuel tanks while on LCS and interfacing with connections IAW LCS ICD and LCS LRHS AG.

3.9.8 Lube Oil Change System.

Engines, generators, and marine gears shall be equipped with the Fast Lube Oil Change System or functional equivalent to facilitate rapid oil changes.

3.9.9 Freshwater Washdown.

Off-board Components shall be capable of freshwater washdown provided by LCS IAW LCS ICD and LCS LRHS AG.

3.9.10 Shore Power System.

a) Off-board Component shore power system shall be compatible with LCS supplied power IAW LCS ICD and LCS LRHS AG.

b) Off-board Component, with the exception of influence sweep generator(s), shall be capable of being powered indefinitely from a shore power connection(s).

c) Off-board Component shore power connection shall provide power to safely operate the system pier-side, on shore or in the water, within LCS, and to properly store the craft.

3.9.11 Data.

3.9.11.1 LAN Connection.

Off-board Component shall have the capability to interface with LCS LAN IAW LCS ICD and LCS LRHS AG to support upload and download of all mission data.

3.9.12 Data Storage System.

a) Off-board Component shall have a removable data storage system(s) that can be swapped out between sorties for PMA.
b) The system(s) shall be readily accessible during Turnaround and Post-Mission Capabilities.
c) The storage system(s) shall be compatible with MPCE and support PMA.
d) Off-board Component recorded data shall be stored in an industry standard database or clear-text format.

3.9.13 Voice.

Off-board and LCS Components shall provide the capability for UVDO to communicate with the UVO and LCS via LCS LAN IAW LCS ICD and LCS LRHS AG.

3.9.14 Multi-Vehicle Communication System (MVCS).

a) MVCS is part of the MCM MP and is not under the development or control of the UISS Program.
b) UISS shall interface with MVCS (GFP) on board the Off-board Component IAW MVCS ICD.
c) Off-board Component shall provide space, weight, power reservations, and install MVCS (GFP) equipment IAW MVCS ICD.
d) Off-board Component shall provide antenna(s) including all required antenna amplifiers and cabling to interface with MVCS IAW MVCS ICD.
e) Primary MVCS LOS antenna shall be mounted 18ft above the Off-board Component Full Load waterline.

3.10 Software Interface Requirements.

a) All software (OIS, MPCU, & Off-Board Component) shall interface both internally and externally IAW Society of American Engineers (SAE)-AS4 Joint Architecture for Unmanned Systems Standards (SAE-AS4 JAUS).

b) All software (OIS, MPCU, & Off-Board Component) shall interface with MVCS IAW External Interface Design Document (EIDD) for the LCS MVCS, (NSWCPC-MVCS-EIDD).

3.10.1 OIS Software.

a) OIS shall execute within the MPCE IAW MPCE Reference Architecture Document and MPCE Design and Implementation Specification.

b) OIS shall interface with Mission Package Application Software (MPAS) IAW Interface Design Document (IDD) for the Unmanned Vehicle Management System (UVMS) (NSWCPC-MCM-MPAS-UVMS-IDD).

c) OIS shall store MEDAL data to the MPCE Network Storage Device IAW MPCE ICD.

d) OIS shall integrate with the Mission Package Services (MPS) software to a Level 2 at a minimum IAW MPS to MM Integration Requirements Specifications (IntRS) (IntRS 1773-C-1250).

3.11 Modularity Open Systems Architecture (MOSA)/Open Architecture.

UISS shall employ MOSA and shall have the following characteristics:

a) Use publicly available standards specifications, and protocol established and maintained through a consensus process, preferably by an internationally-recognized governing group.

b) Well-defined, widely-used, non-proprietary interfaces, services and formats.

c) Employment of modular design principles (e.g., cohesion, encapsulation, de-coupledness) that facilitate component replacement.

d) Upgradeable modules that enable the incorporation of additional or more-capable components with minimum impact, requiring little or no changes to the overall system.

e) MOSA compliance shall be a minimum of 85% as calculated by the Open Architecture Assessment Tool.

f) MOSA compliance shall be a minimum level of “satisfactory” as calculated by the MOSA Program Assessment and Rating Tool.

3.12 Information Assurance (IA) & Program Protection.

a) UISS shall be IAW Chief of Naval Operations (CNO) Navy IA Program (OPNAVINST 5239.1C) and Information Assurance (DoD Directive (DODD) 8500.01E) which establishes the IA policies and procedures for all Navy systems that process, store, display and/or transmit DoD information.

b) UISS shall incorporate measures to protect information by ensuring confidentiality, integrity, availability, authentication, and non-repudiation. Confidentiality assures

information is not disclosed to unauthorized individuals, processes, or devices. UISS shall also incorporate measures for disaster recovery and continuity of operations.

c) UISS shall prevent unauthorized access to software and collected data IAW OPNAVINST 5239.1C to include, but not limited to, the following additional requirements:

d) UISS shall protect from disclosure to unauthorized entities, any information that discloses the Navy's operational intent or areas of interest.

e) UISS shall protect from disclosure to unauthorized entities, any information that discloses the host ship's location.

f) UISS shall provide means to sanitize the system in a non-destructive manner, including electronic data storage devices, in order to declassify the system, when necessary, IAW Department of Navy (DON) Remanence Security Guidebook (NAVSOP-5239-26) and National Security Agency guidelines for cryptographic key zeroization methods.

g) UISS shall maintain the confidentiality, integrity, and availability of DoD classified information and unclassified information that has not been approved for public release during transmission.

h) The transmission of DoD information shall be protected through communications security (COMSEC) measures and procedures set forth by the Assistant Secretary of Defense for Networks and Information Integration /DoD Chief Information Officer (CIO) in “Communications Security” (DoD Instruction (DODI) 8523.01). DoD policy requires:

   i. COMSEC materials shall be developed, acquired, operated, maintained, and disposed of through the approved methods set forth in DODI 8523.01.

   ii. A program to ensure operational availability of commonly used COMSEC equipment during crisis or contingencies shall be established and maintained.

   iii. COMSEC equipment shall be compatible with DoD-approved key management systems.

   iv. Controlled cryptographic items, classified cryptographic devices and unencrypted keying material shall be accounted for.

i) The UISS Program shall describe the security measures to protect all aspects of the UISS system to include the protection of classified information, critical program information, and/or critical components to meet DoD security and IA requirements. This information shall be reflected in an IA Strategy Plan IAW DON CIO IA Strategy Guidance.

j) In order to meet the IA standards for COTS products, the acquisition of all IA and IA-enabled COTS hardware and/or software shall be limited to products that have been evaluated or validated through either the International Common Criteria, the National

Information Assurance Partnership Evaluation and Validation Program, or the Federal Information Processing Standard Validation Program.

k) IAW Operation of the Defense Acquisition System (DODI 5000.02) and Critical Program Information (CPI) Protection within the Department of Defense (DODI 5200.39), a comprehensive program protection and technology control plan shall be adhered to throughout the acquisition system lifecycle to support program protection efforts.

l) A Program Protection Plan (PPP) shall be prepared for the UISS Program to guide these efforts.

   i. As part of the Program Protection requirements, the UISS Program shall identify CPI)/Critical Technologies (CT) inherent in the system or inherited from external systems, and shall perform a Criticality Analysis (CA) for Supply Chain Risk Management (SCRM) to determine mission critical components that may result in catastrophic or critical protection failures due to operational, system information, or component integrity aspects.

   ii. The CA shall result in the identification of these UISS mission critical components.

   iii. A UISS PPP shall be IAW Deputy Assistant Secretary of Defense, Systems Engineering Program Protection Plan Outline and Guidance (DASD SE PPP O-G).

m) The Directive-Type Memorandum 09-016"Supply Chain Risk Management (SCRM) to Improve the Integrity of Components Used in DoD Systems" (DTM 09-016) shall be adhered to for the mitigation and management of supply chain risk for any critical components that may be identified through the CA process.

n) An Anti-Tamper Plan (ATP) shall be required if any CPI/CT are identified for the UISS Program ATP which is a classified annex to the PPP, shall be properly implemented to deter efforts of foreign control of any CPI/CT or critical components due to battlefield loss or foreign sales.

3.12.1 IA Certification.

UISS shall be IA certified and accredited for operation:

a) UISS shall be IAW DoD IA Certification and Accreditation (C&A) Process (DIACAP) (DODI 8510.01) which establishes the DoD-mandated process by which UISS shall be certified as meeting a set of IA security requirements and then will be accredited for operation.

b) As a Platform Information Technology system, UISS is exempt from the full DIACAP C&A process, and is regulated by Implementation of NAVSEA Afloat IA Governance and Guidance (NAVSEAINST 9400.2A) establishing afloat IA governance and guidance, and therefore shall follow the policies and guidance IAW

NAVSEA Afloat Information Assurance Implementation Manual (NAVSEA 9400.2-M).

3.13 Personnel.

UISS shall ensure that personnel providing IA services, such as installation, patching and vulnerability management of a DoD Information System are certified and accredited IAW Information Assurance Training, Certification, and Workforce Management (DODD 8570.01) for the IA functions they will perform on the UISS system.

3.14 Command, Control, Communication, and Computers (C4) Requirements.

3.14.1 C4 Elements.

C4 subsystem shall include all the hardware and software elements required to command and control the Off-board Component from LCS, the host platform. It includes the following elements:

a) Control system on the Off-Board Component.

b) OIS for USV and sweep subsystem control and status.

c) MPCU software for tele-operation during L&R.

d) USV-mounted components of the MVCS for host to Off-board Component communications.

3.14.2 C4 System Requirements.

a) The C4 system shall have an A_o of 0.99 IAW Operational Availability Handbook: A Practical Guide for Military Systems, Subsystems and Equipment (OPNAVINST 3000. 12A).

b) During an operation all C4 data shall be recorded and stored onboard the Off-Board Component for transfer to MPCE for archive, PMA, and diagnostic support.

c) During operation all C4 data passing through the OIS shall be recorded and stored within MPCE for archive, PMA, and diagnostic support.

d) Processing of C4 data that is critical for safety of craft operations shall take priority over all other data elements.

e) C4 shall be divided into two sub-systems, the C4 computer environment (C4CE) and C4 systems automation (C4SA).

f) C4CE performs the higher level C4 processing functions, including mission planning, mission execution, high bandwidth sensor processing and data storage.

g) C4SA shall utilize COTS, ruggedized, mobile processors for low-level control and automation of core craft systems. Core systems are those systems and associated

control capabilities required to safely operate and maintain the craft under manual control (e.g. electrical distribution, engines, generators, bilge pumps).

3.14.3 C4SA System.

C4SA shall support all automated tasks identified as specified in the HRI FAA.

3.14.3.1 Intercommunication with C4CE.

C4SA shall use controlled area network bus (CANbus) (SAE J1939 or National Marine Electronic Association 2000) for intra-communication between core systems, as well as, for inter-communication with the C4CE.

3.14.4 Automatic Identification System (AIS).

3.14.4.1 The Off-board Component shall have an AIS which shall be controlled remotely by the UVO.

3.14.4.2 Tools and Test Equipment.

The Off-Board Component shall have the capability to accept tools and test equipment enabling an independent radio transmission to positively put the Off-Board Component in a safe state as specified in Section 3.20.3.2 Emergency Stop.

3.14.5 Navigation.

3.14.5.1 Navigation Methods.

The Off-board and LCS Components shall provide the following navigation methods, as selected by the UVO:

a) Manual navigation tele-operation: off-board system to be navigated via tele-operation. System perception sensors provide feedback to the UVO to allow safe navigation.
b) Track navigation per the mission plan following the MEDAL path. Off-board system to follow the MEDAL provided or separately developed track. This is similar to an autopilot where the Off-board Component goes from waypoint to waypoint. The UVO will monitor the system.
c) Obstacle avoidance navigation.

3.14.5.2 Navigation Method Transition.

Transition from C4 to manual control and vice versa shall allow for the graceful and safe transition between any methods of navigation and be safe IAW Unmanned Systems Safety Guide for DoD Acquisition (2007) and the Navy System Safety Program (OPNAVINST 5100.24B).

3.14.5.3 Global Positioning System (GPS).

a) All geodetic position computations, navigation calculations, and data displays in the Off-board and LCS Components shall be based on DoD World Geodetic System 1984 (WGS84) global geodetic reference frame.

b) The Off-board Component shall have two, fully redundant Selective Availability Anti-Spoofing Module-compliant GPS Systems.

3.14.5.4 Cross Track Error.

The Off-board Component shall have a cross track error less than 20yds.

3.14.6 Navigation Rules Compliance.

a) The Off-board Component shall comply with "Navigation Rules, International/Inland" US Coast Guard Commandant Instruction (COMDTINST) M16672.2D.

b) The Off-board Component shall comply with the Navigation Safety Advisory Council (NAVSAC) Resolution 11-02.

3.14.7 Obstacle Avoidance Capability.

a) Off-board and LCS Components shall provide obstacle detection and avoidance capability to reduce the possibility of the Off-board Component colliding with surface objects.

b) Off-board and LCS Components shall be able, in all modes of operations, to perceive a 24ft small boat (assume 7M Navy standard rigid-hull inflatable boat (RHIB) and all speeds up to 30kt in any relative direction) and any charted, fixed obstacles and navigational aids at a range that allows the UVO to avoid collision and, if applicable, avoid damage to any deployed sweep equipment.

c) OIS shall provide the UVO the capability to initiate pre-programmed avoidance maneuvers and get Off-board Component back on route.

d) OIS shall provide the UVO the capability to manually maneuver to avoid objects at any time.

3.15 Human Systems Integration.

3.15.1 Operator Interfaces.

Personnel (e.g. operator, maintainer) interfaces shall be IAW US DoD Design Criteria Standard: Human Engineering (MIL-STD 1472G) and Human Engineering Requirements for Military Systems, Equipment, and Facilities (MIL-STD-46855).

3.15.1.1 Operator Console.

The LCS Components shall utilize existing LCS MP consoles IAW LCS ICD and LCS LRHS AG.

3.15.1.2 UVO Monitoring and Control of Off-board Component.

a) The Off-board Component shall be capable of operation by a single UVO using OIS on one LCS MP Common Console.
b) OIS shall provide the capability to positively transfer control of the Off-board Component between the MP Common Console and to, and take control from, the MPCU.
c) Manual control shall always override automated control (e.g. waypoint navigation and subsystem automation).

3.15.2 Health Monitoring.

a) The Off-board and LCS Components shall provide relevant near real-time information to UVO regarding the input, output, response monitoring information, and equipment source identification for all automated equipment, as specified in the HRI FAA.
    i. This data shall be recorded, stored and archived for PMA.
b) The Off-board and LCS Components shall provide system diagnostic and prognostic information, as specified in the HRI FAA.
    i. This data shall be recorded, stored and archived for PMA.

3.16 Fault Management (FM) and Fault Localization (FL).

The Off-board and LCS Components shall identify/include:

a) The passive FM assets and tools for the systems and subsystems to include identification of the alarms and alerts that occur and are recorded. Passive FM shall only provide the information that identifies the lowest replaceable/repairable unit (LRU) it is monitoring is intelligent enough to generate an error and report it to the management tool.
b) The active FM assets and tools for the systems and subsystems that have the capability to ping the system or LRU and receive a response. If the system or LRU does not respond, the system shall alarm and allow for the proactive correction of the problem, return to a safe state or condition, or require operator input.
c) Any tools, test equipment, or procedures for diagnosing, testing, or repairing faults when a failure occurs.
d) All of these functions for the system or subsystems shall be able to, in near-real-time, provide personnel (e.g. operator, maintainer) information on localization of faults encountered while in all states and modes.

3.16.1 FM/FL Capabilities.

The Off-board and LCS Components shall identify the following capabilities for the active and passive FM/FL for the systems and subsystems:

a) Detect;
b) Isolate;
c) Correct malfunctions;
d) Compensate for environmental changes;
e) Include error logs;
f) Accept and act on error detection notifications;
g) Trace and identify faults;
h) Sequences and perform diagnostics tests;
i) Correct faults;
j) Reporting error conditions and identifies location to trace faults by examining and manipulating system reporting information.

3.16.2 FM/FL Messages.

All sensors, recorders, and reasoning devices shall provide accurate and predefined non-ambiguous messages to the operator/maintainer.

a) These messages shall provide status information for both normal and abnormal conditions.

b) Messages shall be IAW MIL-STD-1472G.

3.17 Built-In-Test (BIT).

The Off-board and LCS Components shall identify:

3.17.1 Automatic and Semiautomatic Features.

a) All internal automatic or semiautomatic features in the system or subsystem design that will detect, diagnose condition, or isolate failures by interrogating a system or monitoring system performance. These shall be identified as: Powering on BIT (PBIT);

b) Continuous BIT (CBIT);

c) Operator Initiated Bit (OBIT);

d) Built-in-Test diagnostics (BITD).

3.17.2 Hardware and Software Failures.

All BITD or software routines that execute any sequence that will identify system status to include failure or potential failure of the hardware or software elements in the system or subsystem to the LRU.

3.17.3 Analysis Tools.

Analysis tools for the overall system status as required to support the integration of all systems and subsystems.

3.17.4 False Alarm Percentages.

False alarm percentages for each BIT/BITE sequence or sequences.

3.17.5 System Status.

System status during the test for example "NOT READY for Operation" and "Initiate system start up". The system status shall be provided for all tests in all states and modes.

3.17.6 Test Equipment.

Any device that is part of the UISS equipment or system that will be used for the purpose of testing the equipment or system.

3.17.7 Procedures.

The procedures used to initiate the test sequences:

a) Sequence of test events to include buttonology and hookups for off-board/onboard hardware/software.

b) Define systems status and messaging that will be shown to indicate failure or potential failures.

c) Define action required to return the equipment to ready for use status based on messages.

d) Define items that must be referred to an Intermediate (I)- or D-Level maintenance facility for further evaluation or testing.

3.17.8 Incorporation of COTS.

Any COTS diagnostics or BITE shall be submitted to Systems Engineering team for review prior to system integration.

3.18 Built-in Test (BIT)/BIT Equipment (BITE).

BIT/BITE shall provide status in all states and modes and to include identification of system/subsystem condition and shall provide the user with the ability to detect and isolate failures and perform maintenance actions that will allow the system to be returned to operational status within the MTTR two-hour (THRESHOLD)/one-hour threshold (OBJECTIVE).

3.19 Manpower.

3.19.1 Detachment Size.

Total number of trained personnel needed to safely maintain and operate the Off-board and LCS Components shall not exceed fifteen personnel (THRESHOLD)/six personnel (OBJECTIVE) within the available LCS Mine Warfare Detachment manpower/skill levels.

3.19.2 Watch Section Size.

Watch section size based on a three section rotation, shall not exceed five personnel (THRESHOLD)/two personnel (OBJECTIVE) for operations during deployment.

3.19.3 Human-Robot Interaction (HRI).

UISS shall not require human capabilities that exceed human limitations IAW MIL-STD-46855 and the Human Integration Design Handbook (NASA/SP-2010-3407).

3.19.4 Situational Awareness (SA).

a) Off-board and LCS Components shall collect and process all SA sensor information and provide near real-time information to the UVO to include:
   i. SA information from LCS via UVMS
   ii. SA information from Off-board Components
b) Off-board and LCS Components shall support SA to simulate watchstander capabilities IAW COMDTINST M16672.2D.
c) Off-board and LCS Components shall provide the UVO the capability to discriminate contacts and/or obstacles identified by one or more sensors.
d) All SA sensor data shall be shall be recorded, stored and archived for PMA.

3.19.5 Human Factors.

a) UISS shall ensure physical accommodation for compatibility, operability, and maintainability by a range of body types representing the 5th to 95th percentile for males and females, IAW Anthropometry of US Military Personnel (DOD-HDBK 743A).
b) Accommodation for operation, including L&R, and maintenance shall account for the wearing of personal protective equipment (PPE) during all modes and states and all environmental conditions.
c) Accommodation for operation, including L&R, and Chemical, Biological, Radiological (CBR) washdown shall account for the wearing of PPE during operational modes and states in a CBR environment.
d) UISS design, equipment (hardware and software/firmware) and maintainer interface shall be IAW MIL-STD-1472G.

3.20 System Safety.

System safety practices shall be IAW Unmanned Systems Safety Guide for DoD Acquisition (2007) and System Safety Engineering Policy (NAVSEAINST 5100.12B).

3.20.1 Emergency Operation.

a) If a mission-critical failure occurs during sortie execution and critical control components (e.g., vehicle computer, propulsion system, steering, C2) are available, the Off-board Component shall provide the capability to revert to a safe condition as specified in Section 3.20.3.2 Emergency Stop and send a message to the operator.

b) If failsafes fail to address the problem or issue, then Off-board and LCS Components shall provide the operator capability to override and control system manually.

c) UISS shall have the capability of disengaging from the LCS tow line while retaining communications and full control of the Off-board Component.

3.20.2 Emergency Recovery.

The Off-board Component shall provide the capability for emergency recovery:

a) The Off-board Component shall have the capability for personnel in the LCS' ready service life boat to configure it for recovery configuration regardless of the power status.

b) The Off-board Component shall be capable of being towed by the LCS' ready service life boat.

c) Any subsystems deployed from the Off-board Component shall have the capability to be manually disconnected by personnel in the LCS' ready service life boat.

3.20.3 Stopping the Off-board Component.

The UVO shall have the following options to stop the Off-board Component at any time.

3.20.3.1 Sortie Abort.

a) The Off-board and LCS Components shall provide the operator the capability to transmit a sortie abort command to the control system via MVCS link.

b) When this command is received, the Off-board Component shall safely stop sortie execution and secure, or retrieve, as applicable, sweep equipment.

c) The Off-board Component shall remain in a condition that allows the operator to continue the sortie or send a sortie re-direction, and command execution of the redirected plan or other pre-loaded sortie plan.

d) The time to stop is dependent upon the time needed to convert to a safe state. A safe state is defined as the Off-board Component in the following condition:

   i. All deployed systems retrieved and stowed.

   ii. Engines at idle.

   iii. Propulsors disengaged.

iv. All C4 systems powered.

v. Sweep system not generating any acoustic or magnetic signature.

3.20.3.2 Emergency Stop.

a) UISS shall provide an emergency stop capability, at all times, that allows the Operator onboard LCS, at either the primary control station or MPCU to put the system into a Safe Condition.

b) The emergency stop condition is defined as the Off-board Component in the following condition:

i. All deployed systems in whatever condition they were in when the emergency stop command was issued.

ii. Engines stopped but are capable of being restarted if the UVO or UVDO chooses to.

iii. Propulsors in whatever condition they were in when the emergency stop command was issued.

iv. All C4 systems powered.

v. Sweep system not generating any magnetic or acoustic signature.

3.20.4 Mine Fire Survivability.

a) The Off-board Component shall be designed and built to survive [KSF1] Keel Shock Factor (KSF) (Mission Survival) such that it may continue a sortie after a mine fire event. For KSF values, see Annex A to UISS SRD (A-5.1.A, A-5.1.B).

b) The Off-board Component shall be designed and built to survive [KSF2] KSF (Craft Survival) loads such that it shall be salvageable. For KSF values, see Annex A to UISS SRD (A-5.2.A, A-5.2.B).

3.20.5 Accelerations Monitoring.

The Off-board Component shall have the capability to measure vehicle accelerations at the center of gravity and report to the UVO.

3.20.6 Stability.

The Off-board Component shall meet Procedures Manual for Stability Analysis of US Navy Small Craft (NAVSEACOMBATSYSENGSTA Report No. 6660-99) for intact and single compartment damage stability.

3.20.6.1 Stability Cases.

The following stability cases shall be included in the analysis:

a) Intact stability for beam winds with rolling.

b) A 60-kt wind velocity shall be applied IAW NAVSEACOMBATSYSENGSTA Report No. 6660-99 (see 2-C of Table 3-2).

c) For open deck craft (e.g., 11m Navy RHIB), the following conditions shall be considered:

   i. Normal Operating Condition – The downflooding point is considered as the point where seawater enters the craft exterior compartment(s) (e.g., top of the collar or gunwale). An exterior compartment is defined as any volume of the craft that is normally exposed to the environment and self-bailing or able to drain freely, such as a cockpit.

   ii. Swamped Condition –Seawater is flooding the craft exterior compartment(s) and no longer able to drain by normal means. Seawater is only able to evacuate the exterior compartment(s) by the same means that it entered (e.g., spilling over the collar or gunwale when the craft is heeled). In this condition, the downflooding points shall be considered as any non-watertight hatches or openings into interior compartments.

   iii. Free Flooding Condition – Seawater freely flows into and out of the craft exterior compartment(s). This condition simulates faulty scupper or drain check valves that are no longer preventing seawater from entering the craft. In this condition, the downflooding points shall be considered as any non-watertight hatches or openings into interior compartments.

c) Additional stability cases for lifting heavy weights over the side and towing are required if either is within the function of the Off-board Component.

d) Topside icing and passenger crowding calculations are not required.

e) Reduced rollback angles shall be considered where they can be justified by the type of craft when operating in the required operating environmental parameters.

3.20.7 Fire Suppression.

Off-board Component shall have fire suppression capability to fight more than one fire at a time in any combination of watertight spaces.

3.21 Electrical System.

3.21.1 Electrical System Standards.

Unless otherwise specified, electrical systems shall be designed and installed IAW the following, as applicable, in order of precedence:

a) “Standard Electrical Installation Requirements and Nomenclature" (NAVSEA DWG 53711-GEN-300-5107858).

b) “US Navy Boat Electrical Practices” (NSWCCD-23-TM-2009/58 Rev B).

c) Original Equipment Manufacturer (OEM) Recommendations.

d) ABYC.

3.21.2 Grounding and Bonding System.

a) Off-board Component shall be grounded and bonded IAW Shipboard Bonding, Grounding and other Techniques for Electromagnetic Compatibility, Electromagnetic Pulse Mitigation and Safety (MIL-STD-1310H).

b) Off-board Component shall have provisions to be bonded to the stowage cradle IAW MIL-STD-1310H with a class C, type I bonding strap.

c) Off-board Component shall provide the capability to be grounded during recovery IAW LCS ICD.

3.21.3 Batteries.

a) Batteries shall be IAW standards specified in Section 3.21.1 Electrical System Standards.

b) Battery banks shall be sized to power all equipment required to support the Pre-launch, Launch, and Turnaround Capabilities when disconnected from shore power for at least two hours and still be able to start the engines.

c) Lithium batteries used to power any subsystem or component of UISS shall be approved for use IAW Navy Lithium Safety Battery Program (NAVSEAINST 9310.1B), High Energy Storage System Safety Manual (DRAFT) (NAVSEA SG270-BV-SAF-010) and NAVSEA Technical Manual for Batteries, Navy Lithium Safety Program Responsibility and Procedures (S9310-AQ-SAF-010).

d) Rechargeable lithium batteries shall be approved for shipment under the provisions of 49 Code of Federal Regulations (CFR) Section 173.185.

3.22 Mechanical Systems.

3.22.1 Mechanical System Standards.

Unless otherwise specified, mechanical systems shall be designed and installed IAW the CFR, as applicable to unmanned systems.

3.22.2 Propulsor Requirements.

a) Off-board Component shall have the capability to disengage the propulsor from the engine.

b) Off-board Component shall have the capability to generate forward, neutral, and reverse thrust.

3.22.3 Bilge System.

a) Compartments on the Off-board Component that can collect water shall have a means to evacuate said water.

b) Any pumps in this system shall provide the UVO control to be put in an automatic, on or off state.

c) Any volume of fluid remaining in a compartment upon completion of evacuation shall be accounted for in the weight and stability calculations.

d) The UVO shall receive alarms if the accumulation of water overwhelms the evacuation system.

e) Thru-hulls shall be designed and installed to prevent the backflow of water into the hull.

3.23 Construction Standards.

3.23.1 Structural Requirements.

a) USV structure shall be designed IAW Direct Analysis of Structural Loads and Structural Design for UISS (NSWCCD-23-TM-2012/20).

b) Structural design shall maintain structural continuity and alignment and avoid creation of stress concentrations.

c) Metal structure shall be of welded construction, except that non-welded metal fabrication is acceptable where necessary for access or equipment removal and reconfiguration.

3.23.2 Fabrication Requirements.

a) Welders shall be certified IAW American Welding Society (AWS) or ASME.

b) Welding shall be IAW AWS or ASME guidelines.

c) Laminators shall be certified by Contractor's Quality Assurance (QA) system.

d) Lamination shall be performed IAW Contractor's QA system.

3.23.3 Materials.

a) Unless otherwise stated, materials shall meet requirements of ABS "Guide for Building and Classing HSNC".

b) The USV hull and deck structure shall be constructed from 5000-series marine grade aluminum conforming to ASTM B928 and/or fiber-reinforced plastic (FRP).

c) Wood and other hygroscopic and biodegradable materials are prohibited.

3.23.3.1 Aluminum.

Aluminum materials shall meet the following:

a) Plate and Sheet: ASTM‑B209 or ASTM-B928 as applicable, Unified Numbering System (UNS) A95086‑H116 or A95086-H117, UNS A95083-H116 or UNS A95083-H321; for non-welded applications UNS A96061‑T6 or UNS A96061‑T651 may be substituted.

b) Extrusions: ASTM-B221, UNS A95086-H111 or UNS A95083-H111; for non-welded applications UNS A96061-T6 or UNS A96061-T52 may be substituted.

c) Drawn Tube: ASTM-B210, UNS A95086-H32; for non-welded applications UNS A96061-T6 may be substituted.

3.23.3.2 Fiber Reinforced Plastic (FRP).

a) Material properties used for design of all structural laminates, including single-skin laminates, cored laminates, and laminates used for major framing components, shall be verified. They shall be verified by testing of specimens taken from test panels having the same properties as the laminates used in construction and using the same materials, laminate schedules, laminating processes and conditions, post-cure, and other relevant factors.

b) Scope of components tested shall be sufficient to validate all materials properties used for design of the structure. They shall include, as a minimum, the laminates used in the hull bottom structure.

c) As a minimum, single-skin laminate tests shall include strength and modulus properties in tension (ASTM D638), flexure (ASTM D7264 Procedure B), and compression (ASTM D3410). Cored laminate tests shall include flexural and shear properties (ASTM D7249 and D7250) and in-plane compressive properties (ASTM C364 or D5467).

d) Alternate test method standards that achieve the same purpose of design properties validation may be proposed, subject to approval by the Government.

e) To validate suitability for use when exposed to the relevant operational and storage loads, the Contractor shall provide mechanical properties test data at elevated temperatures to the upper limit of the operational and storage temperature ranges for any proposed FRP materials subject to thermal effects (e.g., thermoplastic reinforcing fibers or laminating resins having heat distortion temperatures in that range).

3.23.4 Corrosion Prevention.

a) Exposed metal surfaces shall be corrosion resistant or treated to resist corrosion from seawater, salt spray or atmospheric conditions during the life cycle of the system.

b) Use of dissimilar metals shall be minimized to preclude corrosion, cathodic, or electrolytic reaction with the equipment itself and between the equipment.

c) Engines and drive system shall be protected from corrosion by appropriate sacrificial anodes.

d) The Contractor shall install the anodes IAW the OEM's guidance regarding the locations, sizes, and replacement intervals of the anodes.

3.24 Support Equipment.

3.24.1 Diagnostic Support Device.

a) Device shall provide capability to initiate, monitor and display results of all available BIT and PM/FD/FL capabilities provided by system.

b) Device shall provide capability to monitor and display system health status and prognostic data.

3.24.2 Trailer.

a) Trailer shall comply with all applicable federal requirements, including CFR Title 49 (Transportation) Chapter III (Federal Motor Carrier Safety Administration, Department of Transportation (DOT)) Part 393 (Parts and Accessories Necessary for Safe Operations) and Chapter V (National Highway Traffic Safety Administration, DOT) Part 571 (Federal Motor Vehicle Safety Standards), excepting the CFR exclusion of heavy hauler trailers does not apply for all cited CFR requirements.

b) Trailer shall interface with a tow vehicle with a fifth wheel-type hitch and air brakes.

c) Trailer shall support float on/off capability from improved ramps.

d) All components shall be capable of total submersion in saltwater for L&R of the Off-board Component.

e) Provision shall be made to secure craft to trailer such that craft and trailer can be lifted as a unit using lifting fittings on craft.

f) Fittings shall be provided so trailer can be lifted by itself.

g) Design Safety Factor (DSF) of 1.5 on the post welded yield strength of the material shall be applied to the trailer's structural members.

h) Trailer Gross Vehicle Weight Rating shall be equal to or greater than the weight of the Off-board Component in Full-Load Condition.

3.24.3 Stowage Cradle Bunk Pads.

The Off-board Component shall be capable of interface with LCS Stowage Cradle with Contractor-furnished bunk pads to provide support between the cradle's flat bunks and the USV IAW USV 11M RHIB Cradle Assembly drawings (Naval Facilities Engineering Service 20053001 thru 20053006).

3.24.4 Man-Portable Control Unit (MPCU).

a) MPCU shall provide capability for primary control of the Off-board Component during L&R operations.

b) The MPCU shall be operated by the UVDO onboard LCS in the position shown IAW LCS ICD and LCS LRHS AG.

c) MPCU shall interface with LCS service panel at the UVDO position.

d) MPCU shall use MVCS as the communication link with the Off-board Component.

e) MPCU shall be man-portable IAW Human Strength and Handling Limits section in MIL STD 1472G.

f) MPCU shall be capable of main engine start and stop, maneuver of the Off-board Component for L&R and any other controls required for L&R (e.g. equipment requiring re-positioning, LCM actuation).

g) MPCU shall display data needed by UVDO to safely perform L&R (e.g. USV GPS speed and heading, engine rpm, propulsor status, steering angle, equipment requiring re-positioning (if applicable), LCM status, alarms).

h) MPCU shall have an emergency stop capability separate from MVCS.

i) The emergency stop capability shall instantly and positively put the craft in to a safe condition.

3.25 Tools and Test Equipment.

3.25.1 Tools and Equipment

a) Support and test equipment includes all equipment, mobile and fixed, that is required to perform the support and maintenance functions in the states and modes defined in this document.

b) Support equipment categories may be defined from the OEM and cross referenced to the General Services Administration Catalog http://www.gsa.gov or Defense Logistics Agency Logistics Information Services http://www.dlis.dla.mil/WebFlis or Federal Item Identification Catalog found at http://www.logisticsinformationservice.dla.mil/IIG/

c) Where possible identification of existing support equipment should be selected for use on systems or equipment as opposed to developing new, special purpose support equipment. The identification of the support equipment reduces the total ownership cost to the US Navy since training, provisioning, maintenance planning, and calibration procedures are not needed.

d) Support equipment categories include:

   i. Handling and maintenance equipment.

   ii. Tools (hand tools as well as power tools).

   iii. Metrology and measurement devices.

   iv. Calibration equipment.

   v. Test equipment.

   vi. Automatic Test Equipment.

vii. Peculiar or unique support equipment for system maintenance.

viii. Special inspection equipment for intermediate and depot maintenance equipment, which includes all equipment and tools required to assemble, disassemble, test, maintain, and support the repair of end items or components.

3.25.2 Special Test Equipment

3.25.2.1 Strain Measurement System.

The Off-board Component shall have the capability to measure and record strain of critical structural members (e.g. hull plating, hull girders, frames) throughout the hull while underway and be able to correlate that data with accelerations monitoring data.

3.25.2.2 Safety Observer Kill Switch (SOKS).

During developmental and operational testing, the Off-board Components shall have a SOKS capability via a dedicated radio signal that enables a safety observer on a chase craft the ability to positively put the Off-board Component to a safe state as specified in Section 3.20.3.2 Emergency Stop.

a) Capability shall not require any action or interaction from the C4CE system.

b) Capability shall be of a failsafe design IAW Unmanned Systems Safety Guide for DoD Acquisition (2007) and Navy System Safety Program (OPNAVINST 5100.24B).

c) The SOKS equipment on the Off-board Component shall be capable of being disabled and/or removed when not in use.

d) The SOKS shall have a range of 2nm.

e) The SOKS operator control unit shall be self-contained and man-portable IAW Human Strength and Handling Limits section in MIL STD 1472G.

f) The SOKS unit shall be watertight to Ingress Protection Rating (IP67).

3.26 Logistics Requirements.

3.26.1 Operational Availability (A_o).

The Off-board and LCS Components shall meet Operational Availability (A_o) of 0.80 (THRESHOLD)/ 0.85 (OBJECTIVE).

a) A_o is defined in Equation 12:

Equation 12 - A_o

$$A_0 = \frac{Uptime}{Uptime + Downtime} \quad \text{or} \quad A_0 = \frac{MTBF}{MTBF + MTTR + MLDT}$$

where,

Uptime=when system is considered ready for use and either operates in standby or off as measured against the design reference mission profile.

Downtime=when system is down for repair of operational mission hardware failures and/or for restoration from operational mission software faults, including off-board logistic delays.

MTBF= Mean Time between Failure. The average time between system failures under specified conditions.

MTTR= Mean Time to Repair. The average time required to repair the system after failure (active repair time only).

MLDT=Mean Logistics Delay Time. The average time required for all non-administrative maintenance delays involved in repair actions (e.g., including transportation of the system to the repair location; time required to obtain necessary spares; time waiting for repair personnel availability).

3.26.2 Mean Time Between Failure (MTBF).

The Off-board and LCS Components shall have an MTBF of 125hrs (THRESHOLD)/200hrs (OBJECTIVE).

a) MTBF is defined in Equation 13:

Equation 13 - MTBF

$$MTBF = \frac{Total_{System\ Operating\ Hours}}{Total_{Failures}}$$

where,

$Total_{System\ Operating\ Hours}$=for the Off-board and LCS Components, system operating time is from when the vehicle is released from the LCS L&R system until the time vehicle returns and is tethered to the L&R system.

$Total_{Failures}$=total number of failures within a stated period of time. Further defined as any hardware/software failures and/or faults that occur during operating hours, not just those that cause mission abort.

3.26.3 Mean Time to Repair (MTTR).

The Off-board and LCS Components shall have a MTTR of two hrs (THRESHOLD)/one hr (OBJECTIVE).

a) MTTR is defined as the average time required to repair the system after failure and includes active repair time and other factors such as logistics or administrative delay times.

b) For the Off-board and LCS Components, assume the MLDT (logistics or administrative delay) is 30 minutes.

3.26.4 Supportability.

Supportability analysis shall be performed IAW Reliability Program Standard for Systems Design, Development and Manufacturing (ANSI/GEIA-STD-0009),. The types of supportability analysis required includes: Failure Modes Effects and Critically Analysis, Fault Tree Analysis, and Level of Repair Analysis.

3.26.5 Reliability and Availability.

UISS repairable items shall be identified within the hierarchy of the end item, broken down by an agreed-upon configuration control method IAW Expanded Ship Work Breakdown Structure: Hierarchical Structure Codes for Ships, Ship Systems, and Surface Combatant Systems (NAVSEAINST 4790.1) series. MTBF includes all failures (i.e., non-mission-critical, mission-critical) that may occur within the hardware and software systems and can be used in determining the total maintenance requirements.

3.26.6 Materiel Availability (A_m).

The Off-board and LCS Components shall meet A_m of [A_MT] (THRESHOLD)/[A_MO] (OBJECTIVE). Annex A to UISS SRD (A-6.1, A-6.2)

a) A_m is a measure of the percentage of total inventory of UISS operationally capable of performing an assigned mission at a given time, based on materiel condition. A_m is defined by Equation 14:

Equation 14 - A_m

$$A_m = \frac{Total\ number\ of\ operational\ UISS}{Total\ population\ of\ UISS}$$

where,

Total number of operational UISS is 24.
Total population of UISS is 24.

3.26.7 Maintainability.

UISS maintainability requirements shall be identified IAW Condition-Based Maintenance Plus for Materiel Maintenance (DODI 4151.22) to include prognostics and diagnostics.

3.26.7.1 Turnaround.

The Off-board and LCS Components shall provide the operator/maintainer with the capability to fuel, inspect fluid levels, assess material condition, and all other actions required for turnaround in 60 minutes.

3.26.7.2 Maintenance Task Identification.

a) Maintenance tasks shall be IAW Reliability Centered Maintenance Process (MIL-STD-3034) and amended Planned Maintenance System, Development of Maintenance Requirements Cards, Index Pages, and Associated Documentation (MIL-P-24534A).

b) UISS shall have all LRUs identified IAW Serialized Item Management for Materiel Maintenance (DODI 4151.19).

3.26.7.3 Parts Management and Control.

a) UISS repairable items shall be identified within the hierarchy of the end item, broken down by an agreed-upon configuration control method IAW NAVSEAINST 4790.1.

b) UISS parts management shall include those processes identified IAW Diminishing Manufacturing Sources and Material Shortages (SD-22).

c) Standard Practice Parts Management (MIL-STD-3018) shall be reviewed to identify guidelines for identification of UISS parts and components.

d) UISS Configuration Management (CM) shall be identified and managed IAW CM Guidance (MIL-HDBK-61A) for all LRUs of systems and subsystems.

e) UISS parts shall be identified to support shipping to designated support facility within 72hrs (THRESHOLD)/24hrs (OBJECTIVE).

3.26.8 Supply Support.

a) UISS parts management, supply support and control shall be IAW Supply Chain Materiel Management Regulation (DOD 4140.1-R).

b) UISS shall use procedures, policy, and guidance for the provisioning process IAW Provisioning, Allowance, and Fitting Out Support Manual (NAVSEA Tech Spec 9090-1500) and shall be used to identify the process to be implemented for UISS.

c) The Hazardous Materials User's Guide (OPNAVINST 5100.28) and Ships Hazardous Materials List for LCS shall be used to identify petroleum, oils, and lubricants.

3.27 Training Requirements.

The training development for the shipboard operation of the UISS as an off-board vehicle from the LCS shall maximize the use of classroom and simulator training. All developed training shall be considered the starting point for providing the MCM Detachment members, and civilian personnel (Government and Contractor) with the prerequisite knowledge, skills, and abilities to operate and maintain the UISS in all states and modes until the formal curriculum development is implemented. All training development for the UISS must support this premise and the Contractor development of the UISS specific training shall incorporate the following:

3.27.1 Train to Qualify (T2Q).

The LCS concept is to provide training in a shore-based training environment that teaches the individual MCM MP crewmember the basic tasks associated with the specific knowledge, skills, and abilities to safely and effectively operate in all watch stations or maintenance performance criteria associated with UISS.

3.27.2 Training to Certify (T2C).

The LCS concept is to provide training in a shore-based training environment that teaches the watch team the advanced tasks associated with the specific knowledge, skills, and abilities to safely and effectively operate in all watch stations or maintenance performance criteria associated with the UISS.

3.27.3 Subject Areas.

The following subject areas shall guide the Contractor in the development of training required to develop the knowledge, skills, and abilities to operate and maintain the UISS in each state and mode:

a) Function;

b) Location;

c) System/subsystem and component characteristics;

d) The System/subsystem components to include connections and interfaces;

e) Operating values and limits for:

f) Abnormal values and corrective action;

g) Emergency situations and corrective action;

h) System or component access;

i) Display information and data displayed for operation identified to the component level;

j) Protective and security devices installation and function to include location;

k) Component discharge and discharge routing;

l) Component controls or actuators;

m) BIT/BITE;

n) Troubleshooting and repair.

3.27.4 Component Training.

Developed training shall use classroom lead discussion and system interaction to develop the Mineman, Engineman, and Aerographer skills to operate and maintain:

a) USV;

b) Influence sweep system;

c) C4 system;

d) OIS;

e) Trailer;

f) Cradle;

g) MPCU;

h) Diagnostic support device;

i) Tools and Test Equipment.

3.27.5 Training Curriculum.

All training curriculum developed for operation and maintenance shall support the T2C/T2Q concept and shall contain the following:

a) Each Terminal Learning Objectives (TLO) contains a statement that defines the expectations of the student's performance at the end a specific lesson or unit.

b) Each TLO shall have a Condition, Task, and Standard that is observable and can be measured.

c) The use of Enabling Learning Objectives (ELOs) shall support the TLO and shall allow the student to develop the knowledge, skills, and ability to complete the TLO to the standard and condition defined.

d) The TLOs and ELOs shall be used to develop the:

   i. Instructor Guides.

   ii. Student Guides.

3.27.6 Training Content.

The developed training shall contain supporting information that shall include:

a) System/Equipment diagram sheets.

b) Illustrations and pictures.

c) Function, location, and operational values and parameters.

3.27.7 Exams.

Each section of the designed training for UISS shall require the development of written examinations that contains multiple choices, true/false, and essay questions.

3.27.7.1 Answer Key.

An answer/examination key shall be generated for each test.

3.27.8 Training Systems.

a) The development of the training systems for UISS shall include simulators and training devices that represent the systems in all states and modes.

b) The training system shall be configurable and packetized to allow employment with established training systems and devices for LCS Mission Modules Common Mission Package Trainer or Mission Package Training System (MPTS) comprised of a personal computer (PC)-emulation of the tactical software.

c) The software and hardware necessary for the development of PC training devices shall be IAW the PC-Based Open-Architecture Reconfigurable Training System information located in the UISS Bidder's Library.

3.27.9 Training/Instructor Control Station.

Instructor control station hardware and software shall be developed and allow the instructor to:

a) Simulate conditions defined as normal or abnormal conditions in the various states and modes.

b) Inject into simulation or actual controlled operational training to develop reaction and response time of the operator.

3.27.9.1 Operating Training Stations.

The control station shall be developed to support the operator training stations developed IAW standards defined the PC-Based Open-Architecture Reconfigurable Training System to interface with the MPTS and Network Tactical Training System.

3.27.9.2 Delivery.

The control station shall be delivered with:

a) Technical documentation required to operate and sustain the hardware and software;

b) BOM and COTS data;

c) Identification of corrective and preventative maintenance actions to include software updates;

d) Firmware and software licenses.

3.28 Packaging, Handling, Shipping, and Transportation.

a) Packing requirements shall be identified IAW MIL-STD-2073-1 or its equivalent for methods of preservation to protect materiel against environmentally-induced corrosion and deterioration; physical and mechanical damage; and other forms of degradation during storage, multiple handling, and shipment of materiel.

b) Electronics or electrical equipment packaging required to support C4 systems shall ensure safe and secure storage, shipping, and handling of components.

c) Containers and packaging shall be marked IAW current standards, to ensure identification of all UISS components or support equipment.

3.29 Marking.

a) Piping systems, valves, and interfaces shall be marked by color code and plain language to clearly indicate interfaces and functions IAW Naval Ship Technical Manual 50: Piping Systems (S9086-RK-STM-010).

b) Physical barriers and proper signage shall be provided to identify safety or equipment hazards IAW Navy Safety and Occupational Health (NAVSOH) Program Manual for Forces Afloat (OPNAVINST 5100.19).

i. For example, compartments that exceed recommended decibel levels shall be identified and marked to identify the hazards.

3.29.1 Unique Identification (UID).

The Contractor shall follow DoD Standard Practice Identification Marking of US Military Property (MIL-STD-130N) to implement UID labeling.

4 VERIFICATION

4.1 Verifications.

4.1.1 Conformance.

a) Conformance to all requirements specified herein shall be verified by examination, analysis, demonstration, test, or a combination of these methods.

b) The vendor shall be responsible for verifying conformance to all requirements of this specification. The Government reserves the right to witness the verification or verify independently conformance to any and all specified requirements.

4.1.2 Methods and Codes.

a) Combinations of methods are acceptable when cost effective, or when the maturity of the system precludes full verification by a single method. Verification of requirements shall be performed at the earliest appropriate opportunity during the design, construction, and delivery process.
b) The verification methods and Codes are defined for TABLE V as listed below:

i. Assembly Level and Nature of the representative unit verified.

Codes	**Definitions**
A	Assembly - Constituent element of a subsystem that performs an identifiable and measurable function.
FS	Full Scale – Assembly, subsystem, and/or system that represent the actual physical configuration.
S	Scale – A representation or copy of an assembly, subsystem, or system that is proportionally larger or smaller than the actual size of the object being represented.
SS	Subsystem – A group of assemblies that perform an identifiable group of functions, available in final configuration.
Sys	System – All system components available in final configuration.
V	Virtual – Mathematical model or simulation of component, subsystem, or system.

ii. System State(s) applicable to the verification requirement, as specified in Section 3.3 States and Modes.

Codes	**Definitions**
DM	Deployed Maintenance
ER	Emergency Recovery
ES	Emergency Stop
L	Launch
LTS	Long-Term Storage
MS	Mine Sweeping
NDM	Non-Deployed Maintenance
NDT	Non-Deployed Training
PL	Pre-Launch Operations
PR	Post Mission
S	Stowed on Ship

SA	Sortie Abort
SR	Standard Recovery
STS	Short-Term Storage
T	Transit
TA	Turn-Around Operations
TR	Transport

iii. Environmental State(s) applicable to the verification requirement.

Codes	**Definitions**
Operating	Environmental requirements as specified in Section 3.6.2.Operating Environmental Parameters.
Non-Operating	Environmental requirements as specified in Section 3.6.3 Non-Operating Environmental Parameters.

iv. Verification method to be used.

Codes	**Definitions**
A	Analysis. Verification shall be accomplished by technical evaluation or mathematical models and simulations, algorithms, charts, graphs, circuit diagrams, or scientific principles and procedures to provide evidence that stated requirements are met.
I	Inspection. Verification shall be accomplished by inspection, without the use of special laboratory equipment or procedures, to determine conformance to the specified requirements that can be determined by the investigators. Examination shall be non-destructive and can include: sight, hearing, smell, touch, and taste, and physical manipulation, mechanical and electrical gauging and measurement, and other forms of investigation.
D	Demonstration. Verification shall be accomplished by actual operation, adjustment, or re-configuration of items (Assembly, Subsystem, or System) to provide evidence that the designed functions are accomplished under specific scenarios. The item under test may be instrumented and quantitative limits of performance monitored/measured.
T	Test. Verification shall be accomplished by systematically exercising the System or major Subsystem under appropriate or relevant operational environmental conditions. Instrumentation to measure required parameters may be utilized. Collection, analysis, and evaluation of quantitative data will determine that the measured parameters equal or exceed specified

requirements.

v. Test Phase.

Codes	Definitions	Description
BT	Builder's Trials	EDM[1] Only (See SOW 2.11.7)
CDR	Critical Design Review	See SOW 2.3.2.6
DT	Developmental Tests	EDM Only (See SOW 2.11.12)
FAT	Factory Acceptance Test	LRIP[2] Only (See SOW 2.11.13)
InT	Inclining Tests	EDM Only (See SOW 2.11.9)
IOT&E	Initial Operational Test and Evaluation Support	LRIP Only (See SOW 2.11.14)
I-PI	In-Plant Inspections	EDM and LRIP (See SOW 2.11.6)
I-PT	In-Plant Tests/Demonstrations	EDM and LRIP (See SOW 2.11.5)
PDR	Preliminary Design Review	See SOW 2.3.2.5
PDI	Post-Delivery Inspection	EDM Only (See SOW 2.11.10)
PDIT	Pre-Delivery Inspection and Trials	EDM and LRIP (See SOW 2.11.8)
PDSPV	Post-Delivery Sweep Performance Verification	EDM Only (See SOW 2.11.11)

NOTES:

1. EDM-Engineering Design Model
2. LRIP-Low Rate Initial Production

4.1.3 Detailed Verification Requirements.

Individual requirements shall be verified according to the matrix presented in TABLE V.

TABLE V. System Requirements Verification Matrix (SRVM)

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.1	**General Operations**	The Off-board Component shall be a self-propelled, unmanned, semi-autonomous surface vehicle capable of operating independently in shallow water regions of the ocean to sweep magnetic and acoustic mines.						Requirement verified through following sections.
3.1.1	Depot-Level Overhaul (DLO)	UISS shall provide the capability to support operations in the specified environment in Section 3.5 Deployed State for five years without failure until DLO.	Sys	S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	I-PI, PDIT	Ongoing analysis as design matures up to CDR. Final analysis as part of PDIT.
3.1.2	Operational Profile	Operation is defined as operating 386 hours in 16 months with the following operation temp: 10% Idle 25% Transit 65% Sweeping						Definition.
3.1.3	Post Mission Analysis (PMA)	During operation, the Off-board Component shall record data for analysis during PMA.	Sys	L, T, MS, SA, ES, SR, ER	Operating	D	PDIT	
3.2	**Typical Concept of Operations**							Header.
3.2.1	Mission Planning	The Mission Planner uses Mine Warfare Environmental Decision Aids Library (MEDAL) and Unmanned Vehicle Management System (UVMS) software tools aboard LCS to conduct detailed mission planning and de-	SS, Sys	PL, TA, PM	Operating	D	I-PT, DT	In-Plant Tests - lab setting. DT - with LCS.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		confliction, and delivers complete sortie plan.						
3.2.2	Mission Upload	After formulating and receiving approval for the sortie plan, mission parameters are downloaded to the Off-board Component prior to launch.	SS, Sys	PL, TA	Operating	D	I-PT, DT	In-Plant Tests - lab setting. DT - with LCS.
3.2.3	Pre-Launch	During launch process, a communications link is established.	SS, Sys	PL, L	Operating	D	PDIT, DT	PDIT - simulate launch process, DT - with **LCS.**
3.2.4	Launch	An MPCU, connected to the ship's local area network (LAN) and MVCS, is used by the Unmanned Vehicle Deck Operator (UVDO) to release the Off-Board Component from ship's launch and recovery (L&R) equipment and navigate to a safe stand-off position.	A, SS, Sys	L	Operating	D	PDIT, DT	PDIT - simulate launch process with LAN and Developmental Test System (DTS). DT - with **LCS**.
3.2.5	Transfer of Control	The Unmanned Vehicle Operator (UVO) then takes responsibility for control of the Off-board Component.	SS, Sys	L	Operating	D	PDIT, DT	PDIT - simulate launch process w/ LAN and DTS, DT - with **LCS**.
3.2.6.a	Transit	Under normal operations, the Off-board Component will navigate to sweep area based on the pre-planned route.	SS, Sys	T	Operating	D	PDIT	
3.2.6.b		The UVO will continually monitor various sensors and systems status aboard Off-board Component to maintain lookout throughout the mission and be capable of taking	SS, Sys	T	Operating	D	PDIT	Will need DTS or Mission Package Portable Control System

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		remote, manual control of system.						(MPPCS).
3.2.6.c		The Off-board Component location information will periodically transmit back to LCS for auto-forwarding to Link 16 and Navy command and control systems (e.g., Global Command and Control System– Maritime (GCCS-M)).	SS, Sys	T	Operating	D	PDIT, DT	PDIT - back to OIS. DT - back to Link 16 and GCCS-M.
3.2.6.d		Should circumstances require a change in sortie plan; the UVO can send a new mission plan via MVCS data link for execution.	SS, Sys	T	Operating	D	PDIT	
3.2.7	Sweep System Initialization	After arrival at sweep area, the UVO will be notified and the Off-board Component will commence engagement/deployment of the Sweep system.	SS, Sys	T	Operating	D	PDIT	
3.2.8	Sweeping	When the sweep is fully engaged/deployed, the UVO will be notified and the Off-board Component will perform track navigation of the sweep pattern. Securing or retrieving of the Sweep system is done in the same manner in reverse order.	SS, Sys	MS	Operating	D	PDIT	
3.2.9	Return Transit and Recovery	Once sweep equipment is secured, the Off-board Component navigates to the recovery point at which time the UVDO uses the MPCU to recover the system aboard LCS.	SS, Sys	T, SR	Operating	D	PDIT, DT	PDIT - simulate recovery. DT - recover with **LCS**.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.2.10	Post-Mission	Post-recovery, the data recorded aboard the Off-board Component hard drive is removed for PMA.	SS, Sys	PR	Operating	D	PDIT, DT	PDIT - remove hard drive and show correct data is on it. DT- remove hard drive and demonstrate it is compatible with **LCS**'s systems.
3.3	**System States and Modes**	The following sections describe the states, modes and capabilities of the system in the context of how the system will be utilized in a typical mission. FIGURE 2. shows the hierarchical relationship of UISS states, modes and capabilities.						Description.
3.4	**Non-Deployed State**	In this state, UISS can be in one of four modes: Storage, Training, Maintenance, and Transport.						Description
3.4.1	Non-Deployed Storage Mode	UISS shall provide capability to be stored both short-term and long-term, shore-side without system degradation such that the system retains full mission capability after reactivation.	Sys	STS, LTS	Non-Operating	A	PDIT	
3.4.1.1	Non-Deployed Storage Environment	UISS shall survive this storage mode in environment specified in Section 3.6.3 Non-Operating Parameters without system performance degradation.						Contextual statement.
3.4.1.2.a	Short-Term	Shall be able to be stored in short-	SS, Sys	STS	Non-Operating	A	PDIT	Analyze final

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
	Storage Capability	term storage for up to 90 days						design.
3.4.1.2.b		UISS shall be capable of placement into or taken out of short-term storage in less than 24hrs (THRESHOLD (T))/12hrs (OBJECTIVE (O)).	SS, Sys	STS	Non-Operating	D	PDIT	
3.4.1.2.c		UISS shall be capable of short-term storage for short periods without special maintenance procedures.	SS, Sys	STS	Non-Operating	A	PDIT	
3.4.1.2.d		UISS shall remain de-energized when in short-term storage, except as required, to support periodic cycles of maintenance.	SS, Sys	STS	Non-Operating	A	PDIT	
3.4.1.2.e		While in short-term storage, the Off-board Component shall be able to perform Built-in-Test (BIT) and Preventive Maintenance (PM)/Fault Detection (FD)/Fault Localization (FL) (PM/FD/FL) to determine the system is functional and can meet required performance tests.	SS, Sys	STS	Non-Operating	D	PDIT	
3.4.1.3.a	Long-Term Storage Capability	UISS shall be able to be stored in long-term storage from 91 days to three years.	Sys	LTS	Non-Operating	A	PDIT	
3.4.1.3.b		UISS shall be capable of placement into or taken out of long-term storage in less than 40hrs (THRESHOLD)/24hrs (OBJECTIVE).	Sys	LTS	Non-Operating	D	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.4.1.3.c		Procedures and equipment shall be provided for placement and removal of UISS from long-term storage (e.g., remove engine fluids, add protective lubricants).	Sys	LTS	Non-Operating	A	PDIT	
3.4.1.3.d		UISS shall remain de-energized during this mode, except as required to support periodic cycles of maintenance.	Sys	LTS	Non-Operating	A	PDIT	
3.4.1.3.e		All other equipment comprising UISS shall be packaged IAW DoD Standard Practice for Military Packaging (military standard (MIL-STD)-2073-1) to preserve equipment and prevent degradation or damage.	Sys	LTS	Non-Operating	A	PDIT	
3.4.2.1	Non-Deployed Training Environment	In this mode, the Off-board and MPSF Components, configured with DSD, shall provide the capability to select and initiate self-paced tutorials embedded within the interactive electronic technical manual to execute playback of recorded mission data and digitally record all training session activity.	SS, Sys	NDT	Operating	D	PDIT	
3.4.3	Non-Deployed Maintenance Mode	In this mode, UISS shall be able to undergo routine maintenance, as well as, non-routine troubleshooting and repairs, and periodic overhauls.						Qualifying statement.
3.4.3.1	Non-Deployed	Routine maintenance activities	Sys	NDM	Operating	D	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
	Maintenance Environment	include preparation of UISS for deployment and post-deployment preparation for storage.						
3.4.3.2	Diagnosis and Trouble-shooting	This mode shall support diagnosis and troubleshooting of UISS, to include:						Qualifying statement.
3.4.3.2.a		In-water tests	SS, Sys	NDM	Operating	D	PDIT	
3.4.3.2.b		In-water vehicle operations	SS, Sys	NDM	Operating	D	PDIT	
3.4.3.2.c		Installation of software or firmware upgrades	SS, Sys	NDM	Operating	D	PDIT	May be demonstrated throughout testing period as upgrades become available.
3.4.3.2.d		Application of software security patches and updates	SS, Sys	NDM	Operating	D	PDIT	May be demonstrated throughout testing period as upgrades become available.
3.4.4	Non-Deployed Transport Mode	In this mode, UISS shall be configured for shipment by road, ship, and air as specified in Section 3.9.3 Transportability.						Requirements located in Section 3.9.3 Transportability
3.4.4.1	Non-Deployed Transport Environment	UISS shall be capable of transport in all transport configuration(s) in the environment as specified in Section 3.6.3 Non-Operating Parameters without sustaining a level of damage that would	Sys	TR	Non-Operating	A	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		degrade the full mission capability or limit use of support equipment.						
3.5	**Deployed State**	In this state, UISS shall be capable of being in one of three modes: Sortie, Maintenance, and Stowed						Description.
3.5.1	LCS Interface	The Off-board and LCS Components shall interface with LCS for all necessary interfaces IAW LCS Interface Control Document (ICD) and the LCS Launch, Recovery, Handling, and Stowage (LRHS) Amplification Guide (AG).	SS, Sys	S	Operating	A, I, D	I-PI, PDIT, DT	Analyze design throughout design period. Inspect components for compliance with cited documents during PDIT. Perform **LCS** check during DT.
3.5.2	Deployed Sortie Mode	In this mode, the Off-board and LCS Components shall provide the primary operational capability to conduct remote, unmanned mine sweeping operations.						Description
3.5.2.1	Deployed Sortie Environment	The Sortie Mode environment is specified in Section 3.6.2 Operating Environmental Parameters.						Testing to be performed as part of Section 3.8 Sweep System Performance.
3.5.2.2.a	Pre-Launch Capability	Off-board and LCS Components shall be capable to perform pre-launch checks on all major subsystems to ensure system readiness immediately prior to	SS, Sys	PL	Operating	D	PDIT, DT	Simulate pre-launch during PDIT.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		launch.						
3.5.2.2.b		Pre-launch checks shall be provided via BIT to the maximum extent practicable						Description.
3.5.2.2.c		This will be the final opportunity for physical contact with the Off-board Components prior to a sortie or exercise						Description.
3.5.2.3.a	Launch Capability	The Off-board Components shall be capable for the safe, reliable launching from both LCS variants without any damage or degradation to the system or the ship	Sys	L	Operating	D	PDIT, DT	Simulate launch during PDIT.
3.5.2.3.b		No personnel shall be required to be off LCS in support craft, or in the water, to facilitate the launch operation						Performed as part of demonstration of requirement 3.5.2.3.a.
3.5.2.4.a	Transit Capability	The Off-board Component shall be capable of transit from host ship to operation area and vice versa	Sys	T	Operating	D	PDIT	Using DTS or MPPCS.
3.5.2.4.b		The Off-board Component shall transit with sweep secured/retrieved, as applicable	Sys	T	Operating	D	PDIT	
3.5.2.5.a	Mine Sweeping Capability	Off-board Component shall be capable of full performance influence mine sweeping as specified in Section 3.8 Sweep System Performance.						Requirement verified under Section 3.10 Software Interface Requirements.
3.5.2.5.b		Off-board and LCS Components shall provide the capability to						Requirement verified under

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		achieve ACRS as specified in Section 3.8.1 ACRS.						Section 3.10 Software Interface Requirements.
3.5.2.5.c		Off-board Component shall provide the capability to execute sweep tracks in the mission plan.	SS, Sys	MS	Operating	D	PDIT	Using DTS or MPPCS.
3.5.2.6	Contingency Operations Capability	Contingency operations consist of two sub-capabilities: Sortie Abort and Emergency Stop.						Description.
3.5.2.6.1.a	Sortie Abort Sub-Capability	Off-board and LCS Components shall provide the capability to allow the UVO to abort a preplanned sortie at anytime during execution of the sortie.	SS, Sys	PL, L, T, MS, SA, SR, ER, TA, PM	Operating	D	PDIT	Using DTS or MPPCS.
3.5.2.6.1.b		Off-board and LCS Components shall provide the capability to, after the SORTIE ABORT command is given, allow the UVO to:						Requirement verified below in sub-requirements.
3.5.2.6.1.b.i		Send and begin a new sortie plan	SS, Sys	SA	Operating	D	PDIT	
3.5.2.6.1.b.ii		Transit Off-board Component to current LCS position or other location	SS, Sys	SA	Operating	D	PDIT	Simulate transit to LCS.
3.5.2.6.1.b.iii		Restart the existing sortie at the point where it was aborted	SS, Sys	SA	Operating	D	PDIT	
3.5.2.6.2.a	Emergency Stop Sub-Capability	Off-board and LCS Components shall provide the capability to allow the UVO to command an emergency stop at any time to put the Off-board Component into a safe condition.	SS, Sys	PL, L, T, MS, ES, SR, ER, TA, PM	Operating	D	PDIT	Using DTS or MPPCS.
3.5.2.6.2.b		Safe condition shall be defined as	SS, Sys	PL, L, T,	Operating	I	PDIT	Inspect system

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		one where all moving machinery and components that can pose a threat to equipment or personnel (e.g. rotating machinery, high voltage power) are positively secured and render the system dead in the water.		MS, ES, SR, ER, TA, PM				after command is executed.
3.5.2.6.2.c		In this condition, the Off-board and LCS Components shall retain as much BIT/built-in test equipment (BITE) functionality and mission capability as possible given possible failure of particular sub-systems to enable the operators to troubleshoot and try to remotely restart the Off-board Component.	SS, Sys	PL, L, T, MS, ES, SR, ER, TA, PM	Operating	D	PDIT	Demonstrate after command is executed.
3.5.2.7	Recovery Capability	The Recovery Capability consists of two sub-capabilities: Standard Recovery and Emergency Recovery.						Description.
3.5.2.7.a		Standard Recovery Sub-Capability. No personnel shall be required to be off-board in support craft, or in the water, to assist standard recovery operations to LCS throughout the environment as specified in Section 3.6.2 Operating Environmental Parameters.	Sys	SR	Operating	D	PDIT, DT	Simulate during PDIT.
3.5.2.7.b		Emergency Recovery Sub-Capability. Off-board Component shall be capable of emergency	Sys	ER	Operating	D	PDIT, DT	Simulate during PDIT.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		recovery during situations of a disabled or inoperable Off-board Component within the capabilities and constraints of LCS IAW LCS ICD and LCS LRHS AG. Personnel may be required to be off-board in support craft to assist with emergency recovery.						
3.5.2.8.a	Turnaround Capability	After recovery aboard LCS, Off-board and LCS Components shall be able to prepare system for a follow-up sortie						Description.
3.5.2.8.b		Preparation shall include refuel of Off-board Component, off-load mission data from on-board data storage system and subsystem checks on all major subsystems to ensure system availability immediately prior to launch	SS, Sys	TA	Operating	D	PDIT, DT	Simulate turnaround.
3.5.2.8.c		Pre-launch checks shall be provided via BIT to the maximum extent practicable.	SS, Sys	TA	Operating	D	PDIT, DT	Simulate turnaround.
3.5.2.9.a	Post-Mission Capability	After recovery aboard LCS, Off-board and LCS Components shall be capable of being prepared for stowage.						Description.
3.5.2.9.b		Preparation shall include off-load of mission data from the on-board data storage system, post-recovery checks to determine system status for maintenance and repair planning prior to moving the craft	SS, Sys	PR	Operating	D	PDIT, DT	Simulate post-recovery.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		to the stowage location.						
3.5.3.a	Deployed Maintenance Mode	In this mode, Off-board and LCS Components, at a minimum, shall provide the capability to perform Organizational-Level (O-Level) maintenance procedures on subsystems in preparation for sortie.	SS, Sys	DM	Operating	D	PDIT	
3.5.3.b		Procedures shall include, at a minimum, performance of BIT and PM/FD/FL to determine system is functional and can meet required performance tests (e.g. battery charging, fluid checks).	A, SS, Sys	DM	Operating	A	PDIT	Analyze procedures.
3.5.4	Deployed Stowed Mode	In this mode, the Off-board Component shall be on the stowage cradle, tied down, hatches closed and all necessary electrical and LAN connections made with LCS.	SS, Sys	S	Operating	D	PDIT	
3.6	**Environmental Parameters**	The UISS environmental condition requirements are broken into three sections: those requirements which apply to all states and modes; those that apply only to operating modes; and those that apply only to non-operating modes. FIGURE 3. depicts the three aforementioned sections.						Description.
3.6.1	Overall Parameters	The following environmental parameters apply to all states and modes.						Qualifying statement.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.6.1.1	Humidity	UISS shall provide all capabilities as specified in Section 3.5 Deployed and Section 3.4 Non-Deployed States during and after exposure to 0-100% relative humidity conditions IAW Environmental Engineering Considerations and Laboratory Tests (MIL-STD-810G (Section 507.5))	A, SS, Sys	All	All	T, A	I-PT, DT	Test components IAW referenced MIL-STD during In-Plant Tests. Analyze chosen components if unable to test. Test system during DT.
3.6.1.2	Salt Fog	UISS shall be capable of all requirements as specified in Section 3.5 Deployed and Section 3.4 Non-Deployed States during and after exposure to salt fog conditions IAW MIL-STD-810G (Section 509.5).	A, SS, Sys	All	All	T, A	I-PT, DT	Test components IAW referenced MIL-STD during In-Plant Tests. Analyze chosen components if unable to test. Test system during DT.
3.6.1.3	Solar Radiation	UISS shall be capable of all requirements as specified in Section 3.5 Deployed and Section 3.4 Non-Deployed States during and after exposure to solar radiation of sinusoidal variable levels ranging from 0-1120 W/m^2, throughout 16 hours of a 24-hour period.	A, SS, Sys	All	All	T, A	I-PT, DT	Test components IAW referenced MIL-STD during In-Plant Tests. Analyze chosen components if unable to test. Test system

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
								during DT.
3.6.2	Operating Environmental Parameters	UISS shall operate in all Deployed Modes (Section 3.5) and Non-deployed Training (Section 3.4.2) and Non-deployed Maintenance Modes (Section 3.4.3) within environmental ranges specified in subsequent sections.						Qualifying statement.
3.6.2.1	Daylight/ Nighttime Operations	UISS shall be capable of full sweeping and transit operations in bright sunlight to full darkness (moonless night) without use of artificial visible light.	SS, Sys	NDT, NDM, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	
3.6.2.2	Sea State	Sea State requirement is for three conditions of operation (TABLE 1)						Description.
3.6.2.2.1	Normal Conditions (THRESHOLD)	UISS shall maintain full mission capability. (T = 3; O=4)	Sys	NDT, NDM, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	T	PDIT	
3.6.2.2.2	Degraded Conditions (OBJECTIVE)	UISS mission capability shall degrade gracefully, such that it may continue sweeping with reduced effectiveness. (T=4; O=5)	SS, Sys	NDT, NDM, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	
3.6.2.2.2.a		The Off-board Components shall						Verified under

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		be able to retrieve any deployed sweep gear, if applicable, transit to a rendezvous point with LCS, and resume normal operation at full mission capability when the environment returns to Normal Conditions.						testing for Section 3.8.2.2 EID Value.
3.6.2.2.3	Survival Conditions (THRESHOLD)	The Off-board Components with the sweep gear retrieved and secured, if applicable, shall survive environment and resume operations as the environment improves.	SS, Sys	NDT, NDM, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	
3.6.2.3	Operational Water Temperature	Off-board Component shall be fully operational in water temperatures 32°F to 100°F without degradation throughout deployment	A, SS, Sys	NDT, NDM, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A, T	PDIT, DT	Analyze chosen components for compliance. Obtain data during testing to compare to validate analysis.
3.6.2.4	Operational Air Temperature	Off-board and LCS Components shall be fully operational in ambient air temperatures from -4°F to 115°F.	A, SS, Sys	NDT, NDM, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A, T	PDIT, DT	Analyze chosen components for compliance. Obtain data during testing to compare to validate analysis.
3.6.2.5	Icing/Freezing Rain	Off-board and LCS Components are not intended for operation in						Description.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		icing/freezing rain.						
3.6.2.6	Icing Conditions	Off-board and LCS Components are not intended to operate in conditions that would result in the build-up of ice on the system.						Description.
3.6.2.7.a	Shipboard Shock and Vibration	Off-board Component shall comply be IAW with Grade B requirements of Shock Tests, High Impact Shipboard Machinery, Equipment and Systems Requirements (MIL-S-901D) when in Stowed Mode on-board LCS.	A, SS, Sys	S	Operating	A, T	I-PI, I-PT, DT	Analyze chosen components for compliance. Test components as necessary. Test system in DT.
3.6.2.7.b		LCS Components shall meet Grade B Class II shock requirements of MIL-S-901D when secured within the mission module (MM).	A, SS, Sys	S	Operating	A, T	I-PI, I-PT, DT	Analyze chosen components for compliance. Test components as necessary. Test system in DT.
3.6.2.7.c		Off-board and LCS Components shall be able to meet shipboard vibration conditions IAW Mechanical Vibrations of Shipboard Equipment (MIL-STD 167-1A) in all states and modes aboard LCS as specified in all Deployed Modes (Section 3.5) and Non-Deployed Training (Section 3.4.2) and Maintenance Modes (Section 3.4.3).	A, SS, Sys	NDT, NDM, S, DM, PL, L, SR, ER, TA, PR	Operating	A, T	I-PI, I-PT, DT	Analyze chosen components for compliance. Test components as necessary. Test system in DT.
3.6.2.8	Shipboard Red Light Operations	Off-board Component capabilities shall be able to conduct pre-launch,	SS, Sys	PL, L, SR, ER, PR,	Operating	D	PDIT, DT	Simulate as practical during

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		launch, recovery, post--mission, and turnaround in red light conditions.		TA				PDIT. Test system in DT.
3.6.2.9	Salinity	UISS shall be capable of operations in water with salinity greater than or equal to 20 Practical Salinity Units (PSU) (THRESHOLD)/10 PSU (OBJECTIVE).	SS, Sys	NDT, NDM, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A, T	PDIT, DT	Analyze design for compliance. Validate analysis with test data from DT.
3.6.3	Non-Operating Parameters	Non-operating parameters apply to UISS in Non-Deployed State Storage Mode (Section 3.4.1) and Non-Deployed State Transport Mode (Section 3.4.4).						Description.
3.6.3.1.a	Transportation Altitude	UISS shall withstand rigors (e.g., low pressure, rapid decompression) incurred in transportation by civilian or military aircraft, pressurized and non-pressurized, at a nominal altitude of 40,000 ft IAW MIL-STD-810G (Section 500.5).	SS, Sys	TR	Non-Operating	A, T	I-PT, DT	Analyze design. Test critical components during In-Plant Tests. Test system during DT.
3.6.3.1.b		It is assumed the system shall be defueled for air transport (internal and external).						Qualifying statement.
3.6.3.2.a	Transportation and Storage Temperatures	UISS shall be able to perform its mission after transport and/or after stored in Non-Deployed State (Section 3.4) in air temperatures from -40°F to 140°F when not affected by solar radiation.	SS, Sys	TR, STS, LTS	Non-Operating	A	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.6.3.2.b		UISS shall be able to perform its mission after transport and/or after stored in Non-Deployed State (Section 3.4) in air temperatures from -40°F to 125°F when exposed to solar radiation.	SS, Sys	TR, STS, LTS	Non-Operating	A	PDIT	
3.6.3.3.a	Transportation Accelerations and Vibration	UISS shall be fully mission capable after exposure to shock and vibration conditions encountered in transportation by aircraft (internal & external), sea vessels, and over highways, secondary and tertiary roads.	A, SS, Sys	TR	Non-Operating	A, T	I-PT, PDIT	Test critical components as necessary.
3.6.3.3.b		Transport loads shall be IAW DoD Interface Standard for Transportability Criteria (MIL-STD-1366E) and Small Craft Transportability Design and Certification Process Guidance (NSWC CCD-23-TM-2009/64).	A, SS, Sys	TR	Non-Operating	A, I	I-PI, PDIT	Analyze transportation loads used in design for compliance. Inspect at PDIT to ensure final configuration matches design.
3.6.3.4	Sand and Dust	UISS shall be fully operational, without degradation, after exposure to dry, blowing dust (e.g. Red China Clay) and sand conditions IAW MIL-STD-810G (Section 510.5).	A, SS, Sys	TR, STS, LTS	Non-Operating	A, T	I-PT, DT	Analyze design. Test critical components during In-Plant Tests. Test system during DT.
3.6.3.5	Icing/Freezing Rain	UISS shall be fully operational, without degradation, after exposure to freezing rain (glaze ice) or icing	SS, Sys	TR, STS, LTS	Non-Operating	A, T	PDIT, DT	Analyze design. Verify with available data

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		from salt water spray (e.g. soft rime ice), and at medium loading thickness conditions IAW MIL-STD-810G (Section 521.3).						points from DT.
3.7	Electromagnetic Interference and Electromagnetic Environmental Effects	UISS must comply, and be compatible, with electromagnetic environments during operations aboard and around Navy surface ships IAW Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment (MIL-STD-461F) and Electromagnetic Environmental Effects, Requirements for Systems (MIL-STD-464C).	SS, Sys	All	All	A, T	PDIT, DT	Analyze design. Test system during DT.
3.7.1	Electromagnetic Compatibility	UISS shall be capable of operating in its own electromagnetic field.	SS, Sys	NDT, NDM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	
3.7.3	Electromagnetic Susceptibility	UISS shall not be affected by electromagnetic susceptibility values as required for Navy Surface Ships by MIL-STD-461F as follows:						Qualifying statement.
3.7.3.a		Test Method RS101, Radiated Susceptibility, Magnetic Field, 30 Hz to 100 KHz.	SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR,	Operating	A, T	PDIT, DT	Analyze design. Test system during DT using test method.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
				ER, TA, PR				
3.7.3.b		Test Method RS103, Radiated Susceptibility, Electric Field, 2 MHz to 40 GHz.	SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A, T	PDIT, DT	Analyze design. Test system during DT using test method.
3.8	**Sweep System Performance**	The following section details the ACRS, Effective Influence Depth (EID) and Influence Field requirements the Off-board Component shall meet.						Description.
3.8.1.1	Mission Time Overview							Header
3.8.1.2	ACRS Definition	The primary Measure of Effectiveness (MOE) is the ACRS IAW Standard Mine Warfare MOE and Measures of Performance (MOP) Program Executive Office Littoral Mine Warfare Instruction (PEO LMW INST) 3370.1A.						Description
3.8.1.3	ACRS Value	UISS shall have a minimum ACRS of [ACRS1] nm^2/day (THRESHOLD)/ [ACRS2] nm^2/day (OBJECTIVE). Values can be found in Annex A to UISS SRD (A-2.1, A-2.2).	SS, Sys	PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT, PDSPV	Verify, through tests, that the contractor's system meets values provided Table II. Contractor Specified Parameters and

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
								that system meets applicable requirements in Table III. Government-Specified Parameters. Use results and equations provided to determine if contractor meets ACRS.
3.8.1.3.a		ACRS equation						Equation.
3.8.1.3.a-1		The area to be swept in a mission is defined as a mine danger area which is a rectangular area with dimensions of 4nm by 3nm.						Qualifying statement.
3.8.1.3.a-2		Equations 2 through 11 shall be used to calculate the ACRS of the system. Parameters in TABLE II are specified by the Contractor. Parameters in TABLE III are specified by the Government.						Qualifying statement.
3.8.1.3.a-3		Mission Time equation						Equation.
3.8.1.3.a-4		Equation relating total time under consideration to the time available for actively performing the mission						Equation.
Table II	Table II	Sortie rate based on system endurance (see limit in TABLE III)	Sys	L, T, MS, SA, ES, SR, ER	Operating	T	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
Table II		Effective distance of the influence fields	SS, Sys	MS	Operating	A, T	PDSPV	Analysis at PDR and CDR for magnetic signature. Testing on instrumented range for magnetic and acoustic signatures.
Table II		Velocity during sweeping	SS, Sys	MS	Operating	T	PDIT, PDSPV	
Table II		Time to turn at the end of the track	SS, Sys	MS	Operating	T	PDIT, PDSPV	
Table II		Velocity of transit to the operational area	Sys	T	Operating	T	PDIT	
Table II		Velocity of transit to the staging area	Sys	T	Operating	T	PDIT	
Table II		Time to deploy the sweep (if applicable)	SS, Sys	T	Operating	T	PDIT	
Table II		Time to retrieve the sweep (if applicable)	SS, Sys	T	Operating	T	PDIT	
Table II		Time to perform a system turnaround between sorties	SS, Sys	TA	Operating	T	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
Table II		Time to perform pre-mission preparations	SS, Sys	PL	Operating	T	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
Table II		Time to perform pre-mission checkouts in the launch position	SS, Sys	PL	Operating	T	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
Table II		Time to perform post-mission	SS, Sys	TA, PR	Operating	T	PDIT,	Simulate during

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		preparations in the launch position					DT	PDIT. Test with **LCS** in DT.
Table II		Time to perform post-mission activities in the stowed position	SS, Sys	PR	Operating	T	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
Table III	Table III	Area Coverage Rate Sustained						See Section 3.8.1 ACRS
Table III		Operational Availability						Verified under Section 3.26.1 Operational Availability
Table III		Total Area to be swept in a mission	Sys	MS	Operating	T	PDIT, PDSPV	Sweep representative area.
Table III		Time to launch Off-board Component	SS, Sys	L	Operating	T	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
Table III		Time to recover Off-board Component	SS, Sys	SR	Operating	T	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
3.8.2.a	Effective Influence Depth (EID)	The EID is defined as the depth required for mine actuation at the Effective Influence Distance ($D_{influence}$).						Definition.
3.8.2.b		EID is measured in feet of depth, from the ocean surface to the mine sensors.						Method of measurement.
3.8.2.1	Minimum Operating Depth	The Off-board Component shall be capable of sweep operations in water depths greater than or equal to 40ft.	SS, Sys	MS	Operating	T	PDSPV	
3.8.2.2	EID Value	The Off-board Component shall be	SS, Sys	MS	Operating	T	PDSPV	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		capable of an EID of a minimum of [EID1] (THRESHOLD)/[EID2] (OBJECTIVE). Values can be found in Annex A to UISS SRD (A-3.1, A-3.2).						
3.8.2.3	Effect of Depth on Influence	Description						Description.
3.8.2.4	Influence Field Requirements	Sweep system shall produce magnetic and acoustic influence fields with characteristics as specified in Annex A UISS SRD (A-4) to trigger mines.	SS, Sys	MS	Operating	T	PDSPV	
3.8.3.a	Sweep Subsystem Operational Data	Sweep system health, status and operation data shall be monitored by the system and reported IAW Human-Robot Interaction (HRI) Functional Area Analysis (FAA) Process: USV (NSWCCD-23-TM-2012/09) to the operator in near real-time.	SS, Sys	T, MS	Operating	A, D	PDIT	Analysis for HRI FAA compliance. Demonstrate data is being reported.
3.8.3.b		System health data and recording of data shall be as specified in Section 3.15.2 Health Monitoring						Testing conducted under Section 3.16.2 FM/FL Messages.
3.8.3.c		The Off-board Component shall be capable to provide the magnitude and location of the magnetic and acoustic fields.	SS, Sys	T, MS	Operating	T	PDSPV	Test system providing magnetic and acoustic field information to ensure accuracy.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.8.4.a	Mine Fire Detection	Off-board Component shall provide the capabilities to detect, record, and report mine detonations as they occur during the mission.	SS, Sys	MS	Operating	A, T	PDIT, DT	Analyze design. Test system during DT.
3.8.4.b		Off-board and LCS Components shall correlate detection time with the Off-board Component's position data at time of detection.	SS, Sys	MS	Operating	T	I-PI, DT	Simulate during In-Plant Tests. Test system during DT.
3.9.a	**Hardware Integration Requirements**	Off-board and LCS Components shall meet LCS ICD and LCS LRHS AG for Sea Type 1 MM for integration with both LCS variants.	A, SS, Sys	S	Operating	I	I-PI, PDIT	Inspect critical parts during In-Plant Inspections. Inspect final product during PDIT.
3.9.b		Overall dimensions of Off-board Component shall fit within LCS Sea Type 1 MM IAW LCS ICD and LCS LRHS AG.	Sys	S	Operating	I	PDIT	
3.9.1.a	Launch and Recovery Compatibility with all LCS Configurations	Off-board Component shall be capable, in all load conditions, of L&R with both LCS variants IAW LCS ICD and LCS LRHS AG.	SS, Sys	L, SR, ER	Operating	D	PDIT, DT	Simulate as practical during PDIT. Test system in DT.
3.9.1.b		Off-board Component's hull, appendages, and thru-hulls shall not interfere with LCS L&R equipment.	SS, Sys	L, SR, ER	Operating	I, D	PDIT, DT	Inspect hull prior to **mating** with L&R equipment.
3.9.1.c		Off-board Component, assuming raw water is available for cooling, shall be able to run indefinitely in the Surface Tow Cradle (STC) and	SS, Sys	L, SR, ER	Operating	T, A	PDIT	Measure engine wet exhaust temperature and compare to STC

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		without damaging the STC.						temperature limitations.
3.9.2.a	System Weight and Center of Gravity	USV Lightship weight shall include a 2.5% Service life margin at delivery (TABLE IV).	SS, Sys	All	All	T	PDIT	Scale weigh and compare to design values.
3.9.2.b		Sweep system weight shall include a 2.5% Service life margin at delivery (TABLE IV).	SS, Sys	All	All	T	PDIT	Scale weigh and compare to design values.
3.9.2.c		Off-board Component Full Load weight including entrained water shall not exceed LCS L&R capabilities IAW LCS ICD and LCS LRHS AG.	SS, Sys	S, DM, PL, L, T, MS, SA, ES SR, ER, TA, PR	Operating	T	PDIT	Scale weigh and compare to LCS LRHS AG.
3.9.2.d		Longitudinal Center of Gravity of the vehicle at Full Load and Minimum Operations Load shall be within LCS limits for both variants IAW LCS ICD and LCS LRHS AG.	Sys	S, DM, PL, L, T, MS, SA, ES SR, ER, TA, PR	Operating	T	PDIT	Scale weigh and compare to LCS LRHS AG.
3.9.2.e		The support container weight shall not exceed the weight limit IAW LCS ICD and LCS LRHS AG.	SS	S, DM, PL, L, T, MS, SA, ES SR, ER, TA, PR	Operating	T	PDIT	Scale weigh and compare to ICD. Scale weigh and compare to LCS LRHS AG.
3.9.3.a	Transportability	Small Craft Transportability Design and Certification Process Guidance (NSWCCD-23-TM-2009/64 Rev B) shall be used for design and certification of transportability.	SS, Sys	TR	Non-Operating	A, I	PDIT	Inspection as necessary. Analyze design for compliance.
3.9.3.b		The Off-board Component shall be						Qualifying

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		capable of the following modes of transport IAW MIL-STD-1366E:						statement.
3.9.3.b.i		Over the road on its trailer.	SS, Sys	TR	Non-Operating	A. I	PDIT	Inspection as necessary. Analyze design for compliance.
3.9.3.b.ii		It shall not exceed a height of 138in (THRESHOLD)/120in (OBJECTIVE) on its road trailer.	SS, Sys	TR	Non-Operating	T	PDIT	
3.9.3.b.iii		On a commercial 18-wheel tractor-trailer on its trailer and on the LCS Stowage Cradle.	SS, Sys	TR	Non-Operating	A, I	PDIT	Inspection as necessary. Analyze design for compliance.
3.9.3.b.iv		On a ship on both its trailer and on the LCS Stowage Cradle.	SS, Sys	TR	Non-Operating	A, I	PDIT	Inspection as necessary. Analyze design for compliance.
3.9.3.b.v		As internal air cargo onboard C-5 and C-17 on its trailer and on the LCS Stowage Cradle.	SS, Sys	TR	Non-Operating	A, I, T	PDIT, DT	Inspection as necessary. Analyze design for compliance. Test during DT.
3.9.3.1	Helicopter Transport	The Off-board Component shall be capable of transport as external air cargo via CH-47 helicopter IAW Design Criteria Requirements for the Certification of Sling Loaded Military Equipment for External Transportation by DoD Helicopters (MIL-STD-913).	SS, Sys	TR	Non-Operating	A, I, T	PDIT, DT	Inspection as necessary. Analyze design for compliance. Test during DT.
3.9.3.2.a	Air Transport	The Off-board Component on its trailer and on LCS Stowage Cradle	SS, Sys	TR	Non-Operating	I, A	PDIT	Inspection as necessary.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		shall be designed for air transport certification IAW Designing Internal Aerial Delivery (military handbook (MIL-HDBK)-1791).						Analyze design for compliance.
3.9.3.2.b		Tie-downs for transport shall be IAW Interface Standard for Lifting and Tie-down Provisions (MIL-STD-209).	A, SS	TR	Non-Operating	T	PDIT	Test to referenced MIL-STD.
3.9.4	Fire Retardency and Toxicity	Materials used in the Off-board and LCS Components shall meet the fire performance criteria IAW Composite Materials, Surface Ship, Topside Structural and other Topside Applications-Fire Performance Requirements (NAVSEA DDS-078-1):	A, SS, Sys	All	All	A	I-PI	Analyze planned materials at CDR.
3.9.4.a		Flame spread index American Society of Testing and Materials (ASTM) E 84 Test Method: 25 max.	A, SS, Sys	All	All	A	I-PT	Analyze Contractor test results.
3.9.4.b		Smoke index (ASTM E 84 Test Method): 50 max.	A, SS, Sys	All	All	A	I-PT	Analyze Contractor test results.
3.9.4.c		Fire gas toxicity (ASTM E 662/ASTM E 800): carbon monoxide: 600 parts per million (ppm); hydrogen chloride: 30 ppm; hydrogen cyanide: 30 ppm; Immediate Danger to Life or Health Index: less than one.	A, SS, Sys	All	All	A	I-PT	Analyze Contractor test results.
3.9.5.1.a	Lifting Fittings	Off-board Component shall be able to be lifted by a crane using a four-	SS, Sys	All	All	T	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		leg, single-point lift sling						
3.9.5.1.b		Sling(s) and lifting fittings shall be designed and built with a Factor of Safety (FOS) of six (6) on the Ultimate Strength of the ultimate material strength IAW Hoisting System Design and Certification Process Guidance (NSWCCD-23-TM2009/33 Rev B).	SS, Sys	All	All	A, T	PDIT	Analyze design and test final product.
3.9.5.1.c		Lifting fittings shall be capable of lifting the Off-board Component in the Full Load Condition and trailer or cradle as a unit using the lifting fittings on the craft with an FOS of five (5) on Ultimate Material Strength.	SS, Sys	All	All	A, T	PDIT	Analyze design and test final product.
3.9.5.1.d		Off-board Component shall interface with lifting arrangements identified in LCS ICD and LCS LRHS AG.	SS, Sys	S, DM, PL, L, SR, ER, TA, PR	Operating	A, D	PDIT, DT	Analyze design. Simulate during PDIT. Demonstrate with **LCS** during DT.
3.9.5.1.e		Use of the LCS spreader bars, as represented in the LCS ICD, to align hoisting loads within LCS to those of the single-point lift sling (THRESHOLD)/No use of the LCS spreader bars (OBJECTIVE).	SS, Sys	S, DM, PL, L, SR, ER, TA, PR	Operating	A, D	PDIT, DT	Analyze design. Simulate during PDIT. Demonstrate with **LCS** during DT.
3.9.5.2.a	Line Capture Mechanism (LCM)	Automated/Automatic LCM shall be provided and installed to interface with LCS tow line IAW LCS ICD and LCS LRHS AG.	SS, Sys	L, SR, ER	Operating	I, T	PDIT, DT	Inspect and demonstrate during PDIT (simulate L&R).

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
								Test with **LCS** in DT.
3.9.5.2.b		LCM and its attachment to the hull shall be designed IAW USN Bow Eye Design Criteria for USV Launch and Recovery (NSWCCD-23-TM-2006/27).	SS	L, SR, ER	Operating	A	I-PI	Analyze design for conformance.
3.9.5.2.c		As a safety release, the LCM shall be set to automatically open below a load that will damage the equipment.	SS	L, SR, ER	Operating	T	I-PT, PDIT	Test to design load designated by Contractor. (Test LCM in plant. Test installed in final system during PDIT.)
3.9.5.2.d		LCM shall be able to release the line upon command from any of the operator control interfaces.	SS, Sys	L, SR, ER	Operating	D	I-PT, PDIT	Demonstrate with each control interface.
3.9.5.3.a	Mooring and Tow Fittings	Off-board Component shall be equipped with an emergency tow fitting designed for use in high sea states where craft may be disabled and/or it may be unsafe to transfer personnel onboard or pull another vessel along-side to rig a more conventional towing bridle to other deck fittings.	SS	SR, ER	Operating	I	I-PI, PDIT	
3.9.5.3.b		Tow fittings shall be designed and installed with a FOS of five (5) on Ultimate Material Strength and shall be installed on the craft IAW	SS	SR, ER	Operating	A, T	I-PI, PDIT	Analyze design (In-Plant Inspections) and pull test (PDIT).

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		Towing Fitting Design and Certification Process Guidance Rev B (NSWCCD-23-TM-2009/65 Rev B).						
3.9.5.3.c		Off-board Component shall be equipped with mooring fitting to secure the craft to a dock or pier IAW Mooring Fitting Design and Verification Process Guidance (NSWCCD-23-TM-2011/38).	SS, Sys	NDM, NDT	Operating	I, D	PDIT	Inspect for fittings and demonstrate adequacy.
3.9.6.a	Propulsion Engine, Marine Gear, & Generator Requirements	Off-board Component shall be capable of operating all engines and generators, as applicable, within LCS using cooling water and exhaust interfaces IAW LCS ICD and LCS LRHS AG.	SS, Sys	PL, L, TA, PR	Operating	D	PDIT	
3.9.6.b		Off-board Component shall operate using Diesel Fuel Marine, Distillate Marine Fuel A, and Off Highway Number 2 Diesel (to include ultra low sulfur (less than 15ppm) diesel fuels).	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	
3.9.6.c		Engines and drive systems shall have the capability to run without cooling water (i.e. without external source) for one minute (THRESHOLD)/five minutes (OBJECTIVE).	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	T	PDIT	
3.9.6.d		The average fuel consumption of all Off-board Components over the	SS, Sys	L, T, MS, SA, ES,	Operating	T	PDIT, PDSPV	Test system without sweep

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		course of one sortie shall be less than 40 gallons per hour (gph) (THRESHOLD)/25gph (OBJECTIVE).		SR, ER				deployed and with sweep deployed as applicable.
3.9.7.a	Fuel System	Off-board Component shall be capable of taking on fuel from LCS via connections IAW LCS ICD and LCS LRHS AG.	SS, Sys	PL, TA, PR	Operating	D	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
3.9.7.b		Off-board Component shall be capable of de-fueling/stripping all fuel tanks while on LCS and interfacing with connections IAW LCS ICD and LCS LRHS AG.	SS, Sys	PL, TA, PR	Operating	D	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
3.9.8	Lube Oil Change System	Engines, generators, and marine gears shall be equipped with the Fast Lube Oil Change System or functional equivalent to facilitate rapid oil changes.	SS, Sys	STS, LTS, NDM, DM	All	I, D	PDIT	Inspect system to ensure systems exist and demonstrate they work.
3.9.9	Freshwater Washdown	Off-board Components shall be capable of freshwater washdown provided by LCS IAW LCS ICD and LCS LRHS AG.	SS, Sys	NDM, PL, TA, PR	Operating	D	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
3.9.10.a	Shore Power System	Off-board Component shore power system shall be compatible with LCS supplied power IAW LCS ICD and LCS LRHS AG.	SS, Sys	S, DM, PL, TA, PR	Operating	A, D	PDIT, DT	Analyze design for compliance. Simulate during PDIT. Test with **LCS** during DT.
3.9.10.b		Off-board Component, with the exception of influence sweep generator(s), shall be capable of being powered indefinitely from a	SS	NDM, NDT, S, DM, PL, TA, PR	Operating	A, T	PDIT	Analyze design. Test as necessary to validate.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		shore power connection(s).						
3.9.10.c		Off-board Component shore power connection shall provide power to safely operate the system pier-side, on shore or in the water, within LCS, and to properly store the craft.	SS, Sys	STS, LTS, NDM, NDT, S, DM, PL, TA, PR	All	D	PDIT, DT	
3.9.11.1	LAN Connection	Off-board Component shall have the capability to interface with LCS LAN IAW LCS ICD and LCS LRHS AG to support upload and download of all mission data	A, SS, Sys	S, DM, PL, TA, PR	Operating	D	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
3.9.12.a	Data Storage System	Off-board Component shall have a removable data storage system(s) that can be swapped out between sorties for PMA	A, SS	TA, PR	Operating	D	PDIT	
3.9.12.b		The system(s) shall be readily accessible during Turnaround and Post-Mission Capabilities.	SS, Sys	TA, PR	Operating	D	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
3.9.12.c		The storage system(s) shall be compatible with MPCE and support PMA.	SS, Sys	TA, PR	Operating	A, D	PDIT, DT	Analyze design for compliance. Simulate during PDIT. Test with **LCS** during DT.
3.9.12.d		Off-board Component recorded data shall be stored in an industry standard database or clear-text format	A, SS	TA, PR	Operating	A	I-PI	Analyze data format.
3.9.13	Voice	Off-board and LCS Components shall provide the capability for UVDO to communicate with the UVO and LCS via LCS LAN IAW	SS, Sys	PL, L, SR, ER, PR, TA	Operating	D	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		LCS ICD and LCS LRHS AG.						
3.9.14.a	MVCS	MVCS is part of the MCM MP and is not under the development or control of the UISS Program.						Description.
3.9.14.b		UISS shall interface with MVCS (GFP) on board the Off-board Component IAW MVCS ICD.	SS, Sys	All	All	I	I-PI, PDIT	
3.9.14.c		Off-board Component shall provide space, weight, power reservations, and install MVCS (GFP) equipment IAW MVCS ICD.	A, SS, Sys	All	All	A, D	I-PI, PDIT	Analyze design for compliance. Demonstrate through use.
3.9.14.d		Off-board Component shall provide antenna(s) including all required antenna amplifiers and cabling to interface with MVCS IAW MVCS ICD	A, SS	All	All	I	PDIT	
3.9.14.e		Primary MVCS LOS antenna shall be mounted 18ft above the Off-board Component Full Load waterline	A, SS	T, MS, SA, ES, NDM, NDT	Operating	I	PDIT	Measure height.
3.10.a	**Software Interface Requirements**	All software (OIS, MPCU, & Off-Board Component) shall interface both internally and externally IAW Society of American Engineers (SAE)-AS4 Joint Architecture for Unmanned Systems Standards (SAE-AS4 JAUS).	A, SS	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	I-PI	
3.10.b		All software (OIS, MPCU, & Off-Board Component) shall interface with MVCS IAW External Interface Design Document	A, SS	NDM, NDT, S, DM, PL, L, T, MS, SA,	Operating	I	I-PI	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		(EIDD) for the LCS MVCS, (NSWCPC-MVCS-EIDD).		ES, SR, ER, TA, PR				
3.10.1.a	OIS Software	OIS shall execute within the MPCE IAW MPCE Reference Architecture Document and MPCE Design and Implementation Specification	A, SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A, D	I-PI, PDIT, DT	Analyze design for compliance. Verify as much as possible during PDIT. Test with **LCS** in DT.
3.10.1.b		OIS shall interface with Mission Package Application Software (MPAS) IAW Interface Design Document (IDD) for the Unmanned Vehicle Management System (UVMS) (NSWCPC-MCM-MPAS-UVMS-IDD).	A, SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	I-PI	
3.10.1.c		OIS shall store MEDAL data to the MPCE Network Storage Device IAW MPCE ICD.	A, SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	I-PI	
3.10.1.d		OIS shall integrate with the Mission Package Services (MPS) software to a Level 2 at a minimum IAW MPS to MM Integration Requirements Specifications (IntRS), (IntRS 1773-C-1250).	A, SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	I-PI	
3.11	**Modularity**	UISS shall employ MOSA and						Qualifying

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
	Open Systems Architecture (MOSA)/ Open Architecture	shall have the following characteristics:						statement.
3.11.a		Use publicly available standards, specifications, and protocol established and maintained through a consensus process, preferably by an internationally-recognized governing group	A, SS, Sys	All	All	A	I-PI	Analyze design.
3.11.b		Well-defined, widely-used, non-proprietary interfaces, services, and formats	A, SS, Sys	All	All	A	I-PI	Analyze design.
3.11.c		Employment of modular design principles (e.g. cohesion, encapsulation, de-coupledness) that facilitate component replacement	A, SS, Sys	All	All	A	I-PI	Analyze design.
3.11.d		Upgradeable modules that enable the incorporation of additional or more-capable components with minimum impact, requiring little or no changes to the overall system	A, SS, Sys	All	All	A	I-PI	Analyze design.
3.11.e		MOSA compliance shall be a minimum level of 85% as calculated by the Open Architecture Assessment Tool	A, SS, Sys	All	All	A	I-PI	Analyze design.
3.11.f		MOSA compliance shall be a minimum level of "satisfactory" as calculated by the MOSA Program Assessment and Rating Tool	A, SS, Sys	All	All	A	I-PI	Analyze design.
3.12.a	**Information Assurance (IA) & Program**	UISS shall be IAW Chief of Naval Operations (CNO) Navy IA Program (OPNAVINST 5239.1C)	A, SS, Sys	NDM, NDT, S, DM, PL, L,	Operating	A	PDIT	IA SME verification required.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
	Protection	and Information Assurance (DoD Directive (DODD) 8500.01E) which establishes the IA policies and procedures for all Navy systems that process, store, display and/or transmit DoD information.		T, MS, SA, ES, SR, ER, TA, PR				
3.12.b		UISS shall incorporate measures to protect information by ensuring confidentiality, integrity, availability, authentication, and non-repudiation. Confidentiality assures information is not disclosed to unauthorized individuals, processes, or devices. UISS shall also incorporate measures for disaster recovery and continuity of operations.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.c		UISS shall prevent unauthorized access to software and collected data IAW OPNAVINST 5239.1C to include, but not limited to, the following additional requirements:						Qualifying statement.
3.12.c.i		UISS shall protect from disclosure to unauthorized entities any information that discloses the Navy's operational intent or areas of interest.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.c.ii		UISS shall protect from disclosure to unauthorized entities, any information that discloses the host	A, SS, Sys	NDM, NDT, S, DM, PL, L,	Operating	A	PDIT	IA SME verification required.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		ship's location.		T, MS, SA, ES, SR, ER, TA, PR				
3.12.c.iii		UISS shall provide means to sanitize the system in a non-destructive manner, including electronic data storage devices, in order to declassify the system, when necessary, IAW Department of Navy (DON) Remanence Security Guidebook (NAVSOP-5239-26) and National Security Agency guidelines for cryptographic key zeroization methods.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	T	PDIT	IA SME verification required.
3.12.d		UISS shall maintain the confidentiality, integrity, and availability of DoD classified information and unclassified information that has not been approved for public release during transmission.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.e		The transmission of DoD information shall be protected through communications security (COMSEC) measures and procedures set forth by the Assistant Secretary of Defense for Networks and Information Integration /DoD Chief Information Officer (CIO) in	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		"Communications Security" (DoD Instruction (DODI) 8523.01). DoD policy requires:						
3.12.e.i		COMSEC materials shall be developed, acquired, operated, maintained, and disposed of through the approved methods set forth in DODI 8523.01.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.e.ii		A program to ensure operational availability of commonly used COMSEC equipment during crisis or contingencies shall be established and maintained.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.e.iii		COMSEC equipment shall be compatible with DoD-approved key management systems.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.e.iv		Controlled cryptographic items, classified cryptographic devices and unencrypted keying material shall be accounted for.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.f		The UISS Program shall describe	A, SS, Sys	NDM,	Operating	A	PDIT	IA SME

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		the security measures to protect all aspects of the UISS system to include the protection of classified information, critical program information, and/or critical components to meet DoD security and IA requirements. This information shall be reflected in an IA Strategy Plan IAW the DON CIO IA Strategy Guidance.		NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR				verification required.
3.12.g		In order to meet the IA standards for COTS products, the acquisition of all IA and IA-enabled COTS hardware and/or software shall be limited to products that have been evaluated or validated through either the International Common Criteria, the National Information Assurance Partnership Evaluation and Validation Program, or the Federal Information Processing Standard Validation Program.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.h		IAW Operation of the Defense Acquisition System (DODI 5000.02), and Critical Program Information (CPI) Protection within the Department of Defense (DODI 5200.39), a comprehensive program protection and technology control plan shall be adhered to throughout the acquisition system lifecycle to support program	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		protection efforts.						
3.12.i		A Program Protection Plan (PPP) shall be prepared for the UISS Program to guides these efforts.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.i.i		As part of the Program Protection requirements, the UISS Program shall identify CPI)/Critical Technologies (CT) inherent in the system or inherited from external systems, and shall perform a Criticality Analysis (CA) for Supply Chain Risk Management (SCRM) to determine mission critical components that may result in catastrophic or critical protection failures due to operational, system information, or component integrity aspects.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.i.ii		The CA shall result in the identification of these UISS mission critical components.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.i.iii		A UISS PPP shall be IAW Deputy Assistant Secretary of Defense, Systems Engineering Program	A, SS, Sys	NDM, NDT, S, DM, PL, L,	Operating	A	PDIT	IA SME verification required.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		Protection Plan Outline and Guidance (DASD SE PPP O-G).		T, MS, SA, ES, SR, ER, TA, PR				
3.12.j		The Directive-Type Memorandum 09-016, "Supply Chain Risk Management (SCRM) to Improve the Integrity of Components Used in DoD Systems" (DTM 09-016) shall be adhered to for the mitigation and management of supply chain risk for any critical components that may be identified through the CA process.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.k		An Anti-Tamper Plan (ATP) shall be required if any CPI/CT are identified for the UISS Program ATP which is a classified annex to the PPP, shall be properly implemented to deter efforts of foreign control of any CPI/CT or critical components due to battlefield loss or foreign sales.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.12.1	IA Certification	UISS shall be IA certified and accredited for operation						Description.
3.12.1.a		UISS shall be IAW DoD IA Certification and Accreditation (C&A) Process (DIACAP) (DODI 8510.01) which establishes the DoD-mandated process by which UISS shall be certified as meeting a set of IA security requirements	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		and then will be accredited for operation.						
3.12.1.b		As a Platform Information Technology system, UISS is exempt from the full DIACAP C&A process, and is regulated by Implementation of NAVSEA Afloat IA Governance and Guidance (NAVSEAINST 9400.2A) establishing afloat IA governance and guidance, and therefore shall follow the policies and guidance IAW NAVSEA Afloat Information Assurance Implementation Manual (NAVSEA 9400.2-M).	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.13	Personnel	UISS shall ensure that personnel providing IA services, such as installation, patching and vulnerability management of a DoD Information System are certified and accredited IAW Information Assurance Training, Certification, and Workforce Management (DODD 8570.01) for the IA functions they are performing on the UISS system.	A, SS, Sys	NDM, NDT, S, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	PDIT	IA SME verification required.
3.14	**Command, Control, Communication and Computers (C4)**							Header.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
	Requirements							
3.14.1	C4 Elements	C4 subsystem shall include all the hardware and software elements required to command and control the Off-board Component from LCS, the host platform. It includes the following elements:						Qualifying statement.
3.14.1.a		Control system on the Off-Board Component.	SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	I	I-PI	
3.14.1.b		OIS for USV and sweep subsystem control and status.	SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	I	I-PI	
3.14.1.c		MPCU software for tele-operation during L&R.	SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	I	I-PI	
3.14.1.d		USV-mounted components of the MVCS for host to Off-board Component communications.	SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA,	Operating	I	I-PI	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
				ES, SR, ER, TA, PR				
3.14.2.a	C4 System Requirements	The C4 system shall have an A_o of 0.99 IAW Operational Availability Handbook: A Practical Guide for Military Systems, Subsystems and Equipment (OPNAVINST 3000. 12A).	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	T	PDIT, DT	Start measuring during PDIT; continue through DT.
3.14.2.b		During an operation all C4 data shall be recorded and stored onboard the Off-Board Component for transfer to MPCE for archive, PMA, and diagnostic support.	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	
3.14.2.c		During operation all C4 data passing through the OIS shall be recorded and stored within MPCE for archive, PMA, and diagnostic support.	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT, DT	Demonstrate as practical in PDIT. Demonstrate all in DT.
3.14.2.d		Processing of C4 data that is critical for safety of craft operations shall take priority over all other data elements	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	I-PI	Analyze C4 system design.
3.14.2.e		C4 shall be divided into two sub-						Description.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		systems, the C4 computer environment (C4CE) and C4 systems automation (C4SA).						
3.14.2.e.i		C4CE performs the higher level C4 processing functions, including mission planning, mission execution, high bandwidth sensor processing and data storage.	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	I-PI	Analyze C4 system design.
3.14.2.e.ii		C4SA shall utilize COTS, ruggedized, mobile processors for low-level control and automation of core craft systems. Core systems are those systems and associated control capabilities required to safely operate and maintain the craft under manual control (e.g. electrical distribution, engines, generators, bilge pumps).	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A, I	I-PI	Analyze C4 system design and inspect for correct hardware.
3.14.3	C4 SA System	C4SA shall support all automated tasks identified as required by the HRI FAA.	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	I-PI	Analyze C4 system design.
3.14.3.1	Intercommunication with C4CE	C4SA shall use controlled area network bus (CANbus) (SAE J1939 or National Marine Electronic Association 2000) for intra-communication between core	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR,	Operating	A	I-PI	Analyze C4 system design.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		systems, as well as, for inter-communication with the C4CE.		ER, TA, PR				
3.14.4	Automatic Identification System (AIS)	The Off-board Component shall have an AIS which shall be controlled remotely by the UVO.	SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	I, D	I-PI, PDIT	
3.14.4.1	Tools and Test Equipment	The Off-Board Component shall have the capability to accept tools and test equipment enabling an independent radio transmission to positively put the Off-Board Component in a safe state as specified in Section 3.20.3.2 Emergency Stop.	SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	Demonstrate as part of emergency stop demonstration/test.
3.14.5.1	Navigation Methods	The Off-board and LCS Components shall provide the following navigation methods, as selected by the UVO:						Qualifying statement.
3.14.5.1.a		Manual navigation tele-operation – Off-board system to be navigated via tele-operation. System perception sensors provide feedback to the UVO to allow safe navigation.	SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	
3.14.5.1.b		Track navigation per the mission plan following the MEDAL path. Off-board system to follow the MEDAL provided or separately	SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA,	Operating	D	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		developed track. This is similar to an autopilot where the Off-board Component goes from waypoint to waypoint. The UVO will monitor the system.		ES, SR, ER, TA, PR				
3.14.5.1.c		Obstacle avoidance navigation.	SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	
3.14.5.2	Navigation Method Transition	Transition from C4 to manual control and vice versa shall allow for the graceful and safe transition between any methods of navigation and be safe IAW Unmanned Systems Safety Guide for DoD Acquisition (2007) and the Navy System Safety Program (OPNAVINST 5100.24B).	SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A, D	I-PI, PDIT	Analyze design for compliance and demonstrate handoffs.
3.14.5.3.a	Global Positioning System (GPS).	All geodetic position computations, navigation calculations, and data displays in the Off-board and LCS Components shall be based on DoD World Geodetic System 1984 (WGS84) global geodetic reference frame.	A, SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	I-PI	
3.14.5.3.b		The Off-board Component shall have two, fully redundant Selective Availability Anti-Spoofing	A, SS	NDM, NDT, DM, PL, L, T,	Operating	I	I-PI	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		Module-compliant GPS Systems.		MS, SA, ES, SR, ER, TA, PR				
3.14.5.4	Cross Track Error	The Off-board Component shall have a cross track error less than 20 yds	SS, Sys	T, MS	Operating	T	PDIT, PDSPV	
3.14.6.a	Navigation Rules Compliance	The Off-board Component shall comply with US Coast Guard Commandant Instruction (COMDTINST) M16672.2D "Navigation Rules, International/Inland".	SS, Sys	NDM, NDT, T, MS, SA, ES	Operating	A, T	I-PI, PDIT	Analyze design during build. Test critical points during PDIT.
3.14.6.b		The Off-board Component shall comply with the Navigation Safety Advisory Council (NAVSAC) Resolution 11-02.	SS, Sys	NDM, NDT, T, MS, SA, ES	Operating	A, T	I-PI, PDIT	Analyze design during build. Test critical points during PDIT.
3.14.7.a	Obstacle Avoidance Capability	Off-board and LCS Components shall provide obstacle detection and avoidance capability to reduce the possibility of the Off-board Component colliding with surface objects.	SS, Sys	NDM, NDT, T, MS, SA, ES	Operating	D	PDIT	
3.14.7.b		Off-board and LCS Components shall be able, in all modes of operations, to perceive a 24ft small boat (assume 7M Navy standard rigid-hull inflatable boat (RHIB) and all speeds up to 30kt in any relative direction) and any charted, fixed obstacles and navigational	SS, Sys	NDM, NDT, T, MS, SA, ES	Operating	T	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		aids at a range that allows the UVO to avoid collision and, if applicable, avoid damage to any deployed sweep equipment.						
3.14.7.c		OIS shall provide the UVO the capability to initiate pre-programmed avoidance maneuvers and get Off-board Component back on route.	SS, Sys	NDM, NDT, T, MS, SA, ES	Operating	D	PDIT	
3.14.7.d		OIS shall provide the UVO the capability to manually maneuver to avoid objects at any time.	SS, Sys	NDM, NDT, T, MS, SA, ES	Operating	D	PDIT	
3.15	**Human Systems Integration**							Header.
3.15.1	Operator Interfaces	Personnel (e.g. operator, maintainer) interfaces shall be IAW US DoD Design Criteria Standard: Human Engineering (MIL-STD 1472G) and Human Engineering Requirements for Military Systems, Equipment, and Facilities (MIL-STD-46855)	SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	A	I-PI	
3.15.1.1	Operator Console	The LCS Components shall utilize existing LCS MP consoles IAW LCS ICD and LCS LRHS AG.	A, SS	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT, DT	Simulate as necessary during PDIT. Test with **LCS** in DT.
3.15.1.2.a	UVO Monitoring and Control of	The Off-board Component shall be capable of operation by a single	A, SS	NDM, NDT, DM,	Operating	D	PDIT, DT	Simulate as necessary

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
	Off-board Component	UVO using OIS on one LCS MP Common Console		PL, L, T, MS, SA, ES, SR, ER, TA, PR				during PDIT. Test with **LCS** in DT.
3.15.1.2.b		OIS shall provide the capability to positively transfer control of the Off-board Component between the MP Common Console and to, and take control from, the MPCU.	A, SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT, DT	Simulate as necessary during PDIT. Test with **LCS** in DT.
3.15.1.2.c		Manual control shall always override automated control (e.g. waypoint navigation and subsystem automation)	A, SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	
3.15.2.a	Health Monitoring	The Off-board and LCS Components shall provide relevant near real-time information to UVO regarding the input, output, response monitoring information, and equipment source identification for all automated equipment, as specified in the HRI FAA	A, SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	
3.15.2.a.i		This data shall be recorded, and stored and archived for PMA	A, SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA,	Operating	D	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
				ES, SR, ER, TA, PR				
3.15.2.b		The Off-board and LCS Components shall provide system diagnostic and prognostic information, as specified in the HRI FAA	A, SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT, DT	Simulate as necessary during PDIT. Final verification with **LCS** in DT.
3.15.2.b.i		This data shall be recorded, and stored and archived for PMA	A, SS, Sys	NDM, NDT, DM, PL, L, T, MS, SA, ES, SR, ER, TA, PR	Operating	D	PDIT	
3.16	**Fault Management (FM) and Fault Localization (FL)**	The Off-board and LCS Components shall identify/include:						Qualifying statement.
3.16.a		The passive FM assets and tools for the systems and subsystems to include identification of the alarms and alerts that occur and are recorded. Passive FM shall only provide the information that identifies the lowest replaceable/repairable unit (LRU) it is monitoring is intelligent enough to generate an error and report it to the management tool.	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A, D	I-PI, PDIT	
3.16.b		The active FM assets and tools for the systems and subsystems that	A, SS	STS, LTS, NDM,	All	A, D	I-PI, PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		have the capability to ping the system or LRU and receive a response. If the system or LRU does not respond, the system shall alarm and allow for the proactive correction of the problem, return to a safe state or condition, or require operator input.		NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR				
3.16.c		Any tools, test equipment, or procedures for diagnosing, testing, or repairing faults when a failure occurs	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A, D	I-PI, PDIT	
3.16.d		All of these functions for the system or subsystems shall be able to, in near-real-time, provide personnel (e.g., operator, maintainer) information on localization of faults encountered while in all states and modes.	A, SS	All	All	A, D	I-PI, PDIT	
3.16.1	FM/FL Capabilities	The Off-board and LCS Components shall identify the following capabilities for the active and passive FM/FL for the systems and subsystems:						Qualifying statement.
3.16.1.a		Detect	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES,	All	A	I-PI	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
				SR, ER, TA, PR				
3.16.1.b		Isolate	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.16.1.c		Correct malfunctions	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.16.1.d		Compensate for environmental changes	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.16.1.e		Include error logs	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.16.1.f		Accept and act on error detection notifications	A, SS	STS, LTS, NDM,	All	A	I-PI	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
				NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR				
3.16.1.g		Trace and identify faults	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.16.1.h		Sequences and perform diagnostics tests	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.16.1.i		Correct faults	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.16.1.j		Reporting error conditions and identifies location to trace faults by examining and manipulating system reporting information.	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER,	All	A	I-PI	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
				TA, PR				
3.16.2	FM/FL Messages	All sensors, recorders, and reasoning devices shall provide accurate and predefined non-ambiguous messages to the operator/maintainer.	A, SS, Sys	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A, D	I-PI, PDIT	
3.16.2.a		These messages shall provide status information for both normal and abnormal conditions.	A, SS, Sys	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.16.2.b		Messages shall be IAW MIL-STD-1472G.	A, SS, Sys	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.17	**Built-In-Test (BIT)**	The Off-board and LCS Components shall identify:						Qualifying statement.
3.17.1	Automatic and Semiautomatic Features	All internal automatic or semiautomatic features in the system or subsystem design that will detect, diagnose condition, or isolate failures by interrogating a system or monitoring system performance. These shall be identified as:	SS, Sys	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.17.1.a		Powering on BIT (PBIT)						*see above*
3.17.1.b		Continuous BIT (CBIT)						*see above*
3.17.1.c		Operator Initiated BIT (OBIT)						*see above*
3.17.1.d		Built-in-Test diagnostics (BITD)						*see above*
3.17.2	Hardware and Software Failures	All BITD or software routines that execute any sequence that will identify system status to include failure or potential failure of the hardware or software elements in the system or subsystem to the LRU.	SS, Sys	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.17.3	Analysis Tools	Analysis tools for the overall system status as required to support the integration of all systems and subsystems	SS, Sys	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A	I-PI	
3.17.4	False Alarm Percentages	False alarm percentages for each BIT/BITE sequence or sequences	SS, Sys	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	D	PDIT	
3.17.5	System Status	System status during the test for example "NOT READY for Operation" and "Initiate system start up". The system status shall be provided for all tests in all states and modes.	SS, Sys	All	All	D	PDIT	
3.17.6	Test Equipment	Any device that is part of the UISS	SS, Sys	STS, LTS,	All	A	I-PI	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		equipment or system that will be used for the purpose of testing the equipment or system		NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR				
3.17.7	Procedures	The procedures used to initiate the test sequences:						Qualifying statement.
3.17.7.a		Sequence of test events to include buttonology and hookups for off-board/onboard hardware/software	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A, D	I-PI, PDIT	
3.17.7.b		Define systems status and messaging that will be shown to indicate failure or potential failures	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A, D	I-PI, PDIT	
3.17.7.c		Define action required to return the equipment ready for use status based on messages	A, SS	STS, LTS, NDM, NDT, DM, PL, T, MS, SA, ES, SR, ER, TA, PR	All	A, D	I-PI, PDIT	
3.17.7.d		Define items that must be referred to an Intermediate (I)- or D-Level maintenance facility for further	A, SS	STS, LTS, NDM, NDT, DM,	All	A, D	CDR, I-PI, PDIT	Analysis can begin at CDR and continues

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		evaluation or testing.		PL, T, MS, SA, ES, SR, ER, TA, PR				through process.
3.17.8	Incorporation of COTS	Any COTS diagnostics or BITE shall be submitted to Systems Engineering team for review prior to system integration	A, SS	STS, LTS, NDM, DM, PL, TA, PR	All	A	I-PT	Analyze starting at PDR and carry through to PDIT.
3.18	**Built-in Test (BIT)/BIT Equipment (BITE).**	BIT/BITE shall provide status in all states and modes and to include identification of system/subsystem condition and shall provide the user with the ability to detect and isolate failures and perform maintenance actions that will allow the system to be returned to operational status within the MTTR two-hour (THRESHOLD)/one-hour threshold (OBJECTIVE).	A, SS	All	All	D	PDIT	
3.19	**Manpower**							Heading.
3.19.1	Detachment Size	Total number of trained personnel needed to safely maintain and operate the Off-board and LCS Components shall not exceed fifteen personnel (THRESHOLD)/six personnel (OBJECTIVE) within the available LCS Mine Warfare Detachment manpower/skill levels.	Sys	All	All	A, D	I-PI, PDIT, DT	Analyze design. Demonstrate during PDIT. Verify during DT.
3.19.2	Watch Section Size	Watch section size based on a three section rotation, shall not exceed	Sys	All	All	A	PDIT	Analyze design.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		five personnel (THRESHOLD)/two personnel (OBJECTIVE) for operations during deployment.						
3.19.3	Human-Robot Interaction (HRI)	UISS shall not require human capabilities that exceed human limitations IAW MIL-STD-46855 and the Human Integration Design Handbook (NASA/SP-2010-3407).	Sys	All	All	A	PDIT	Analyze design.
3.19.4.a	Situational Awareness (SA)	Off-board and LCS Components shall collect and process all SA sensor information and provide near real-time information to the UVO to include:	A, SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	D	PDIT, DT	Demonstrate 3.19.4.a.ii during PDIT. Simulate 3.19.4.a.i during PDIT. Demonstrate 3.19.4.a.i during DT.
3.19.4.a.i		SA information from LCS via UVMS						Tested as part of 3.19.4.a
3.19.4.a.ii		SA information from Off-board Components						Tested as part of 3.19.4.a
3.19.4.b		Off-board and LCS Components shall support SA to simulate watchstander capabilities IAW COMDTINST M16672.2D.	A, SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	A, D	I-PI, PDIT	Analyze design and demonstrate critical components/functions.
3.19.4.c		Off-board and LCS Components shall provide the UVO the capability to discriminate contacts and/or obstacles identified by one or more sensors	A, SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	D	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.19.4.d		All SA sensor data shall be recorded, stored, and archived for PMA	A, SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	D	PDIT	
3.19.5.a	Human Factors	UISS shall ensure physical accommodation for compatibility, operability, and maintainability by a range of body types representing the 5th to 95th percentile for males and females, IAW Anthropometry of US Military Personnel (DOD-HDBK 743A).	SS, Sys	All	All	A	I-PI, PDIT	Inspect design during build and verify as-built complies.
3.19.5.b		Accommodation for operation, including L&R, and maintenance shall account for the wearing of personal protective equipment (PPE) during all modes and states and all environmental conditions.	SS, Sys	All	All	A, D	PDIT	Analyze design. Demonstrate during PDIT.
3.19.5.c		Accommodation for operation, including L&R, and Chemical, Biological, Radiological (CBR) washdown shall account for the wearing of PPE during operational modes and states in a CBR environment.	SS, Sys	All	All	A	PDIT	
3.19.5.d		UISS design, equipment (hardware and software/firmware) and maintainer interface shall be IAW MIL-STD-1472G.	SS, Sys	All	All	A, I	PDIT	Analyze design and inspect critical interfaces as necessary.
3.20	System Safety	System safety practices shall be IAW Unmanned Systems Safety	A, SS, Sys	All	All	A	I-PI	Analyze design during build.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		Guide for DoD Acquisition (2007) and System Safety Engineering Policy (NAVSEAINST 5100.12B)						
3.20.1.a	Emergency Operation.	If a mission-critical failure occurs during sortie execution and critical control components (e.g., vehicle computer, propulsion system, steering, C2) are available, the Off-board Component shall provide the capability to revert to a safe condition as specified in Section 3.20.3.2 Emergency Stop and send a message to the operator.	SS, Sys	NDM, NDT, PL, L, T, MS, SA, ES, SR, ER, TA, PL	Operating	D	PDIT	
3.20.1.b		If failsafes fail to address the problem or issue, then Off-board and LCS Components shall provide the operator capability to override and control system manually.	SS, Sys	NDM, NDT, PL, L, T, MS, SA, ES, SR, ER, TA, PL	Operating	D	PDIT, DT	Fully verify during DT.
3.20.1.c		UISS shall have the capability of disengaging from the LCS tow line while retaining communications and full control of the Off-board Component.	SS, Sys	NDM, NDT, PL, L, T, MS, SA, ES, SR, ER, TA, PL	Operating	D	PDIT, DT	
3.20.2	Emergency Recovery	The Off-board Component shall provide the capability for emergency recovery:						Qualifying statement.
3.20.2.a		The Off-board Component shall have the capability for personnel in the LCS' ready service life boat to configure it for recovery	SS, Sys	L, T, MS, SA, ES, SR, ER	Operating	D	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		configuration regardless of the power status.						
3.20.2.b		The Off-board Component shall be capable of being towed by the LCS' ready service life boat.	SS, Sys	L, T, MS, SA, ES, SR, ER	Operating	D	PDIT, DT	
3.20.2.c		Any subsystems deployed from the Off-board Component shall have the capability to be manually disconnected by personnel in the LCS' ready service life boat.	SS, Sys	L, T, MS, SA, ES, SR, ER	Operating	D	PDIT	
3.20.3	Stopping the Off-board Component	The UVO shall have the following options to stop the Off-board Component at any time.						Qualifying statement.
3.20.3.1.a	Sortie Abort	The Off-board and LCS Components shall provide the operator the capability to transmit a sortie abort command to the control system via MVCS link.	SS, Sys	L, T, MS, SA, SR, ER	Operating	D	PDIT	
3.20.3.1.b		When this command is received, the Off-board Component shall safely stop sortie execution and secure, or retrieve, as applicable, sweep equipment.	SS, Sys	L, T, MS, SA, SR, ER	Operating	D	PDIT	
3.20.3.1.c		The Off-board Component shall remain in a condition that allows the operator to continue the sortie or send a sortie re-direction, and command execution of the redirected plan or other pre-loaded sortie plan.	SS, Sys	L, T, MS, SA, SR, ER	Operating	D	PDIT	
3.20.3.1.d		The time to stop is dependent upon the time needed to convert to a safe	SS, Sys	L, T, MS, SA, SR,	Operating	D	PDIT	Demonstrate functionality

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		state. A safe state is defined as the Off-board Component in the following condition:		ER				and inspect system for compliance after command.
3.20.3.1.d.i		All deployed systems retrieved and stowed						Definition.
3.20.3.1.d.ii		Engines at idle						Definition.
3.20.3.1.d.iii		Propulsors disengaged						Definition.
3.20.3.1.d.iv		All C4 systems powered						Definition.
3.20.3.1.d.v		Sweep system not generating any acoustic or magnetic signature						Definition.
3.20.3.2.a	Emergency Stop	UISS shall provide an emergency stop capability, at all times, that allows the Operator onboard LCS, at either the primary control station or MPCU to put the system into a Safe Condition.	SS, Sys	L, T, MS, SA, ES, SR, ER	Operating	D	PDIT	Demonstrate functionality and inspect system for compliance after command.
3.20.3.2.b		The emergency stop condition is defined as the Off-board Component in the following condition:						Verified under 3.20.3.2.a.
3.20.3.2.b.i		All deployed systems in whatever condition they were in when the emergency stop command was issued.						Definition
3.20.3.2.b.ii		Engines stopped but are capable of being restarted if the UVO or UVDO chooses to.						Definition.
3.20.3.2.b.iii		Propulsors in whatever condition they were in when the emergency						Definition.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		stop command was issued.						
3.20.3.2.b.iv		All C4 systems powered.						Definition.
3.20.3.2.b.v		Sweep system not generating any magnetic or acoustic signature.						Definition.
3.20.4.a	Mine Survivability	Sweep system not generating any magnetic or acoustic signature.	A, SS, Sys	MS	Operating	A, T	I-PI, PDIT, DT	Analyze design. Test during DT.
3.20.4.b		The Off-board Component shall be designed and built to survive [KSF1] Keel Shock Factor (KSF) (Mission Survival) such that it may continue a sortie after a mine fire event. For KSF values, see Annex A to UISS SRD (A-5.1.A, A-5.1.B).	A, SS, Sys	MS	Operating	A, T	I-PI, PDIT, DT	Analyze design. Test during DT.
3.20.5	Accelerations Monitoring	The Off-board Component shall be designed and built to survive [KSF2] KSF (Craft Survival) loads such that it shall be salvageable. For KSF values, see Annex A to UISS SRD (A-5.2.A, A-5.2.B).	SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	T	PDIT	Test for accuracy.
3.20.6	Stability	The Off-board Component shall have the capability to measure vehicle accelerations at the center of gravity and report to the UVO.	SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	A, T	I-PI, InT	Analyze design and conduct inclining experiment on completed product.
3.20.6.1	Stability Cases	The Off-board Component shall meet Procedures Manual for Stability Analysis of US Navy Small Craft						Qualifying statement.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		(NAVSEACOMBATSYSENGSTA Report No. 6660-99) for intact and single compartment damage stability.						
3.20.6.1.a		The following stability cases shall be included in the analysis:	SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	A	I-PI	Analyze design prior to CDR.
3.20.6.1.b		Intact stability for beam winds with rolling.	SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	A	I-PI	Analyze design prior to CDR.
3.20.6.1.c		A 60-kt wind velocity shall be applied IAW NAVSEACOMBATSYSENGSTA Report No. 6660-99 (see 2-C of Table 3-2).	SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	A	I-PI	Analyze design prior to CDR.
3.20.6.1.c.i		For open deck craft (e.g., 11m Navy RHIB), the following conditions shall be considered:						Definition.
3.20.6.1.c.ii		Normal Operating Condition – The downflooding point is considered as the point where seawater enters the craft exterior compartment(s) (e.g., top of the collar or gunwale). An exterior compartment is defined as any volume of the craft that is normally exposed to the environment and self-bailing or able to drain freely, such as a cockpit.						Definition.
3.20.6.1.c.ii		Swamped Condition –Seawater is						Definition.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
i		flooding the craft exterior compartment(s) and no longer able to drain by normal means. Seawater is only able to evacuate the exterior compartment(s) by the same means that it entered (e.g., spilling over the collar or gunwale when the craft is heeled). In this condition, the downflooding points shall be considered as any non-watertight hatches or openings into interior compartments.						
3.20.6.1.d		Free Flooding Condition – Seawater freely flows into and out of the craft exterior compartment(s). This condition simulates faulty scupper or drain check valves that are no longer preventing seawater from entering the craft. In this condition, the downflooding points shall be considered as any non-watertight hatches or openings into interior compartments.	SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	A	I-PI	Analyze design prior to CDR.
3.20.6.1.e		Additional stability cases for lifting heavy weights over the side and towing are required if either is within the function of the Off-board Component.	SS, Sys	NDM, NDT, L, T, MS, SA, ES, SR, ER	Operating	A	I-PI	Analyze design prior to CDR.
3.20.6.1.f		Topside icing and passenger crowding calculations are not required.	SS, Sys	NDM, NDT, L, T, MS, SA,	Operating	A	I-PI	Analyze design prior to CDR.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
				ES, SR, ER				
3.20.7	Fire Suppression	Reduced rollback angles shall be considered where they can be justified by the type of craft when operating in the required operating environmental parameters.	SS, Sys	All	All	A	I-PI	Analyze design prior to CDR.
3.21	**Electrical System**	Off-board Component shall have fire suppression capability to fight more than one fire at a time in any combination of watertight spaces.						Header.
3.21.1	Electrical System Standards	Unless otherwise specified, electrical systems shall be designed and installed IAW the following, as applicable, in order of precedence:	A, SS, Sys	All	All	A, I	I-PI, PDIT	Analyze design prior to CDR. Inspect final product.
3.21.1.a		"Standard Electrical Installation Requirements and Nomenclature" (NAVSEA DWG 53711-GEN-300-5107858).						Publications.
3.21.1.b		"US Navy Boat Electrical Practices" (NSWCCD-23-TM-2009/58 Rev B).						Publications.
3.21.1.c		Original Equipment Manufacturer (OEM) Recommendations.						Publications.
3.21.1.d		ABYC.						Publications.
3.21.2.a	Grounding and Bonding System	Off-board Component shall be grounded and bonded IAW Shipboard Bonding, Grounding and other Techniques for Electromagnetic Compatibility, Electromagnetic Pulse Mitigation and Safety (MIL-STD-1310H).	A, SS, Sys	All	All	A, I	I-PI, PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.21.2.b		Off-board Component shall have provisions to be bonded to the stowage cradle IAW MIL-STD-1310H with a class C, type I bonding strap.	A, SS, Sys	All	All	D	PDIT	
3.21.2.c		Off-board Component shall provide the capability to be grounded during recovery IAW LCS ICD.	A, SS, Sys	All	All	D	PDIT, DT	Simulate during PDIT. Test with **LCS** in DT.
3.21.3.a	Batteries	Batteries shall be IAW standards specified in Section 3.21.1 Electrical System Standards.	A, SS	All	All	I	I-PI	
3.21.3.b		Battery banks shall be sized to power all equipment required to support the Pre-launch, Launch, and Turnaround Capabilities when disconnected from shore power for at least two hours and still be able to start the engines.	A, SS	PL, L, TA	Operating	A, D	I-PI, PDIT	Analyze design. Verify during PDIT.
3.21.3.c		Lithium batteries used to power any subsystem or component of UISS shall be approved for use IAW Navy Lithium Safety Battery Program (NAVSEAINST 9310.1B), High Energy Storage System Safety Manual (DRAFT) (NAVSEA SG270-BV-SAF-010) and NAVSEA Technical Manual for Batteries, Navy Lithium Safety Program Responsibility and Procedures (S9310-AQ-SAF-010).	A, SS	All	All	A	I-PI	
3.21.3.d		Rechargeable lithium batteries	A, SS	All	All	A	I-PI	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		shall be approved for shipment under the provisions of 49 Code of Federal Regulations (CFR) Section 173.185.						
3.22	**Mechanical Systems**							Header.
3.22.1	Mechanical System Standards	Unless otherwise specified, mechanical systems shall be designed and installed IAW the CFR, as applicable to unmanned systems.	A, SS	All	All	A	I-PI	
3.22.2.a	Propulsor Requirements	Off-board Component shall have the capability to disengage the propulsor from the engine.	A, SS	NDM, NDT, DL, T, MS SA, ES, SR, ER	Operating	D	PDIT	
3.22.2.b		Off-board Component shall have the capability to generate forward, neutral, and reverse thrust.	A, SS	NDM, NDT, DL, T, MS SA, ES, SR, ER	Operating	D	PDIT	
3.22.3.a	Bilge System	Compartments on the Off-board Component that can collect water shall have a means to evacuate said water.	A, SS	NDM, NDT, DL, T, MS SA, ES, SR, ER	Operating	D	PDIT	
3.22.3.b		Any pumps in this system shall provide the UVO control to be put in an automatic, on or off state.	A, SS, Sys	NDM, NDT, DL, T, MS SA, ES, SR, ER	Operating	D	PDIT	
3.22.3.c		Any volume of fluid remaining in a compartment upon completion of evacuation shall be accounted for in the weight and stability calculations.	A, SS, Sys	NDM, NDT, DL, T, MS SA, ES, SR, ER	Operating	A	I-PI	Analyze weight and stability calculations.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.22.3.d		The UVO shall receive alarms if the accumulation of water overwhelms the evacuation system.	A, SS, Sys	NDM, NDT, DL, T, MS SA, ES, SR, ER	Operating	D	PDIT	
3.22.3.e		Thru-hulls shall be designed and installed to prevent the backflow of water into the hull.	A, SS	NDM, NDT, DL, T, MS SA, ES, SR, ER	Operating	I, D	I-PI, PDIT, DT	Inspect during In-Plant Inspections. Demonstrate during system operations in PDIT and DT (not dedicated demonstration).
3.23	**Construction Standards**							Header.
3.23.1.a	Structural Requirements	USV structure shall be designed IAW Direct Analysis of Structural Loads and Structural Design for UISS (NSWCCD-23-TM-2012/20).	A, SS	All	All	A	I-PI	Analyze design prior to PDR and CDR.
3.23.1.b		Structural design shall maintain structural continuity and alignment and avoid creation of stress concentrations.	A, SS	All	All	A	I-PI, PDIT	Analyze design prior to PDR and CDR and verify as-built matches design.
3.23.1.c		Metal structure shall be of welded construction, except that non-welded metal fabrication is acceptable where necessary for access or equipment removal and reconfiguration.	A, SS	All	All	A, I	I-PI	Analyze design prior to CDR and inspect during build.
3.23.2.a	Fabrication	Welders shall be certified IAW	None	None	None	A	I-PI	Analyze prior to

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
	Requirements	American Welding Society (AWS) or ASME						PDR.
3.23.2.b		Welding shall be IAW AWS or ASME guidelines.	All	All	All	A, I	I-PI	Analyze welding instructions prior to CDR and inspect critical parts during build.
3.23.2.c		Laminators shall be certified by Contractor's Quality Assurance (QA) system.	None	None	None	A	I-PI	Analyze prior to PDR.
3.23.2.d		Lamination shall be performed IAW Contractor's QA system.	All	All	All	A, I	I-PI	Analyze QA system prior to CDR and inspect critical parts during build.
3.23.3.a	Materials	Unless otherwise stated, materials shall meet requirements of ABS "Guide for Building and Classing HSNC"	All	All	All	A	I-PI	Analysis of materials list.
3.23.3.b		The USV hull and deck structure shall be constructed from 5000-series marine grade aluminum conforming to ASTM B928 and/or fiber-reinforced plastic (FRP).	All	All	All	A, I	I-PI	Analysis of materials list and spot inspection of materials used.
3.23.3.b		Wood and other hygroscopic and biodegradable materials are prohibited.	All	All	All	A, I	I-PI, PDIT	Analysis of design and inspection of final product.
3.23.3.1	Aluminum	Aluminum materials shall meet the						Qualifying

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		following:						statement.
3.23.3.1.a		Plate and Sheet: ASTM-B209 or ASTM-B928 as applicable, Unified Numbering System (UNS) A95086-H116 or A95086-H117, UNS A95083-H116 or UNS A95083-H321; for non-welded applications UNS A96061-T6 or UNS A96061-T651 may be substituted.	A, SS	All	All	A	I-PI	
3.23.3.1.b		Extrusions: ASTM-B221, UNS A95086-H111 or UNS A95083-H111; for non-welded applications UNS A96061-T6 or UNS A96061-T52 may be substituted.	A, SS	All	All	A	I-PI	
3.23.3.1.c		Drawn Tube: ASTM-B210, UNS A95086-H32; for non-welded applications UNS A96061-T6 may be substituted.	A, SS	All	All	A	I-PI	
3.23.3.2.a	Fiber Reinforced Plastic (FRP)	Material properties used for design of all structural laminates, including single-skin laminates, cored laminates, and laminates used for major framing components, shall be verified. They shall be verified by testing of specimens taken from test panels having the same properties as the laminates used in construction and using the same materials, laminate schedules, laminating processes and conditions, post-cure, and	A, SS	All	All	A	I-PT	Analyze Contractor's testing.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		other relevant factors.						
3.23.3.2.b		Scope of components tested shall be sufficient to validate all materials properties used for design of the structure. They shall include, as a minimum, the laminates used in the hull bottom structure.	A, SS	All	All	A	I-PT	Analyze Contractor's testing.
3.23.3.2.c		As a minimum, single-skin laminate tests shall include strength and modulus properties in tension (ASTM D638), flexure (ASTM D7264 Procedure B), and compression (ASTM D3410). Cored laminate tests shall include flexural and shear properties (ASTM D7249 and D7250) and in-plane compressive properties (ASTM C364 or D5467).	A, SS	All	All	A	I-PT	Analyze Contractor's testing.
3.23.3.2.d		Alternate test method standards that achieve the same purpose of design properties validation may be proposed, subject to approval by the Government.	A, SS	All	All	A	I-PT	Analyze Contractor's testing.
3.23.3.2.e		To validate suitability for use when exposed to the relevant operational and storage loads, the Contractor shall provide mechanical properties test data at elevated temperatures to the upper limit of the operational and storage temperature ranges for any	A, SS	All	All	A	I-PT	Analyze Contractor's testing.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		proposed FRP materials subject to thermal effects (e.g., thermoplastic reinforcing fibers or laminating resins having heat distortion temperatures in that range)						
3.23.4.a	Corrosion Prevention	Exposed metal surfaces shall be corrosion resistant or treated to resist corrosion from seawater, salt spray or atmospheric conditions during life cycle of the system.	A, SS	All	All	A, I	I-PI, PDIT	Analyze design. Inspect during build. Inspect final product at PDIT.
3.23.4.b		Use of dissimilar metals shall be minimized to preclude corrosion, cathodic, or electrolytic reaction with the equipment itself and between the equipment	A, SS, Sys	All	All	A	I-PI	Analyze design.
3.23.4.c		Engines and drive systems shall be protected from corrosion by appropriate sacrificial anodes.	A, SS	All	All	A, I	I-PI, PDIT	Analyze design. Inspect during build. Inspect final product at PDIT.
3.23.4.d		The Contractor shall install the anodes IAW the OEM's guidance regarding the locations, sizes, and replacement intervals of the anodes.	A, SS	All	All	I	PDIT	
3.24	Support Equipment							Header.
3.24.1.a	Diagnostic Support Device	Device shall provide capability to initiate, monitor and display results of all available BIT and PM/FD/FL capabilities provided by system	SS	STS, LTS, NDM, NDT, DM, PL, TA, PR	All	D	PDIT	
3.24.1.b		Device shall provide capability to	SS	STS, LTS,	All	D	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		monitor and display system health status and prognostic data.		NDM, NDT, DM, PL, TA, PR				
3.24.2.a	Trailer	Trailer shall comply with all applicable federal requirements, including CFR Title 49 (Transportation) Chapter III (Federal Motor Carrier Safety Administration, Department of Transportation (DOT)) Part 393 (Parts and Accessories Necessary for Safe Operations) and Chapter V (National Highway Traffic Safety Administration, DOT) Part 571 (Federal Motor Vehicle Safety Standards), excepting that the CFR exclusion of heavy hauler trailers does not apply for all cited CFR requirements.	SS	TR, STS, LTS, NDM, NDT	All	A	I-PI	Analyze design.
3.24.2.b		Trailer shall interface with a tow vehicle with a fifth wheel-type hitch and air brakes	SS	TR, STS, LTS, NDM, NDT	All	A, I, D	I-PI, PDIT	Analyze design. Inspect trailer. Demonstrate with tow vehicle.
3.24.2.c		Trailer shall support float on/off capability from improved ramps	SS	TR, STS, LTS, NDM, NDT	All	D	PDIT	
3.24.2.d		All components shall be capable of total submersion in saltwater for L&R of the Off-board Component	SS	TR, STS, LTS, NDM, NDT	All	A	I-PI	Analyze design.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.24.2.e		Provision shall be made to secure craft to trailer such that craft and trailer can be lifted as a unit using lifting fittings on craft	SS	TR, STS, LTS, NDM, NDT	All	I, D	I-PI, PDIT	Inspect for provisions and demonstrate lift.
3.24.2.f		Fittings shall be provided so trailer can be lifted by itself	SS	TR, STS, LTS, NDM, NDT	All	I, D	I-PI, PDIT	Inspect for fittings and demonstrate lift.
3.24.2.g		Design Safety Factor (DSF) of 1.5 on the post welded yield strength of the material shall be applied to the trailer's structural members	SS	TR, STS, LTS, NDM, NDT	All	A	I-PI	Analyze design.
3.24.2.h		Trailer Gross Vehicle Weight Rating shall be equal to or greater than the weight of the Off-board Component in Full-Load Condition	SS	TR, STS, LTS, NDM, NDT	All	A	I-PI, PDIT	Analyze design. Verify after scale weighing of built Off-board Component.
3.24.3	Stowage Cradle Bunk Pads	The Off-board Component shall be capable of interface with LCS Stowage Cradle with Contractor-furnished bunk pads to provide support between the cradle's flat bunks and the USV IAW USV 11M RHIB Cradle Assembly drawings (Naval Facilities Engineering Service 20053001 thru 20053006).	SS	TR, STS, LTS, NDM, NDT, S, DM, PL, TA, PR	All	A, D	I-PI, PDIT	Analyze design and demonstrate with final product.
3.24.4.a	Man-Portable Control Unit (MPCU)	MPCU shall provide capability for primary control of the Off-board Component during L&R operations.	SS, Sys	L, SR, ER	Operating	D	PDIT, DT	Use during simulated L&R during PDIT. Demonstrate

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
								with **LCS** during DT.
3.24.4.b		The MPCU shall be operated by the UVDO onboard LCS in the position shown IAW LCS ICD and LCS LRHS AG.	SS	L, SR, ER	Operating	D	DT	Demonstrate with **LCS** during DT
3.24.4.c		MPCU shall interface with LCS service panel at the UVDO position.	SS	L, SR, ER	Operating	A, D	I-PI, DT	Analyze design and demonstrate with **LCS** during DT.
3.24.4.d		MPCU shall use MVCS as the communication link with the Off-board Component.	SS	L, SR, ER	Operating	D	PDIT	
3.24.4.e		MPCU shall be man-portable IAW Human Strength and Handling Limits section in MIL STD 1472G	SS	L, SR, ER	Operating	A	I-PI	Analyze design.
3.24.4.f		MPCU shall be capable of main engine start and stop, maneuver of the Off-board Component for L&R and any other controls required for L&R (e.g. equipment requiring re-positioning, LCM actuation).	SS	L, SR, ER	Operating	D	PDIT, DT	Demonstrate during PDIT. Demonstrate using **LCS** systems during DT.
3.24.4.g		MPCU shall display data needed by UVDO to safely perform L&R (e.g. USV GPS speed and heading, engine rpm, propulsor status, steering angle, equipment requiring re-positioning (if applicable), LCM status, alarms).	SS	L, SR, ER	Operating	A, D	I-PI, PDIT	Analyze for appropriate data and demonstrate display.
3.24.4.h		MPCU shall have an emergency stop capability separate from MVCS.	SS	L, SR, ER	Operating	D	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.24.4.i		The emergency stop capability shall instantly and positively put the craft in to a safe condition.	SS	L, SR, ER	Operating	D	PDIT	
3.25	**Tools and Test Equipment**							Header.
3.25.a		Support and test equipment includes all equipment, mobile and fixed, that is required to perform the support and maintenance functions in the states and modes defined in this document.						Description.
3.25.b		Support equipment categories may be defined from the OEM and cross referenced to the General Services Administration Catalog http://www.gsa.gov or Defense Logistics Agency Logistics Information Services http://www.dlis.dla.mil/WebFlis or Federal Item Identification Catalog found at http://www.logisticsinformationservice.dla.mil/IIG/	A, SS, Sys	All	All	A	PDR through DT	
3.25.c		Where possible identification of existing support equipment should be selected for use on systems or equipment as opposed to developing new, special purpose support equipment. The identification of the support equipment reduces the total ownership cost to the US Navy since training, provisioning,	A, SS, Sys	All	All	A	PDR through DT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		maintenance planning, and calibration procedures are not needed.						
3.25.d		Support equipment categories include:	A, SS, Sys	All	All	A	PDR through DT	
3.25.d.i		Handling and maintenance equipment.						Item to be included.
3.25.d.ii		Tools (hand tools as well as power tools).						Item to be included.
3.25.d.iii		Metrology and measurement devices.						Item to be included.
3.25.d.iv		Calibration equipment.						Item to be included.
3.25.d.v		Test equipment.						Item to be included.
3.25.d.vi		Automatic Test Equipment.						Item to be included.
3.25.d.vii		Peculiar or unique support equipment for system maintenance.						Item to be included.
3.25.d.viii		Special inspection equipment for intermediate and depot maintenance equipment, which includes all equipment and tools required to assemble, disassemble, test, maintain, and support the repair of end items or components.						Item to be included.
3.25.2	Special Test Equipment							Header.
2.25.2.1	Strain Measurement	The Off-board Component shall have the capability to measure and	A, SS	NDM, NDT, L, T,	Operating	T	PDIT, DT	Test for accuracy of

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
	System	record strain of critical structural members (e.g. hull plating, hull girders, frames) throughout the hull while underway and be able to correlate that data with accelerations monitoring data.		MS, SA, ES, SR, ER				system.
3.25.2.2	Safety Observer Kill Switch (SOKS)	During developmental and operational testing, the Off-board Components shall have a SOKS capability via a dedicated radio signal that enables a safety observer on a chase craft the ability to positively put the Off-board Component to a safe state as specified in Section 3.20.3.2 Emergency Stop.	SS, Sys	T, MS	Operating	A, T	I-PI, PDIT	
3.25.2.2.a		Capability shall not require any action or interaction from the C4CE system.	SS, Sys	T, MS	Operating	A, T	I-PI, PDIT	Analyze design for compliance. Test during PDIT.
3.25.2.2.b		Capability shall be of a failsafe design IAW Unmanned Systems Safety Guide for DoD Acquisition (2007) and Navy System Safety Program (OPNAVINST 5100.24B).	SS, Sys	T, MS	Operating	A	I-PI	Analyze design.
3.25.2.2.c		The SOKS equipment on the Off-board Component shall be capable of being disabled and/or removed when not in use.	SS, Sys	T, MS	Operating	D	PDIT	
3.25.2.2.d		The SOKS shall have a range of 2nm.	SS, Sys	T, MS	Operating	T	PDIT	Test for range and

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
								repeatability at range.
3.25.2.2.e		The SOKS operator control unit shall be self-contained and man-portable IAW Human Strength and Handling Limits section in MIL STD 1472G.	SS, Sys	T, MS	Operating	A	I-PI	Analyze design.
3.25.2.2.f		The SOKS unit shall be watertight to Ingress Protection Rating (IP67).	SS, Sys	T, MS	Operating	A	I-PI	Analyze design.
3.26	**Logistics Requirements**							Header.
3.26.1	Operational Availability (A_o)	The Off-board and LCS Components shall meet Operational Availability (Ao) of 0.80 (THRESHOLD)/ 0.85 (OBJECTIVE)	A, SS, Sys	All	All	A, T	I-PI, PDIT, DT	Start analysis at PDR and carry through program. Start testing in PDIT, carry through DT
3.26.2	Mean Time Between Failure (MTBF)	The Off-board and LCS Components shall have an MTBF of 125 hrs (THRESHOLD)/ 200 hrs (OBJECTIVE)	A, SS, Sys	All	All	A, T	I-PI, PDIT, DT	Start analysis at PDR and carry through program. Start testing in PDIT, carry through DT
3.26.3	Mean Time to Repair (MTTR)	The Off-board and LCS Components shall have an MTTR of two hrs (THRESHOLD)/ one hr (OBJECTIVE)	A, SS, Sys	All	All	A, T	I-PI, PDIT, DT	Start analysis at PDR and carry through program. Start testing in PDIT, carry

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
								through DT
3.26.3.a		MTTR is defined as the average time required to repair the system after failure and includes active repair time and other factors such as logistics or administrative delay times.						Definition.
3.26.3.b		For the Off-board and LCS Components, assume the MLDT (logistics or administrative delay) is 30 minutes.						Guidance.
3.26.4	Supportability	Supportability analysis shall be performed IAW Reliability Program Standard for Systems Design, Development and Manufacturing (ANSI/GEIA-STD-0009),. The types of supportability analysis required includes: Failure Modes Effects and Critically Analysis, Fault Tree Analysis, and Level of Repair Analysis.	A, SS, Sys	All	All	A	PDIT	
3.26.5	Reliability and Availability	UISS repairable items shall be identified within the hierarchy of the end item, broken down by an agreed-upon configuration control method IAW Expanded Ship Work Breakdown Structure: Hierarchical Structure Codes for Ships, Ship Systems, and Surface Combatant Systems (NAVSEAINST 4790.1) series. MTBF includes all failures (i.e., non-mission-critical, mission-	A, SS, Sys	All	All	A	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		critical) that may occur within the hardware and software systems and can be used in determining the total maintenance requirements.						
3.26.6	Materiel Availability (A_m)	The Off-board and LCS Components shall meet Am of [A_mT] (Threshold)/ [A_mT] (Objective). Annex A to UISS SRD (A-6.1, A-6.2)	Sys	All	All	T	PDIT, DT	Start testing in PDIT; carry through DT.
3.26.7	Maintainability	UISS maintainability requirements shall be identified IAW DODI 4151.22 Condition-Based Maintenance Plus for Material Maintenance to include Prognostics and Diagnostics	A, SS, Sys	NDM, DM	Operating	A	I-PI	Analyze prior to PDR.
3.26.7.1	Turnaround	The Off-board and LCS Components shall provide the operator/maintainer with the capability to fuel, inspect fluid levels, assess material condition, and all other actions required for turnaround in 60 minutes.	SS, Sys	TA	Operating	T	PDIT, DT	Test as much as possible during PDIT. Perform full test with **LCS** in DT.
3.26.7.2.a	Maintenance Task Identification	Maintenance tasks shall be IAW Reliability Centered Maintenance Process (MIL-STD-3034) and amended Planned Maintenance System, Development of Maintenance Requirements Cards, Index Pages, and Associated Documentation (MIL-P-24534A).	A, SS, Sys	NDM, DM	All	A	PDIT	
3.26.7.2.b		UISS shall have all LRUs identified IAW Serialized Item	A, SS, Sys	NDM, DM	Operating	A, I	PDIT	Analyze design and inspect

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		Management for Materiel Maintenance (DODI 4151.19).						select items for compliance.
3.26.7.3.a	Parts Management and Control	UISS repairable items shall be identified within the hierarchy of the end item, broken down by an agreed-upon configuration control method IAW NAVSEAINST 4790.1.	A, SS, Sys	NDM, DM	Operating	A	I-PI	Analyze prior to PDR.
3.26.7.3.b		UISS parts management shall include those processes identified IAW Diminishing Manufacturing Sources and Material Shortages (SD-22).	A, SS, Sys	NDM, DM	Operating	A	I-PI	Analyze prior to PDR and continue throughout process.
3.26.7.3.c		Standard Practice Parts Management (MIL-STD-3018) shall be reviewed to identify guidelines for identification of UISS parts and components.	A, SS, Sys	NDM, DM	Operating	A	I-PI	Analyze prior to PDR and continue throughout process.
3.26.7.3.d		UISS Configuration Management (CM) shall be identified and managed IAW CM Guidance (MIL-HDBK-61A) for all LRUs of systems and subsystems.	A, SS, Sys	NDM, DM	All	A	I-PI	Analyze prior to PDR.
3.26.7.3.e		UISS parts shall be identified to support shipping to designated support facility within 72hrs (THRESHOLD)/24hrs (OBJECTIVE).	A, SS, Sys	NDM, DM	All	A, D	I-PI, PDIT, DT	Analyze design starting at PDR continuing throughout process. Verify during testing.
3.26.8.a	Supply Support	UISS parts management, supply support and control shall be IAW Supply Chain Materiel	A, SS, Sys	NDM, DM	All	A	I-PI	Analyze prior to PDR and continue

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		Management Regulation (DOD 4140.1-R).						throughout process.
3.26.8.b		UISS shall use procedures, policy, and guidance for the provisioning process IAW Provisioning, Allowance, and Fitting Out Support Manual (NAVSEA Tech Spec 9090-1500) and shall be used to identify the process to be implemented for UISS	A, SS, Sys	NDM, DM	All	A	I-PI	Analyze prior to PDR and continue throughout process.
3.26.8.c		The Hazardous Materials User's Guide (OPNAVINST 5100.28) and Ships Hazardous Materials List for LCS shall be used to identify petroleum, oils, and lubricants.	A, SS, Sys	NDM, DM	All	A	I-PI	Analyze prior to PDR and continue throughout process.
3.27	**Training Requirements**	The training development for the shipboard operation of the UISS as an off-board vehicle from the LCS shall maximize the use of classroom and simulator training. All developed training shall be considered the starting point for providing the MCM Detachment members, and civilian personnel (Government and Contractor) with the prerequisite knowledge, skills, and abilities to operate and maintain the UISS in all states and modes until the formal curriculum development is implemented. All training development for the UISS	All	All	Operating	A	PDIT	Analyze for compliance and that training includes the following requirements.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		must support this premise and the Contractor development of the UISS specific training shall incorporate the following:						
3.27.1	Train to Qualify (T2Q)	The LCS concept is to provide training in a shore based training environment that teaches the individual MCM MP crewmember the basic tasks associated with the specific knowledge skills and abilities to safely and effectively operate in all watch stations or maintenance performance criteria associated with the UISS.						Verified as part of Section 3.29 Marking.
3.27.2	Training to Certify (T2C)	The LCS concept is to provide training in a shore based training environment that teaches the watch team the advanced tasks associated with the specific knowledge skills and abilities to safely and effectively operate in all watch stations or maintenance performance criteria associated with UISS.						Verified as part of Section 3.29 Marking.
3.27.3	Subject Areas	The following subject areas shall guide the Contractor in the development of training required to develop the knowledge, skills and abilities to operate and maintain the UISS in each state and mode:						Verified as part of Section 3.29 Marking.
3.27.3.a		Function						Item to be included.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.27.3.b		Location						Item to be included.
3.27.3.c		System/subsystem and component characteristics						Item to be included.
3.27.3.d		The System/subsystem components to include connections and interfaces						Item to be included.
3.27.3.e		Operating values and limits for:						Item to be included.
3.27.3.e.i		Abnormal values and corrective action						Item to be included.
3.27.3.e.ii		Emergency situations and corrective action						Item to be included.
3.27.3.f		System or component access						Item to be included.
3.27.3.g		Display information and data displayed for operation identified to the component level						Item to be included.
3.27.3.h		Protective and security devices installation and function to include location						Item to be included.
3.27.3.i		Component discharge and discharge routing						Item to be included.
3.27.3.j		Component controls or actuators						Item to be included.
3.27.3.k		BIT/BITE						Item to be included.
3.27.3.l		Troubleshooting and repair.						Item to be included.
3.27.4	Component Training	Developed training shall use classroom lead discussion and	All	All	All	A	I-PI, PDIT	Analyze during development

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		system interaction to develop the Mineman, Engineman, and Aerographer skills to operate and maintain:						and analyze final product.
3.27.4.a		USV						Item to be included.
3.27.4.b		Influence sweep system						Item to be included.
3.27.4.c		C4 system						Item to be included.
3.27.4.d		OIS						Item to be included.
3.27.4.e		Trailer						Item to be included.
3.27.4.f		Cradle						Item to be included.
3.27.4.g		MPCU						Item to be included.
3.27.4.h		Diagnostic support device						Item to be included.
3.27.4.i		Tools and Test Equipment						Item to be included.
3.27.5	Training Curriculum	All training curriculum developed for operation and maintenance shall support the T2C/T2Q concept and shall contain the following:	All	All	All	A	I-PI, PDIT	Analyze during development. Analyze final product.
3.27.5.a		Each Terminal Learning Objectives (TLO) contains a statement that defines the expectations of the student's performance at the end a specific	All	NDT	Operating	A	I-PI, PDIT	Analyze during development. Analyze final product.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		lesson or unit						
3.27.5.b		Each TLS shall have a Condition, Task, and Standard that is observable and can be measured	All	NDT	Operating	A	I-PI, PDIT	Analyze during development. Analyze final product.
3.27.5.c		The use of Enabling Learning Objectives (ELOs) shall support the TLO and shall allow the student to develop the knowledge, skills, and ability to complete the TLO to the standard and condition defined.	All	NDT	Operating	A	I-PI, PDIT	Analyze during development. Analyze final product.
3.27.5.d		The TLOs and ELOs shall be used to develop the:	All	NDT	Operating	A	I-PI, PDIT	Analyze during development. Analyze final product.
3.27.5.d.i		Instructor Guides						Item to be included.
3.27.5.d.ii		Student Guides						Item to be included.
3.29.6	Training Content	The developed training shall contain support information that shall include:	All	NDT	Operating	A	I-PI, PDIT	Analyze for required contents.
3.27.6.a		System/Equipment diagram sheets						Item to be included.
3.27.6.b		Illustrations and pictures						Item to be included.
3.27.6.c		Function, location, and operational values and parameters						Item to be included.
3.27.7	Exams	Each section of the designed training for UISS shall require the development of written	All	NDT	Operating	A	I-PI, PDIT	Analyze during development. Analyze final

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		examinations that contains multiple choices, true/false, and essay questions.						product.
3.27.7.1		An answer/examination key shall be generated for each test	All	NDT	Operating	A	I-PI, PDIT	Analyze during development. Analyze final product.
3.27.8.a	Training Systems	The development of the training systems for UISS shall include simulators and training devices that represent the systems in all states and modes.	All	NDT	Operating	A	I-PI, PDIT	Analyze during development. Analyze final product.
3.27.8.b		The training system shall be configurable and packetized to allow employment with established training systems and devices for LCS Mission Modules Common Mission Package Trainer or Mission Package Training System (MPTS) comprised of a personal computer (PC)-emulation of the tactical software.	All	NDT	Operating	A, D	I-PI, DT	Analyze during development. Analyze final product. Demonstrate during DT.
3.27.8.c		The software and hardware necessary for the development of PC training devices shall be IAW the PC-Based Open-Architecture Reconfigurable Training System information located in the UISS Bidder's Library.	All	NDT	Operating	A	I-PI, PDIT	Analyze for required contents.
3.27.9	Training/Instructor Control Station	Instructor control station hardware and software shall be developed and allow the instructor to:						Qualifying statement.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
3.27.9.a		Simulate conditions defined as normal or abnormal conditions in the various states and modes	All	NDT	Operating	D	PDIT	
3.27.9.b		Inject into simulation or actual controlled operational training to develop reaction and response time of the operator	All	NDT	Operating	D	PDIT	
3.27.9.1	Operating Training Stations	The control station shall be developed to support the operator training stations developed IAW standards defined the PC-Based Open-Architecture Reconfigurable Training System to interface with the MPTS and Network Tactical Training System.	All	NDT	Operating	A	I-PI, PDIT	Analyze during development. Analyze final product.
3.27.9.2	Delivery	The control station shall be delivered with:	All	NDT	Operating	I	PDIT	Inspect final product for the following items:
3.27.9.2.a		Technical documentation required to operate and sustain the hardware and software						Item to be included.
3.27.9.2.b		BOM and COTS data						Item to be included.
3.27.9.2.c		Identification of corrective and preventative maintenance actions to include software updates						Item to be included.
3.27.9.2.d		Firmware and software license						Item to be included.
3.28.a	**Packaging, Handling, Shipping, and Transportation**	Packing requirements shall be identified IAW MIL-STD-2073-1 or its equivalent for methods of preservation to protect materiel	A, SS	All	All	A	I-PI	Analyze packing requirements.

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		against environmentally-induced corrosion and deterioration; physical and mechanical damage; and other forms of degradation during storage, multiple handling, and shipment of materiel.						
3.28.b		Electronics or electrical equipment packaging required to support C4 systems shall ensure safe and secure storage, shipping, and handling of components	A, SS	All	All	A, I	I-PI	Analyze packing requirements. Inspect select components for compliance.
3.28.c		Containers and packaging shall be marked IAW current standards, to ensure identification of all UISS components or support equipment	A, SS	All	All	I	PDIT	
3.29.a	**Marking**	Physical barriers and proper signage shall be provided to identify safety or equipment hazards IAW Navy Safety and Occupational Health (NAVSOH) Program Manual for Forces Afloat (OPNAVINST 5100.19).	SS, Sys	All	All	I	PDIT	
3.29.a.i		For example, compartments that exceed recommended decibel levels shall be identified and marked to identify the hazards.						Example.
3.29.b		Piping systems, valves, and interfaces shall be marked by color code and plain language to clearly indicate interfaces and functions IAW Naval Ship Technical Manual	SS, Sys	All	All	I	PDIT	

Requirement			i. Assy & Nature of Rep. Unit	ii. Sys State	iii. Environ. State	iv. Ver. Method	v. Test Phase	Notes:
Section #	**Section Title**	**Description**						
		50: Piping Systems (S9086-RK-STM-010).						
3.29.1	**Unique Identification (UID)**	The Contractor shall follow DoD Standard Practice Identification Marking of US Military Property (MIL-STD-130N) to implement UID labeling	SS, Sys	All	All	A	I-PI, PDIT	Analyze Contractor's process. Inspect labeled parts during PDIT for conformance.

5 REQUIREMENTS TRACEABILITY

This section is not applicable to this specification.

6 NOTES

6.1 Government-Furnished Property.

INSERT TABLE of GFE

6.2 Government-Loaned Property.

INSERT TABLE OF GLP

6.3 Acronyms

Acronym	Long Title
ABS HSNC	American Bureau of Shipping High Speed Naval Craft
ABYC	American Boat & Yacht Council
ACRS	Area Coverage Rate Sustained
AG	Amplification Guide
AIS	Automatic Identification System
A_m	Material Availability
ANSI	American National Standards Institute
A_o	Operational Availability
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATP	Anti-Tamper Plan
AWS	American Welding Standard
BIT	Built-In Test
BITD	Built-In Test Diagnostics
BITE	Built-In Test Equipment
BOM	Bills of Material
C4	Command, Control, Communications and Computer
C4CE	C4 Computing Environment
C4SA	C4 Systems Automation
C&A	Certification and Accreditation
CANbus	Controller Area Network Bus
CBIT	Continuous Built-In Test
CBR	Chemical, Biological, Radiological
CCD	Combatant Craft Division
CD	Carderock Division

Acronym	Long Title
CDD	Capability Description Document
CDRL	Contract Data Requirements List
CFE	Contractor Furnished Equipment
CFR	Code of Federal Regulations
CIO	Chief Information Officer
CM	Configuration Management
CNO	Chief of Naval Operations
COMDTINST	US Coast Guard Commandant Instruction
COMSEC	Communications Security
COTS	Commercial Off-the-Shelf
CPI	Critical Program Information
CT	Critical Technologies
DDS	Design Data Sheet
DIACAP	Department of Defense Information Assurance Certification and Accreditation Process
D-Level	Depot-Level
DLA	Defense Logistics Agency
DLIS	DLA Logistics Information Services
DLO	Depot-Level Overhaul
DoD	Department of Defense
DODD	Department of Defense Directive
DOD-HDBK	Department of Defense Handbook
DODI	Department of Defense Instruction
DON	Department of the Navy
DOT	Department of Transportation
DSD	Diagnostic Support Device
DSF	Design Safety Factor
DTM	Directive-Type Memorandum
DTS	Developmental Test System
DWG	Drawing
EDM	Engineering Development Model
EIA	Electronic Industries Associations
EID	Effective Influence Depth
EIDD	External Interface Design Document
ELO	Enabling Learning Objective
EME	Electromagnetic Emissions

Acronym	Long Title
F	Fahrenheit
FAA	Functional Allocation Analysis
FD	Fault Detection
FL	Fault Localization
FOS	Factor of Safety
FOUO	For Official Use Only
FRP	Fiber Reinforced Plastic
GCCS-M	Global Command and Control-Maritime
gph	gallons per hour
GEIA	Government Electronics and Information Technology Association
GFE	Government Furnished Equipment
GFP	Government Furnished Property
GLP	Government Loaned Property
GPS	Global Positioning System
GSA	General Services Administration
HDBK	Handbook
HMUG	Hazardous Materials User's Guide
hr	Hour
HRI	Human-Robot Interaction
Hz	Hertz
IA	Information Assurance
IAW	In Accordance With
ICD	Interface Control Document
IDD	Interface Design Document
IDS	Interface Design Specification
IEC	International Electrotechnical Commission
I-Level	Intermediate-Level
INST	Instruction
IntRS	Integration Requirements Specifications
IP	Ingress Protection
KPP	Key Performance Parameter
KSA	Key System Attribute
KSF	Keel Shock Factor
kts	knots
L&R	Launch and Recovery

Acronym	Long Title
LAN	Local Area Network
LCM	Line Capture Mechanism
LCS	Littoral Combat Ship
LMW	Littoral Mine Warfare
LOS	Line of Sight
LRIP	Low Rate Initial Production
LRU	Lowest Replaceable/Reparable Unit
MTBF	Mean Time Between Failure
MCM	Mine Countermeasure
MEDAL	Mine Warfare Environmental Decision Aids Library
MIL-DTL	Military Detail Specification
MIL-HDBK	Military Handbook
MIL-STD	Military Standard
min	minutes
MIW	Mine Warfare
MLDT	Mean Logistic Delay Time
mm	Millimeters
MM	Mission Module
MOE	Measures of Effectiveness
MOP	Measures of Performance
MOSA	Modular Open Systems Architecture
MP	Mission Package
MPAS	Mission Planning and Analysis System
MPCE	Mission Package Computing Environment
MPCU	Man-Portable Control Unit
mph	miles per hour
MPPCS	Mission Package Portable Control System
MPS	Mission Package Services
MPSF	Mission Package Support Facility
MPTS	Mission Package Training System
MSDS	Material Safety Data Sheet
MTBF	Mean Time Between Failures
MTTR	Mean Time to Repair
MVCS	Multi-Vehicle Communications System
NASA	National Aeronautics and Space Administration

Acronym	Long Title
NATO STANAG	North Atlantic Treaty Organization Standardization Agreement
NAVSAC	Navigation Safety Advisory Council
NAVSEA	Naval Sea Systems Command
NAVSEACOMBATSYSENGSTA	Naval Sea Combat Systems Engineering Station
NAVSEAINST	NAVSEA Instruction
NAVSHIP	Naval Ship Systems Command
NAVSOH	Navy Safety and Occupational Health
NFESC	Naval Facilities Engineering Service
nm	nautical mile(s)
NMEA	National Marine Electronics Association
NSTM	Naval Ship Technical Manual
NSWC	Naval Surface Warfare Center
NSWCCD	Naval Surface Warfare Center Carderock Division
O	OBJECTIVE
OBIT	Optics Built-in Test
OEM	Original Equipment Manufacturer
OIS	Operator Interface Software
O-Level	Organizational-Level
OPNAVINST	Office of the Chief of Naval Operations (CNO) Instruction
OTH	Over-the-Horizon
PBIT	Powering on Built-in Test
PC	Panama City
PC	Personal Computer
PCD	Panama City Division
PDR	Preliminary Design Review
PEO LMW	Program Executive Office Littoral Mine Warfare
PM	Preventive Maintenance
PM/FD/FL	Preventive Maintenance/Fault Detection/Fault Localization
PMA	Post Mission Analysis
PPE	Personal Protective Equipment
ppm	parts per million
PPP	Program Protection Plan
PSU	Practical Salinity Units
QA	Quality Assurance

Acronym	Long Title
RHIB	Rigid-hull Inflatable Boat
SA	Situational Awareness
SAE	Society of American Engineers
SCRM	Supply Chain Risk Management
SOKS	Safety Observer Kill Switch
SOW	Statement of Work
SRD	System Requirements Document
SRVM	System Requirements Verification Matrix
SS	Sea State
STC	Surface Tow Cradle
SUPSHIP	Supervisor of Shipbuilding, Conversion & Repair
T	THRESHOLD
T2C	Training to Certify
T2Q	Train to Qualify
TECH SPEC	Technical Specification
TED	Technical Directive
TLO	Terminal Learning Objective
UID	Unique/Universal Identification
UISS	Unmanned Influence Sweep System
UNS	Unified Numbering System
USV	Unmanned Surface Vehicle
UVDO	Unmanned Vehicle Deck Operator
UVMS	Unmanned Vehicle Management System
UVO	Unmanned Vehicle Operator
WGS 84	World Geodetic System 1984
yds	yards

APPENDIX A SEA STATE TABLE

TABLE A-I. NATO STANAG 4194 Sea State Table

Sea State	Wind Range (kts)		Significant Wave Height** Range (m)		Significant Wave Height** Range (ft)		Modal Wave Period (s) Range (s)		
	Lower	*Upper*	*Lower*	*Upper*	*Lower*	*Upper*	*Lower*	*Upper*	*Most Probable*
0	-	-	-	-	-	-	-	-	-
1	-	6.00	-	0.10	-	0.33	-	-	-
2	7.00	10.00	0.10	0.50	0.33	1.64	3.30	12.80	7.50
3	11.00	16.00	0.50	1.25	1.64	4.10	5.00	14.80	7.50
4	17.00	21.00	1.25	2.50	4.10	8.20	6.10	15.20	8.80
5	22.00	27.00	2.50	4.00	8.20	13.12	8.30	15.50	9.70