APPENDIX B

UNOLS OVERBOARD HANDLING SYSTEMS DESIGN STANDARDS

CRITERIA FOR THE DESIGN AND OPERATIONS OF OVERBOARD HANDLING SYSTEMS

B.0 INTRODUCTION

B.0.1 TABLE OF ACRONYMS

- ABL Assigned Breaking Load (see Appendix A)
- CFR Code of Federal Regulations
- CTD Conductivity, Temperature and Density
- DLT Design Line Tension
- DP Dynamic Positioning
- FS Factor of Safety
- MAOT Maximum Anticipated Operating Tension
- MCD Maximum Capability Document
- MPT Maximum Permissible Tension
- NBL Nominal Breaking Load
- NSF National Science Foundation
- OHDD Overboard Handling Data Document
- OHS Overboard Handling System
- PI Principal Investigator
- QA Quality Assurance
- ROV Remotely Operated Vehicle
- RVSS Research Vessel Safety Standards
- SS Sea State
- SWL Safe Working Load
- UNOLS University-National Oceanographic Laboratory System

B.0.2 OBJECTIVE

The objective of this document is to provide a unified code of practice for the structural design and operating principles of overboard handling systems used on board vessels in the UNOLS Fleet. Attachment A2 provides a flow chart of the process the Operator will use when applying the requirements of Appendix B to overboard handling operations.

Appendix B is not intended to supersede existing regulations. It is intended only to better define the design limits, procedures, documentation, and capabilities of overboard handling systems used specifically for modern oceanographic research.

All UNOLS vessels must comply with Appendix B. UNOLS vessels that are inspected and certificated by USCG under*46 CFR Subchapter U* must comply with Appendix B, as well as the requirements of *46 CFR Subchapter U* (whichever are greater).

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B.0.3 SCOPE OF APPLICATION

This document DOES apply to all overboard handling systems and their component parts intended for use on UNOLS vessels. An overboard handling system is defined as a load handling system intended to lift, deploy, and/or recover science packages over the side and into or out of the water.

This document DOES apply to:

- All fixed and portable overboard handling systems
- General purpose, as well as dedicated systems
- Each component of the overboard handling system
- Components include (as applicable):
  - Winches
  - Overboarding appliances (e.g., frames, davits, cranes, booms, etc)
  - Sheaves (or any other device a tension member is lead through)
  - Foundations for all above components – including ship structure
  - Deck tie downs
  - Shackles and other necessary equipment to achieve the task

This document SHALL apply to cranes if they are used to lift, deploy, and/or recover science packages over the side and into or out of the water.

This document DOES NOT apply to the design of winches and overboard handling systems to be used for manned overside operations (e.g., hyperbaric chambers or submersibles). RVSS Chapter 12, *Human Occupied Vehicles* and *UNOLS Safety Standards for Human Occupied Vehicles* provides the applicable guidance for this activity.

The wire ropes and cables used in overboard handling systems are covered under Appendix A as described in Section B.1 below. Throughout Appendix B the wire ropes and cables are generically referred to as the “tension member”.

Ship operators and their seagoing staff must understand that if, by force of circumstance or by their wish to maintain scientific operations while on a cruise, they re-configure or use systems outside the bounds of the analyzed capability without undertaking the required study of the new arrangement in accordance with Maximum Capability Document, they are embarking on a potentially dangerous activity. The consequences of this activity could be loss of valuable equipment, damage to the vessel and its fixed equipment, and, in the worst case, injury to personnel.

B.0.4 APPLICABLE DATE

All systems commencing development on or after 07/15/2011 must comply with the requirements of this document.

B.0.5 APPLICABILITY TO EXISTING SYSTEMS

All systems already in existence or to be completed before the applicable date are to be brought into compliance with these standards by 07/15/2014

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B.0.6 Application and Responsibilities

It is the responsibility of the Owner of each component of an overboard handling system to ensure that it meets the standards of Appendix B (e.g., a portable winch owner must have documentation that gives that winch's maximum capabilities per Section B.5).

It is the responsibility of the Operator of a UNOLS vessel to ensure that each overboard handling system (including all components either fixed or portable) used on the vessel complies with Appendix B. Each system must have documentation of the system maximum allowable capabilities and configurations per Section B.5. **Component** maximum capability documentation shall be a part of **system** maximum capability documentation. If the Owner of a portable component brought aboard a UNOLS vessel does not have the documentation that provides the maximum capability for the Owner's component, the Operator may reject its use.

When purchasing a new component or system, or retroactively gaining compliance for an existing system, the Owner/Operator must work with the naval architect/engineer and/or the system manufacturer to define all expected uses per Section B.3. If a specific deployment/use is not defined in advance, it will not be part of the component or system maximum capability documentation and thus cannot be approved for a deployment/use without further analysis. An exception to this may be made if it can be shown by the Owner/Operator that the deployment/use is within the parameters of an already defined use.

It is the responsibility of the naval architect/engineer or system manufacturer to apply the described deployment/use loads in the prescribed geometries and determine the maximum capability of the component or system. **The maximum allowed capability shall be described as a maximum permissible tension (MPT) on the tension member along with diagrams of analyzed/approved geometry.** The structural criteria for developing the maximum allowed capability are given in Section B.4.

A flowchart for the process, from development of system deployment information to analysis and development of the maximum allowed capability, is included as Attachment A2.

The naval architect/engineer or system/component manufacturer shall fully share their structural calculations with their client/customer, and these calculations shall be allowed to be reviewed by UNOLS and other government agencies that provide support and/or oversight.

The system/component owner/operator shall comply with operation, maintenance, testing, training, and documentation requirements given in Sections B.6 to B.9.

The details of various tension mitigation devices and systems are given in Section B.10.

B.1 COMPANION STANDARD – RVSS - APPENDIX A

B.1.1 COMPATIBILITY

Appendix B is to be used in conjunction with and its application is to be fully compatible with, Appendix A -*UNOLS Rope and Cable Safe Working Load Standards*.

B.1.2 APPLICATION OF APPENDIX A

The tension member employed is considered part of the overboard handling system for any given deployment scenario. Therefore, the Maximum Permissible Tension (MPT) of the overboard handling system when considered in total must include consideration of the tension member Safe Working Load (SWL) from Appendix A in addition to the limiting MPT of the components (see Attachment A2).

B.2 DEFINITIONS

B.2.1	Assigned Breaking Load (ABL)	A term defined in Appendix A that is the breaking load for the tension member.
B.2.2	Auto Render	The capability of the Overboard Handling System (OHS) to automatically pay out at a pre-set maximum tension in order to prevent the tension member from exceeding the pre-set tension.
B.2.3	Component	Any part of the OHS. Typically, each component has a load imparted upon it by the tension member either by altering the direction of the tension member or otherwise resisting the tension. This includes, but is not limited to, turning blocks, shackles, overboarding frames, booms or cranes, winches, and the ship's supporting structure.
B.2.4	Design Line Tension (DLT)	This is the value used to design or evaluate the capability of OHS components. Normally the DLT is the Nominal Breaking Load (NBL) of the strongest tension member anticipated to be used with the component(s) to ensure the components do not fail at a line tension less than the tension member NBL. However, the Maximum Anticipated Operating Tension (MAOT), potentially a lesser value than the NBL, may be used where the OHS meets criteria that limit the potential maximum loads.
B.2.5	Factor of Safety (FS)	For components, FS = Yield Load/SWL For tension member, FS = ABL/SWL (see Appendix A).
B.2.6	Fixed System	An OHS that is permanently installed in a specific location permanently attached or integrated to the ship structure or systems.
B.2.7	Hydrodynamic Drag	The force due to the cable and or the payload being pulled through the water encompassing the velocities of a tow, of recovery, of waves, and ship motions.
B.2.8	Lifting Appliance	A reference definition used by classification societies that is any equipment that is involved in supporting an elevated load; this includes OHS components, as well as cranes not handling wet gear.

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B.2.9	Load Geometry	The inlet and outlet tension member angles possible for an OHS component.
B.2.10	Maximum Anticipated Operating Tension(MAOT)	A calculated maximum load on the tension member based on the package specifics for weight and the added loads due to dynamic and hydrodynamic effects. The vertical acceleration used for calculation of dynamic effects shall be at least 1.75g (per ABS Rules for Building and Classing Underwater Vehicles, Systems and Hyperbaric Facilities, Appendix 3, 9.3.4).
B.2.11	Maximum Capability Document (MCD)	Defines the MPT for a specific component or system, for a given range of load geometries.
B.2.12	Maximum Permissible Tension (MPT)	The maximum line tension that results in the Safe Working Load of a component or of the Overboard Handling System (OHS). This may vary, depending on the arrangement and geometry of the OHS.
B.2.13	Nominal Breaking Load (NBL)	Manufacturer's minimum published breaking load for a tension member. See Appendix A.
B.2.14	Overboard Handling Apparatus	The component of the OHS that launches/retrieves a package directly from the water, or maintains the tension member leading to the water; i.e., A-frame, hydro-boom, etc.
B.2.15	Overboard Handling System (OHS)	All shipboard components that support the tension member, from the point where the tension member attaches to the science package, to the ship supporting structure/foundation for the shipboard termination of the tension member (typically a winch attached to the ship's structure). The combination of components and tension member constitute the "overboard handling system".
B.2.16	Owner	The party or their representative who is responsible for the inspection, maintenance, and testing of the equipment. This could be the vessel operator, a winch pool managing institute, or the science party.
B.2.17	Portable System	An OHS brought aboard the ship and not permanently attached, or an OHS made up of component(s) brought aboard and integrated with shipboard components that work together to form an OHS for a specific use.
B.2.18	Render/Recover	A means of a winch to automatically maintain a pre-set tension by alternately paying-out and hauling back. Generally recovery haul back is limited to the point of initial rendering.
B.2.19	Safe Working Load (SWL)	The maximum total load that is allowed on any given component in an OHS during normal operation. This is determined by the designer of the component and reflects the maximum total force on the component, not the line tension.

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		SWL = Yield Load for the material/FS for components SWL = ABL/FS for the tension member (see Appendix A)
B.2.20	Tension Member	Generic name used to describe a rope or cable in service for over the side work. The Safe Working Load for the tension member is the value determined by compliance with Appendix A (see definition of SWL in Appendix A)
B.2.21	Tension Mitigation Devices	Hardware and or technology employed in the OHS to limit the tension member tension to a pre-set value.
B.2.22	Ultimate Design Load	The load at which the weakest piece of a component reaches the Yield Load of the material.
B.2.23	Wet Weight Handling Gear	46 CFR 189.35-9 (c) (1) term for what Appendix B refers to as "Overboard Handling System" and includes all "gear used to lower apparatus or objects beneath the surface of the water….."
B.2.24	Yield Load	The load at which the weakest component piece of the OHS reaches the yield stress of that component's material. This excludes the tension member.

B.3 DEPLOYMENT SCENARIOS AND POTENTIAL FOR APPLIED LOADINGS

B.3.1 OVERALL REQUIREMENTS

For any new system or system component, the information listed in the attached Overboard Handling Data Document (OHDD) shall be developed by the Owner to the extent possible see Section B.3.7). The Designer and/or Vendor shall also provide the Maximum Capability Document (MCD) for each component and/or system (see Section B.5). This information shall be highlighted in the introductory section of the system's *Operator's Manual*. The Maximum Capability Document may be either a standalone document provided by the Designer/Vendor that is referenced in the introductory section of the system's Operator's Manual, or added to the Operator's Manual as an addendum.

For any existing system or system component, the Owner shall develop the OHDD and MCD by working closely with the Designer and/or Vendor. This information shall be added to the system Operator's Manual.

For standard deck hardware such as mounting bolts for deck sockets, shackles, swivels, and turnbuckles that are not custom made, a copy of the manufacturer's specification sheet for the hardware will fulfil the requirements of Appendix B for the component Overboard Handling Data Document and Maximum Capability Document. The vessel operator shall establish a written procedure for how standard deck hardware is stored and inspected. The written procedure shall document the controls in place to ensure that when standard deck hardware is used, it has the load capability of the hardware components used when the overboard handling system Maximum Capability Document was developed.

B.3.2 PORTABLE SYSTEMS

For Portable Systems, the Owner (of the portable system or the portable components brought aboard and integrated with the vessels components) shall provide to the Operator the Maximum Capability Document information for each component the Owner brings aboard. Once brought aboard a ship, the Operator will develop a new Overboard Handling Data Document for the resulting overboard handling system that is made up of the portable components brought aboard in combination with the components being provided by the vessel. For example, a science party may bring aboard a portable winch and overboarding sheave with shackle that will be mounted on the ship for deployment using the ship's A-frame. The resulting overboard handling system would be comprised of a combination of portable components provided by the science party and ship components provided by the Operator:

- Portable Components – Winch (with tension member), overboarding sheave, shackle to connect the sheave to the A-frame.
- Ship Components – Deck mounting system (sockets and bolts) and the A-frame.

The resulting portable system is evaluated:

- The Owner provides the Maximum Capability Documents for the three portable components along with the logbook for the tension member (per Appendix A requirements).
- The Operator provides the Maximum Capability Documents for the two shipboard systems.
- The Operator develops the Overboard Handling Data Document for the resulting portable system.
- The Operator utilizes the above information and develops the Maximum Capability Document for the portable system and makes a determination of the Maximum Permissible Tension for the safe use of the portable system.

A new overboard handling system Maximum Capability Document for the portable system shall be generated:

- Each time any of the components are repositioned on board the vessel (system Maximum Capability Document only)
- Each time the system geometry is modified, either alongside or underway. (Overboard Handling Data Document and Maximum Capability Document)
- When the specification of the tension member employed is changed (Overboard Handling Data Document only)

B.3.3 FIXED SYSTEMS

For fixed shipboard systems with a Maximum Capability Document, the Operator shall verify that the currently planned deployment scenario is at or below the existing/original design criteria given in the Maximum Capability Document. A new overboard handling system Overboard Handling Data Document and MCD shall be generated:

- When the specification of the tension member employed is changed

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- When there is a modification to any component (geometry or hardware) of the ship's fixed overboard handling system (Maximum Capability Document).

NOTE: An important consideration for both fixed and portable systems are the hydrodynamic characteristics and entrained mass of the science packages and whether or not the induced accelerations from the vessel exceed the requirement of Section B.4 (>1.75g). The impact these characteristics would have on the tension for the overboard handling system must be evaluated and shown to be within the overboard handling system's capability (Maximum Capability Document).

B.3.4 NON-COMPLIANCE WITH MAXIMUM CAPABILITY IN THE MAXIMUM CAPABILITY DOCUMENT

For either Fixed or Portable Systems, if the planned deployment scenario is determined to NOT be within the existing design criteria, then the deployment shall NOT be allowed, or the operator shall take one of the following actions:

- Structural modifications shall be made to bring the components within the bounds of the original design criteria,
- Geometry modifications shall be made to re-configure the system such that it can safely accommodate the new deployment scenario,
- Perform the planned operations with a reduced payload size (lesser package weight, entrained mass, and/or drag).
- A combination of lesser modifications in all three above areas

In all cases above, a new Overboard Handling Data Document and/or Maximum Capability Document are to be prepared for the system.

B.3.5 DEPLOYMENT TYPE

The Deployment Type shall be determined at the beginning of the design and/or system evaluation process that will then allow the Principal, Secondary, and Worst Case loading cases to be defined. The anticipated Worst Case loading shall then determine the Structural Design Criteria to be used in Section B.4.

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The following table lists the deployment types for oceanographic operations to be specified for design purposes in the OHDD. The allowable deployment type should also be shown in the MCD.

NOTE: The length of the tension member is used in lieu of the deployed depth to take into consideration a science package settling to the bottom if vessel speed is decreased or lost completely.

	Operation	**Examples**
B.3.5.1	Towing – Surface (Floating or shallow tow)	Towed arrays (e.g., streamers, smart floats) Air gun arrays Towed sonar fish (e.g., PES, 3.5kHz, EK60)
B.3.5.2	Towing - Mid Water (Where the deployed length of the tension member does not exceed 75% of the water depth)	Fisheries Nets (Twin and single wire) Magnetometers, Sonar (e.g., SeaSoar, TriAxis, MVP) MOCNESS
B.3.5.3	Towing - Deep Water (Where the deployed length of the tension member is greater than 75% of the water depth with either intentional or high likelihood of bottom contact)	Deep water fisheries nets (single wire) Sonar, Multidiscipline deep towed platforms Dredges, Bottom trawls, Sledges, Grapnel/Batfish, Camera Sled, SeaSoar, TriAxis.
B.3.5.4	Station Keeping – Surface (Shallow Dips With or without Dynamic Positioning (DP)	Plankton nets Precision Echo Sounders (PES) Hydrophones Free floating buoys Autonomous Underwater Vehicles (AUVs, Gliders Sink and Rise Systems)
B.3.5.5	Station Keeping – Mid Water (Where the deployed length of the tension member does not exceed 75% of the water depth, with or without DP)	Acoustic arrays Conductivity, Temperature, Density (CTD)/water sampler operations
B.3.5.6	Station Keeping – Deep Water (Where the deployed length of the tension member is greater than 75% of the water depth with either	• Remotely Operated Vehicles (ROVs) • CTD/water sampler operations • Elevators • Standard Wire Coring

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	intentional or high likelihood of bottom contact, with or without DP)	• Deep Coring (Synthetic Rope) • Multicorer • Rock Drilling • Seabed Laboratory Placement/Retrieval • Steered Bottom Samplers (e.g., HyBIS, ARGO), which differ from ROVs in having no buoyancy. • Moored Buoys

B.3.6 PRINCIPAL, SECONDARY, AND WORST CASE LOADING SCENARIOS

B.3.6.1 Principal Loading

Principal Loading is defined as the tension member loading or loadings and the line(s) of action (vertical, longitudinal and transverse) prevalent at the handling system overboarding sheave during the principal phase or phases of the deployment.

As an example, for a CTD it would include the package weight, tension member weight, dynamic factoring due to ship motion, and hydrodynamic and resistance load during retrieval. Any special requirements of an activity that might have a modifying effect on the loading regime or tension member and equipment lifetime, such a sheave compensation, auto render, or differences between load properties of fixed and free end cables(i.e., use of swivels.) are to be highlighted.

B.3.6.2 Secondary Loading

Secondary Loading is defined as the potential for changes in loading or the primary line(s) of action of the loading.

For example, the vessel, for whatever reason, drifts off station leading to a large tension member angle to the normal nominally vertical case, imparting side loading to the overboarding mechanism. Another example would be for a Track Line Tow when the vessel crabs to maintain its track and imparts a side loading to the towing 'A' frame. In this latter case, a similar but much larger angle of the tension member can occur when the vessel executes a turn in order to follow a reciprocal track, or for collision avoidance while maintaining sufficient tow speed to keep the package from dropping to the seabed.

B.3.6.3 Worst Case Loading

Worst Case Loading situations are to be considered and defined in consultation with the operator.

For example, the ship's machinery suffers a failure while towing a package close to the seabed and the package sinks, risking a hook-up on a rocky seabed, a taut tension member situation, and potential overload of the overboard handling system tension member results as the ship drifts down weather. Or when towing a net at speed near the bottom the net becomes hung-up causing a taut tension member situation and potential overload of the overboard handling system tension member.

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The worst case loading situations may also consider the use of mitigation devices.

For example, auto-render with high value packages;e.g., Scanfish or weak links with low value equipment such as a dredge or net.

NOTE: It is important to specify the tension member properties that each piece of equipment is deployed with and the operating FS envelope required. The choice of tension members and their loadings are, as a pre-requisite, to be in accordance with the requirements of RVSS Appendix A.

B.3.7 OVERBOARD HANDLING DATA DOCUMENT (OHDD)

The Overboard Handling Data Document is a standard data sheet that shall be developed for each component that may be used as part of an overboard handling system for both existing systems and new systems equipment. A Maximum Capability Document (see Section B.5) is then developed for each component using the deployment type information in the Overboard Handling Data Document. The owner of the component must work with the Designer/Vendor to complete the data fields on the Overboard Handling Data Document. The owner would provide as many of the data fields in the Overboard Handling Data Document as is known as part of a purchase specification for new equipment (or as part of an engineering analysis specification for existing equipment) with the Designer/Vendor providing the rest. The use of either metric or imperial units should be consistent throughout the document.

Table B.3 is shown below, with examples and explanations regarding completion of the document.

TABLE B.3 — Overboard Handling Data Document

REQUIRED DATA	**Operator/Designer Response**
Deployment Type	**e.g., "Towing (Surface) – Section B.3.5.1"**
Provide a brief narrative of scientific purpose and the equipment to be deployed. A drawing or drawings of the proposed "system" or "component" architecture is to be appended showing, for example, tension member angles and potential loadings (Principal, Secondary & Worst Case) relative to the various system elements. Provide information on the vessel or vessels (size(s), type(s), UNOLS or not, etc) intended for the system deployment, its/their area(s) of operation and the likely weather conditions to be encountered	e.g., "Portable Deck Winch intended for…" *If this winch were used in a "system" for a particular cruise, a new Table B.3 would be developed using the individual "component" B.3 tables. For example, the stern A-frame would have a B.3 table from the original construction where it was integrated from the fixed trawl winch.* *For portable systems, bolting arrangements (number size and material) are to be defined along with the expected deck loads the system will apply to the vessel*
Provide Primary Deployment Information:	

Package Type	e.g., “Various” for a general purpose system
Maximum Package Weight	
Base Package Mass	
Added Mass to include Captured and Entrained Added Mass (e.g., water/mud)	
Maximum Hydrodynamic Resistance	
Dynamic Factors	
Tension Member Type and Safe Working Tension	e.g., “Various” for a General-Purpose system and/or Manufacturer’s model number
Maximum Tension Member Weight (in water)	
Maximum Tension Member Mass	
Selected Tension Member Factor of Safety per Appendix A	
Maximum Anticipated Depth of Deployment	
Maximum Allowable Depths of Water	
Tension Member Length/Water Depth (%)	*Needed to confirm “Deployment Type”*
Principal Loading	*Verbal Description*
Secondary Loading	*Verbal Description*
Worst Case Loading	*Verbal Description*
Ultimate Design Load	
Load Limiting Equipment	e.g., auto render and/or weak link along with proposed set values, See B.5
Maximum Anticipated Operating Tension (lbs or tons)	e.g., Estimated Maximum Load from Appendix A
Design Line Tension (lbs or tons	e.g., Either Tension Member Breaking strength or Maximum Anticipated Operating Load as applicable.

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Other Emergency Means of Package or Tension Member Detachment	e.g., Acoustic release or deck mounted tension member cutter
Other means proposed for package control	e.g., Heave Compensation, state method and excursion limits proposed
Description of Fail Safes in the event of power loss or mechanical/electrical failure of system components	e.g., Connection of electric winch to the ship's emergency generator suitably sized to allow continued winch use. Use of standardized system components, spare parts and redundancies such that failed parts can be replaced

Attachment A1 provides a blank form of Table B.3 for use in the development of equipment proposals.

B.3.8 THE "SYSTEMS DESIGN" APPROACH

The previous sections establish the range and potential loadings applied to the different components that may be utilized in an overboard handling system. It is rare that a single component with its Overboard Handling Data Document and Maximum Capability Document is enough to comprise an overboard handling system since an overboard handling system is normally made up of multiple components (e.g. a winch, load path with necessary sheaves and shackles, and an A-frame). The handling apparatus, intermediate diverter sheaves, winches, ship attachments, ship support structural arrangements, and tension member must also be evaluated as a completely integrated system from the deployed science package through to the foundation structure of the winch taking into account increases in tension member loading due to passage around any sheaves enroute. For shipboard systems, the operator shall also develop Overboard Handling Data Document's for the standard suite of overboard handling systems that are used aboard their respective ship:

> A ship may be equipped with a hydrographic winch that may be outfitted with either 0.322 EM cable or 3/8" 3x19 rope using interchangeable drums. The load path for the winch may be via a gantry style handling apparatus off the side of the ship, a crane boom with an under slung sheave off the side of the ship, or an A-frame off the fantail. This results in six possible "standard" overboard handling systems that utilize the hydrographic winch, each of which would have an Overboard Handling Data Document developed and a resulting Maximum Capability Document.

Likewise, portable winches are to eventually be incorporated as a component into a completely integrated system through and including, the existing overboarding equipment. Handling apparatus designs (A-frame, gantry, cranes, etc.) need to consider the potential positioning and loads arising from portable systems temporarily mounted on deck and overboarding via the fixed systems.

B.4 STRUCTURAL DESIGN CRITERIA

A flow chart given in Attachment A2 gives the information gathering and decision-making process that allows the appropriate analysis and/or use of an overboard handling system.

The Design Line Tension (DLT) for an overboard handling system shall be the Nominal Breaking Load (NBL) of the tension member used in the system with a minimum factor of safety of 1.5 on the yield of all components in the system, per 46 CFR 189.35 UNLESS the overboard handling system meets any one of the following criteria:

a. It is intended to be used with a deployed tension member length less than 75% of the nominal water depth for any deployment envisioned for that system (except as noted in Section B.0.2).

b. Winches are designed and operated with Auto Render or Render/Recover as described in Section B.10. Tension Member monitoring requirements shall be per Appendix A.

c. Calibrated and tested weak link as described in Section B.10.

d. It can be shown that the ship carrying the overboard handling system cannot develop the thrust or accelerations required to create the full breaking strength of the tension member installed. The calculations must show that the vessel cannot create such loads under power – or in a dead ship or inadvertently anchored situation in Sea State (SS 5/6 (high 5/low 6) wind and sea conditions. Consideration should be given to the added effect of momentum and deceleration of the vessel in the event the payload hangs up on the bottom. It must also be shown that the vessel's stability is adequate to sustain the loads and geometries which might be presented. Based on these calculations, the maximum imparted load on the tension member shall be used in lieu of the breaking strength of the tension member and SS 5/6 shall represent the limiting conditions for operations.

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If any one of these conditions is met, then the DLT may be the MAOT in lieu of the NBL of the tension member used in the system and defined as follows:

For B.4 (a):MAOT = The GREATER OF:

[Package Weight (in water) + Tension Member Weight (in water)] +

(Package mass + Tension Member mass+ added mass) x 0.75 + Hydrodynamic drag

or

the maximum imparted load from the vessel

For B.4 (b): MAOT = Adjusted to a lower value with a Render or Render/Recover System to:

Load setting at which winch/system will render (Pay Out)

For B.4(c): MAOT = Adjusted to a lower value with use of a Calibrated Weak Link.

When using a weak link at the payload package, the Calibrated Weak Link load must be reduced by the weight of the maximum amount of tension member anticipated to be deployed and the

towing resistance of the tension member, the added mass and other dynamic effects such as strumming.

All UNOLS vessels must comply with Appendix B. UNOLS vessels that are inspected and certificated by USCG under*46 CFR Subchapter U* must comply with Appendix B, as well as the requirements of *46 CFR Subchapter U* (whichever are greater).

B.5 MAXIMUM CAPABILITY DOCUMENT (MCD)

The maximum capability for a component is determined by calculation by a Naval Architect/Engineer (Designer) or component/system manufacturer (Vendor), and will be provided for use in the form of a Maximum Capability Document (MCD). For a fixed component this analysis should include not only that component itself, but also the supporting elements such as foundations and supporting ship's structure. The MCD presents the Maximum Permissible Tension (MPT) coupled with the allowed load geometry for the given Tension for each component in a system. Reactions on ship's structure for fixed components, and the bolting pattern for portable components, should also be given in the MCD based on the MPT.

For components that lend themselves to a single limiting MPT regardless of the geometry, the Maximum Capability Document may simply be a single value MPT that is applicable for all uses of that component. More complex components whose MPT is impacted by geometry may require a more complex Maximum Capability Document to take full advantage of the component capability. Some examples to illustrate this distinction include:

- Shackle – the Maximum Capability Document may be the manufacturer's specification sheet for the shackle with a single value that is the shackle's safe working load.
- Deck Socket – the Maximum Capability Document may be three limits depending on the geometry of how the load is applied; vertically, horizontally, or at an angle.
- A-frame – the Maximum Capability Document may look very similar to the load handling diagram for a crane that has different limits dependent upon the geometry of how the load is applied.

For some components that could have a complex Maximum Capability Document such as an A-frame, the operator may choose to simplify it for ease of use. For instance, a single MPT could be derived that applied to all geometries and modes that component could be used with. In this instance, the engineer would investigate all anticipated uses and modes and return with the LOWEST maximum from their calculations and this single blanket MPT could be stamped on the component. For this approach, it is likely that in some modes a possibly higher MPT is being sacrificed for simplicity during operations. Alternatively, various MPT could be presented for various modes of operation (Towing, Vertical Lift, Luffing) and/or tension member angles. In this instance, all approved geometries would be presented within the Maximum Capability Document.

Attachment A3 is a simplified illustration of how the tension a component sees (in this case an A-frame) is dependent on the geometry of the overboard handling system.

In the ultimate example of a Multiple Capability Document, curves and graphs could be presented that allow for varying MPT based on location of the winch on board, as well as location and angle of science package deployed (similar to a crane's loading diagram).

The engineering costs rise proportionally with the rising complexity of the document as a matter of presentation, rather than the necessity of performing the analysis. Over the life of the vessel and/or the equipment, the added understanding of system capabilities far outweighs the up-front cost.

The Maximum Capability Document shall be presented as a booklet with general information on the system or component, the controlling MPT and the various loading diagrams. Completed Overboard Handling Data Documents shall be attached to the booklet to establish the design criteria from which components were selected or developed.

Each system that uses portable components (for instance, a winch from winch pool) shall have the component maximum capability document included in their documentation as an attachment.

NOTE: The MCD Booklet shall be kept with the component at all times and at least two (2) copies should be delivered with it to the vessel operator; one (1) copy kept on the vessel and one at the marine office for after the vessel departs.

As with the Maximum Capability Document developed for each component based upon the component Overboard Handling Data Document, each overboard handling system will have a Maximum Capability Document developed based upon that overboard handling system's Overboard Handling Data Document and evaluation of the MPT for all the components.

The consolidation of the Overboard Handling Data Document's and Maximum Capability Document's for all components aboard a ship along with the standard suite of overboard handling system documentation results in a complete library of documents that will:

- Provide a permanent record of the basic design data and operational set-up of the components.
- Be incorporated into the equipment Operator's manual for each component.
- Promote consistency of approach.
- Be superseded by subsequent amended versions as and when required by changes made (such as new tension members, changes in system configurations, etc) thus providing a 'life history' of the equipment.
- Provide a record of the installation of portable pieces of equipment on different vessels or, of different positions and configurations on the same vessel, for future reference.

The OHS Operator's Manual and the MCD Component Booklets will also provide the operator with the means to evaluate and determine the Maximum Capability Document for a "new" overboard handling system that has not been previously evaluated. The operator would develop the Overboard Handling Data Document for the "new" overboard handling system and evaluate its capability as a system using the Maximum Capability Documents for each component to determine the Maximum Capability Document for the "new" overboard handling system. This evaluation by the operator would be documented prior to using the "new" overboard handling system.

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If the complexities of the “new” overboard handling system are such that the operator is not confident in their ability to properly evaluate the overboard handling system, then it is incumbent upon the operator to have the evaluation done and a Maximum Capability Document prepared by a naval architect/engineer. The availability of the Maximum Capability Documents for each component that makes up the “new” overboard handling system should make this process relatively simple and efficient. This demonstrates the need for early communication between the ship operator and the Principal Investigators (PIs) for each science cruise to ensure “new” overboard handling systems (particularly if portable equipment will be used) can be properly evaluated before use and the necessity for obtaining MCD related information at manufacture.

Attachment A4 (in development) will provide an example Maximum Capability Document for an overboard handling system.

B.6 TESTING AND TEST DOCUMENTATION

Not withstanding the following, all USCG inspected UNOLS vessels must comply with 46 CFR 189.35-5 and as referenced, 189.35-13.

B.6.1 COMPONENT TESTING

Except for tension members and standard deck hardware in good physical condition and previously tested and recorded including those that have a Quality Assurance (QA) data record of manufacturer’s testing (shackles, deck bolts, etc.), system components shall be tested to 125% of their MPT at least every two years. If it can be shown that a system test has applied 125% of MPT (for component in question) to that specific component, then that test is acceptable for compliance. Winches and sheaves may be bench tested to comply with this requirement. This requirement ensures that idle gear that may be in a pool or in storage is still tested at a minimum every two years.

Deck bolting sockets are considered components, NOT standard deck hardware and thus are periodically SWL tested on a 2 year testing cycle.

Tension members shall be tested in accordance with Appendix A.

B.6.2 FIXED SYSTEMS

Fixed systems shall be tested every two years to 125% of the system MPT. A fixed system shall be tested in the configuration(s) it will be used in during operations. A test shall consist of all components including winch, diverter sheaves, handling apparatus, and overboarding sheaves.

Each fixed system shall be tested once in each mode it operates in. As an example, an A-frame might lift vertically (1), tow astern (2), or luff inboard (3). This system would need to be tested in each of these modes. However for testing the tow astern it is anticipated that alternative testing

as defined in section B.6.5 will be used. As far as geometry (winch location, sheave location, tension member angle) is concerned, the Maximum Capability Document shall identify a worse case geometry for each mode. Only that worst case geometry need be tested. Therefore, the example A-frame would be tested in three modes based on the worst case geometry in each model for a total of three (3) tests every two years. If a component (such as an ancillary winch) is not included in the system test (as it may not be part of worst case geometry) it must be tested on its own.

Auxiliary lifting appendages (lower rated side arms on an A-frame for instance) shall also be tested in their modes of operation at their worst case geometrical configuration. Duplicate appendages of identical design (port/stbd for instance) shall be alternated every two year cycle (year 0 – Port, year 2-Stbd). This does not apply to auxiliary pad eyes in the main lifting section of the apparatus, however – these pad eyes should be tested separately every four years.

B.6.3 PORTABLE SYSTEMS AND COMPONENTS

A complete portable system shall be tested on board the vessel of opportunity after installation and before its first use begins. System shall be tested to 125% of MPT. System shall be tested on every new installation/use. If the system has been used on the subject vessel within previous two years and has been tested on the subject vessel, the testing shall be confined to proper function and shall not require a load test.

A portable component (such as a winch) shall be tested on board the vessel of opportunity after installation on the vessel and before its first use. If the portable component has its own current (< 2 year) test documentation and its MPT and geometry falls within the limits of the vessel's pertinent system's Maximum Capability Document, the system test shall be confined to operational testing. If the component does not have its own stand alone test documentation or if its operation is not within the normal scope of the system's Max Capability document (i.e. new geometry) an in situ load test to 125% of the MPT shall be performed.

This test shall be recorded in both the component and system test logs to avoid unnecessary retesting.

In no case shall the MPT of the host system or the Safe Working Load of the tension member used, be exceeded when using a portable component.

B.6.4 PREFERRED TESTING METHOD

The preferred testing method for a system is to test the system in the configuration it is to be used at sea. A tension member of suitable strength for the test should be used and reeved from the winch through all sheaves, at the worst case angle geometry, through sheave attached to pad eye or lifting point on apparatus <u>and</u> to a "virtual package". A substitute tension member can be synthetic line of higher strength but approximate diameter as the normally used tension member. The virtual package may consist of a certified test weight hung on a tension member to create the prescribed tension (125% MPT) <u>or</u> it can be a dead ended tension member with the tension provided by hauling back on the system winch. Test tension shall be measured by properly

calibrated and verified tension measuring device(s) that are either part of the system or that are introduced for the testing purposes only.

This method of mimicking every aspect of an operation is the most rigorous test method as it tests each component in the exact orientation and loading that will be experienced at sea. This also simultaneously tests the adequacy of standard deck hardware (deck bolts, shackles) for a given system configuration.

Even for towing operations where a handling apparatus can be exposed to loads in both the vertical and horizontal planes simultaneously, testing of the “real life” configuration is the only way to ensure the system can consistently withstand the calculated MPT for that particular operation.

B.6.5 ALTERNATIVE TESTING METHODS

In lieu of testing an entire system in the precise configuration it will be used at sea, an alternative test method can be developed that results in the same effect as 125% of MPT. This alternative test method can separate the testing functions for the various components, and/or resolve real world at sea MPT diagrams into more manageable static load tests alongside.

For instance, a configuration might exist where an A-frame is used at sea with a winch somewhat forward on the deck and a vertically lifted load over the transom with a tension member leading from the winch over a sheave hung on the A-frame to a payload package. In lieu of testing this scenario, a test could be developed that mimicked the resultant load on the A frame and a single calibrated weight could be hung at the appropriate angle from the A-frame. In that case, however, a separate test would still have to be performed on the winch, any fairleads or sheaves in the tension member path as well as the hanging sheave used at the A-frame.

A more logical scenario in which this methodology could be used is for testing the Tow mode. While it is possible that an off center, far astern tow situation could be modelled by reeving a test tension member far astern of a vessel to a fixed point on a pier or to a substantial mooring, the logistics of such a test are complex. In lieu of that, a vertical resultant load could be applied to the overboard handling apparatus as well as additional fore/aft and/or side loads that collectively model a real world tow situation.

B.6.6 TEST PROCEDURE AND RECORDING

A formal test procedure shall be developed for each component and/or the entire system. While this may be done by the operator, it may be best accomplished as part of the scope of work for the naval architect/engineer and/or the system manufacturer. The test procedure shall delineate the real world scenarios and geometry to be tested with reference made to the component or system Maximum Capability Document. The test procedure shall include reeving diagrams, indication of tension member to be used, description of system of tension application (test weight or dead end tension, by system winch or ancillary winch), methods of certification of accuracy of tension (on board tension measuring equipment and that system’s calibration, calibrated test weights, calibrated test scale used to weigh miscellaneous weights) and safety precautions. If “alternative” testing method by calculation of equivalent resultant loads is to be used, reference shall be made to these calculations or calculations shall be provided within the test procedure.

Each component and/or the system shall have a Test Log that indicates test dates, test results, test methods (per procedure) and those present. Test logs must be kept aboard the vessel with a shore-side copy maintained at the Marine Office.

The system Test Log shall also incorporate information required by 46 CFR 189.35-13. Specifically, this includes inspections, testing, important repairs and casualties experienced. The Test log shall be kept aboard the vessel and shall be made available to inspectors (regulatory such as USCG and oversight such as NSF or other government agencies as appropriate).

B.6.7 TESTING RESPONSIBILITY

For fixed systems, testing is the responsibility of the vessel Operator.

For portable system components, testing is the responsibility of the component Owner.

For portable systems, testing is the shared responsibility of the component Owner and the vessel Operator. Financial responsibility for setup and conducting the test may be shared with the science user depending on the complexity and availability of documentation (or lack thereof). The ship operator shall assist in making arrangements for all required testing and shall conduct the test with the support of the science user.

B.6.8 TESTING OF LOAD LIMITING DEVICES

Testing of Auto Render, Render/Recovery, and other load limiting devices are as described in Section B.10 below.

B.7 PROCEDURAL AND GENERAL SAFETY REQUIREMENTS

B.7.1 PROCEDURAL REQUIREMENTS

Procedures are to be developed during system design or integration for: Rigging and un-rigging the system, launching and retrieval of packages with emphasis on protection of the handling system, the deployed packages, the vessel, and most importantly, the personnel involved.

These procedures are to be continually reviewed during the design, manufacturing, and/or integration stages to ensure that the process remains valid and safe throughout. Factory acceptance trials and harbor acceptance trials are to be utilized to verify the proposed procedures as far as practicable.

Prior to the first mobilization and sea trial of the system, all the participants are to be rehearsed in the procedures, and a detailed plan prepared of all the tests and trials required to prove the system 'fit for service.'

During the first mobilization and sea trials, the procedures are to be implemented. Where changes become necessary from this experience, they should be incorporated into a revision of the procedure documentation.

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On completion of the sea trials, the procedures are to be reviewed, approved for service, and provided along with all other necessary documentation to the Owner/Operator.

B.7.2 GENERAL SAFETY REQUIREMENTS

All moving elements shall be protected by guards or guard rail enclosures to prevent inadvertent contact by personnel in a seaway environment.

All tension member paths shall be protected by wire mesh guards, casings, restraining posts, or safety zones as far as possible to prevent personnel contact in case of failure in accordance with Appendix A.

Where tension members are led from below deck through trunks, due regard must be taken of the potential for down flooding through the open trunks and the requisite coaming heights provided.

Any other penetrations required by the design must also take into account the need for watertight integrity of the hull and superstructure, and be configured accordingly.

Where portable systems are proposed using a vessel's deck bolting system, the equipment weights and tension member loads and directions must be proven not to overstress the bolting system or the deck in which it is incorporated (part of B.3 analysis).

Where permanent systems are proposed, the equipment weight and tension member loads and directions for Principal, Secondary, and Worst Case loadings are to be used in defining the deck and its underdeck support structural designs (part of B.3 analysis).

B.8 TRAINING

Load Handling System and/or component training shall be auditable, comprehensive, and comply with the requirements for winch operator training in Appendix A *UNOLS Rope and Cable Safe Working Load Standards*

B.9 LABELLING AND DOCUMENTATION

As a minimum, the system components shall be labelled with the following information:

Maximum Permissible Tension (MPT)	XXX	
Test Date	XX/XX/XXX	
MPT Diagram	[providing a clear definition of the geometry]	
Ref. Drawing:	XXXXXX	[where MPT diagram alone is inadequate]

While a system might be designed specifically for a particular use and restricted solely to that, on general purpose ships a tension member, and its winch or handing appliance, might be used for a variety of purposes (e.g., coring, dredging, grappling, trawling). Therefore, proper labelling must be carefully considered, comprehensive in its information and based upon the information contained in its Maximum Capability Document.

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The labelling of winches capable of handling more than one tension member (e.g., traction types) must be comprehensive in its information and based upon the information pertaining to each configuration contained in its Overboard Handling Data Document and Maximum Capability Document.

On general purpose vessels, a trawl winch and its tension member may be pressed into service to take over from a coring winch in support of a science program or to grapple for a piece of lost equipment. Therefore, such eventualities have to be considered and included in the labelling information. General redundancy to meet these requirements and a wide variety of scientific programs must be understood at the concept stage and their implications carefully considered.

Overboarding appliances can be even more complex by being capable of deploying a number of tension members either individually or simultaneously. For example, a midship frame might be capable of deploying a CTD (vertically), a coring wire (vertically), and a dredging wire (at a towing angle to the vertical). An aft frame might be configured to deploy long cores vertically, but also tow nets, which also impart significant side loads when in a turn. All these activities are to be illustrated in Overboard Handling Data Document and Maximum Capability Document documentation.

Overboarding appliances that come as part of the vessel at delivery generally stay with the vessel for its entire service life. Since this equipment may impose limits on the ship's stability and structural design, the initial design loads should be set recognizing that the vessel overboarding requirements may increase over time.

Ship operators and their seagoing staff must understand that if, by force of circumstance or by their wish to maintain scientific operations while on a cruise, they re-configure or use systems outside the bounds of the labelling information without undertaking the required study of the new arrangement in accordance with Maximum Capability Document, they are embarking on a potentially dangerous activity. The consequences of this activity could be loss of valuable equipment, damage to the vessel and its fixed equipment, and, in the worst case, injury to personnel.

B.10 TENSION MITIGATION DEVICES AND SYSTEMS

Detailed requirements for various tension mitigation devices and systems are given in subsections below.

B.10.1 AUTO RENDER AND RENDER/RECOVERY REQUIREMENTS

Where auto render or render/recovery is specified in order to allow the application of the Maximum Anticipated Operating Tension during design, the Overboard Handling Data Document shall clearly state this along with the specific system capabilities.

Auto render and render/recover shall have the following capabilities:

1. Continually monitor the loading condition of the winch
2. Operate continuously in all modes of winch operation without intervention of the operator

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3. Provide rapid response to an overload condition, never allowing the tension member to exceed 100% of Design Line Tension
4. Capable of manual adjustment by the winch operator to enable rendering at any tension between, 10% and 75% of the Design Line Tension.
5. Retain tension at the pre-set load while activated in an overload condition
6. Signal that the system is armed and monitoring with a continuous visual indicator at the control station.
7. Signal that the system is operating in an overload event with a continuously illuminated signal at the control station. The signal shall remain illuminated after the overload event until manually re-set by the operator or until the winch system is powered down.
8. Signal that the system is operating in an overload event with a continuous audible alarm at the control station, winch and working deck areas. The alarm shall stop when the overboard event has passed.
9. Return the winch to full operating capability after the overload event has passed without intervention by the operator.

A means of reliably testing the auto render or render/recover system during winch trials (Factory Acceptance, Harbor Acceptance, Sea Acceptance) and for required periodic load testing shall be described in detail in the Operator's manual.

Note: Render/recover winches can also provide a means of maintaining a constant tension, preventing potential snatch loads after the winch has paid out. The operator should consider the need for an emergency power supply which might be drawn from the ship's emergency generator, in order to keep the winch and its auto render/recovery facility in operation.

B.10.2 WEAK LINKS

Where weak links are specified in order to allow the application of the Maximum Anticipated Operating Tension during design, the Overboard Handling Data Document shall clearly state this along with the design details of the weak link, the calculation of the mechanics of failure and the value of the failure load. The weak link shall be included at the end of the tension member and set to the MPT less the weight of the supported tension member weight and the towing resistance of the tension member, the added mass and other dynamic effects such as strumming.

NOTE: Use of weak links must recognise their limitations when using metallic tension members (as opposed the near neutrally buoyant synthetics) due to the impact of metallic tension member weight on activities such as deep coring. A weak link placed at the package only protects against the package becoming entangled, and if the tension member becomes entangled, it is still possible for the breaking load of the tension member to be generated and transferred to the handling system.

B.10.3 ACOUSTIC RELEASES

In the event a science package may become irretrievable if the tension member parts, an acoustic release device may be considered for inclusion in the system in order to recover either the package and/or a section of the tension member (which could be of very high value).

An acoustic release is not considered a load limiting device for the purposes of designing to MAOT, as it does not automatically prevent the potential overloading of tension members or the overboarding system components. The release is considered a method of last resort if a package is irretrievable.

B.10.4 REMOTELY OPERATED CUTTERS

Where a remotely operated cutting device is installed to sever the tension member, it shall be under the direct control of the vessel's Master who will be the sole arbiter of the necessity and timing of its use.

Load monitoring/alarms as per Appendix A are to be fitted in support.

The cutter should be a stored energy device totally independent of the ship's power system.

Cutters are not considered load limiting device for the purposes of designing to MAOT, as it does not automatically prevent the potential overloading of tension members or the overboarding system components. Cutters are to be used to either release an irretrievable package if an acoustic release is not installed, or if the Captain deems it necessary to cut the tension member to ensure the safety of the vessel.

B.10.5 MOTION COMPENSATION

Motion compensation shall be specified only for the control of the scientific package in the water column to improve scientific data quality (e.g. CTD thermocline following), prevent bottom impact of "low flying" equipment, and/or reduce the dynamic loading per Appendix A. **Motion compensation is not considered a load limiting device for the purposes of designing to MAOT**

NOTE: For motion compensation by winch pay-in/pay-out, the potential for continual working of sections of the tension member over intermediate sheaves and overboarding sheaves must be considered. Sheave diameters and groove profiles should be chosen to minimize possible damage with diameters in excess of the minimum Appendix A requirements fitted if possible.

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Attachment A1

TABLE B.3 — Overboard Handling Data Document

REQUIRED DATA	Operator/Designer Response
Deployment Type	
Provide a brief narrative of scientific purpose and the equipment to be deployed. A drawing or drawings of the proposed "system" or "component" architecture is to be appended showing, for example, tension member angles and potential loadings (Principal, Secondary & Worst Case) relative to the various system elements. Provide information on the vessel or vessels (size(s), type(s), UNOLS or not, etc.) intended for the system deployment, its/their area(s) of operation and the likely weather conditions to be encountered.	
Provide Primary Deployment Information:	
Package Type	
Maximum Package Weight (lbs.)	
Base Package Mass	
Added Mass to Include Captured and Entrained Added Mass (E.G., Water/Mud)	
Maximum Hydrodynamic Resistance	
Dynamic Factors	
Tension Member Type and Breaking Load	
Maximum Tension Member Weight (In Water)	
Maximum Tension Member Mass	
Selected Tension Member Factor of Safety Per Appendix A	
Maximum Anticipated Depth of Deployment	
Maximum Allowable Depths of Water	
Deployment/Water Depth Ratio	
Principal Loading	
Secondary Loading	

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Worst Case Loading	
Ultimate Design Load	
Load Limiting Equipment	
Maximum Anticipated Operating Tension	
Design Line Tension	
Other Emergency Means of Package or Tension Member Detachment	
Other Means Proposed for Package Control	
Description of Fail Safes in the Event of Power Loss or Mechanical/Electrical Failure of System Components	

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Attachment A2 Appendix B Flow Chart

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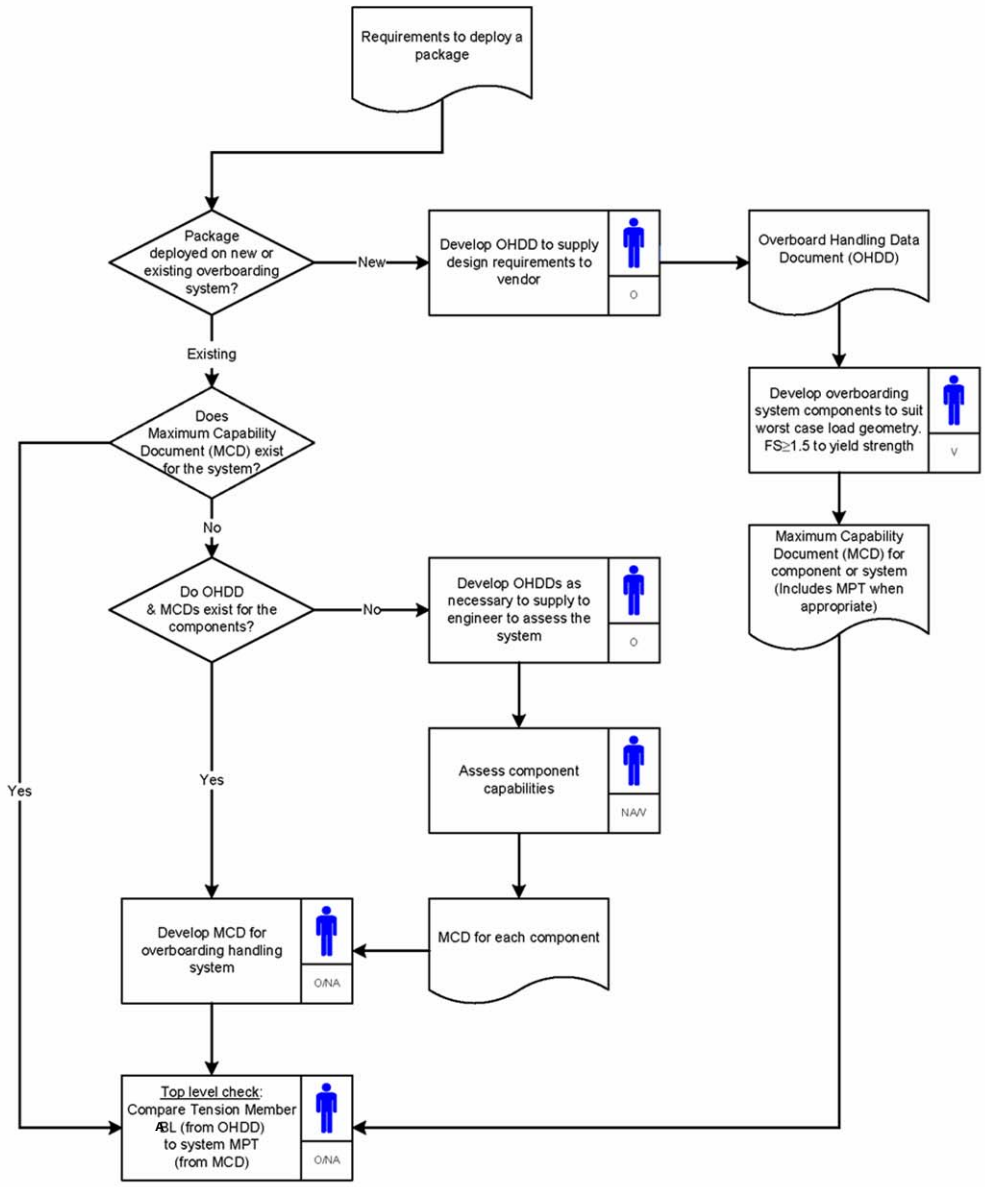

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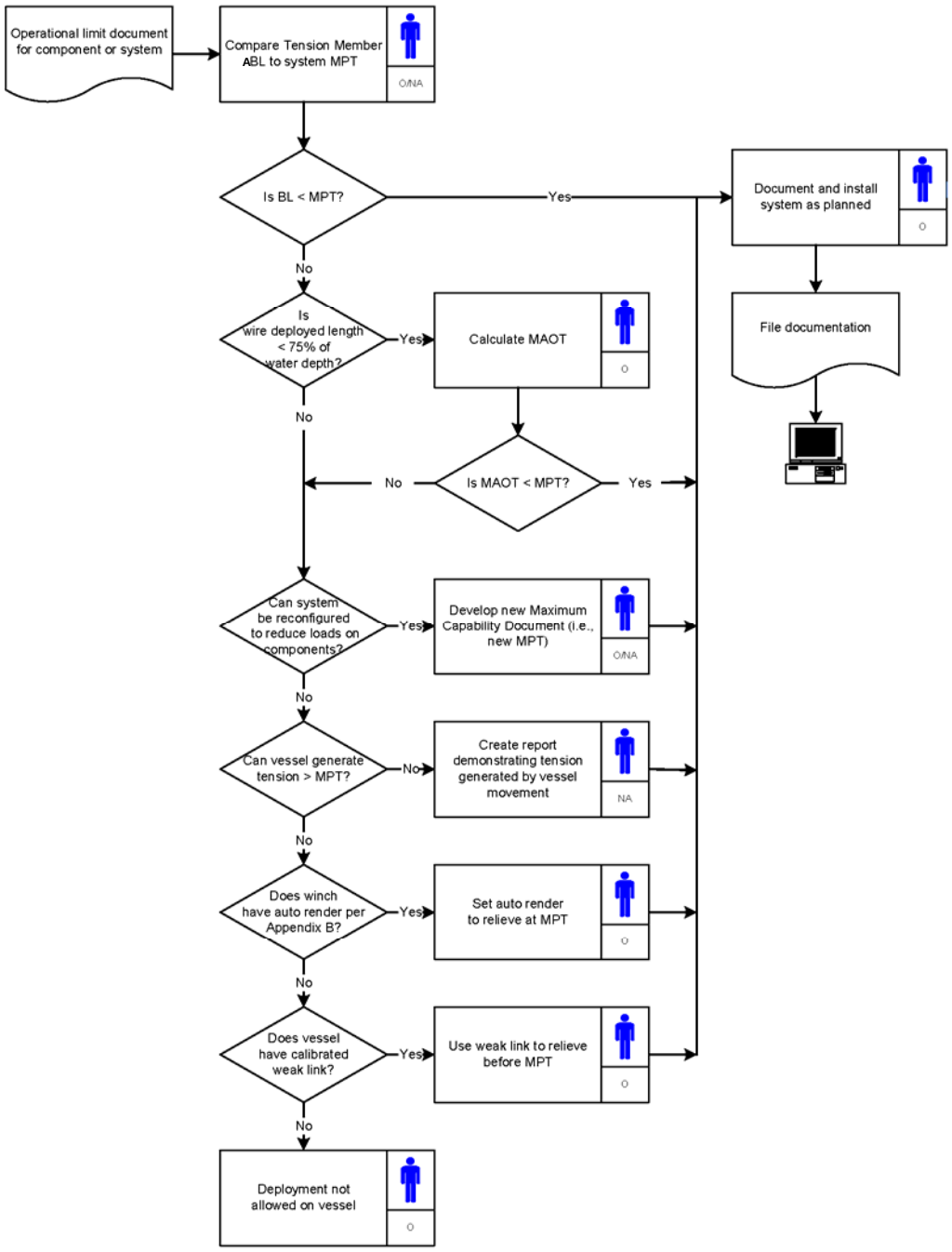

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Attachment A3: Example of the impact of the overboard handling system geometry on the tension an A-frame would see.

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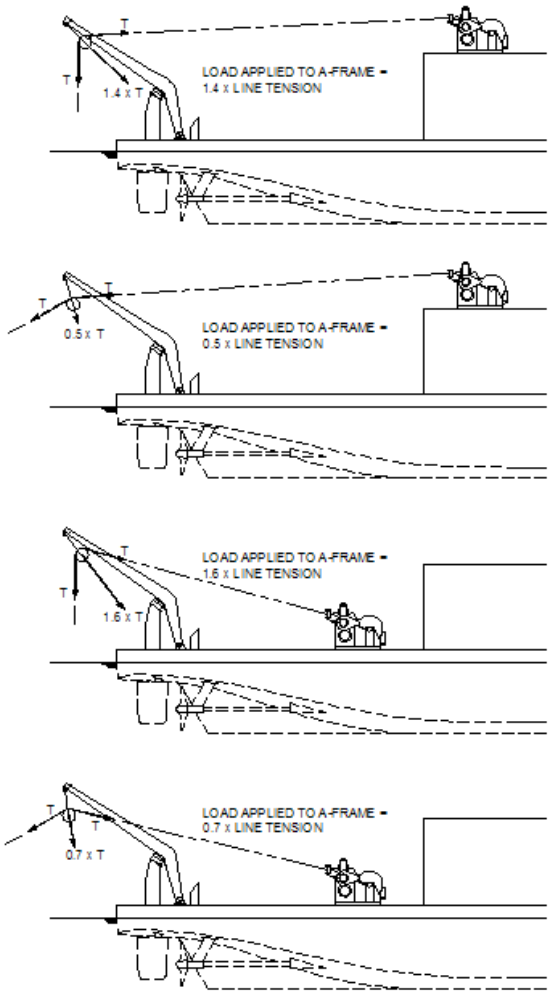
MAX WORKING TENSION (MWT) =10,000 LBS
ACCEPTABLE FOR ALL POSITIONS SHOWN



Attachment A4

Reserved for including an example MCD for an overboard handling system in a later revision to Appendix B.

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Attachment A5 Potential Appendix B data structure:

Note: Some of the items will become non-applicable or optional for specific systems and components.

Each Overboard Handling System (OHS):

The potential contents of the OHS Operator's Manual for each OHS:

- Overboard Handling System Data Document (OHDD) for the system
- Maximum Capability Document for the system with "Top Level Check" of the MPTs of each of the components and compared with the tension member Nominal Breaking Load (NBL)
- OHS test logs
- OHS layout and geometries
- Training and operator qualification requirements
- Inspection procedures
- Testing procedures
- Operational and safety precautions
- Emergency procedures

Each Component:

The potential contents of the MCD Component Booklet for each component:

- Maximum Capability Document with proof or analysis of the MPT included.
- Overboard Handling System Data Document (OHDD) for the system (a list of excluded items such as shackles, turning blocks, cleats, tie down bolts and deck foundations, tugger winches will reduce the complexity and the work load.)
    - Footprint and bolt pattern if applicable
    - Attachment loadings
    - Ship system interface requirements such as electrical power, hydraulics, data transfer
    - Component Test Logs
    - Component weight
    - Overall dimensions
    - Equipment Operator's Manual
    - Training and operator qualification requirements
    - Inspection procedures
    - Testing procedures
    - Preventative maintenance
    - Operational and Safety precautions

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For portable components additionally:

- Sub-component inventory list
- Delivery check-off list
- Installation instructions

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