E-mail sent November 2010:

Dan-

I wanted to give the Safety Committee an excellent example of science winch compliance with Appendix B that I saw during the inspection of NEW HORIZON. A lot of discussion has been given to ship's fixed and portable systems, but I think science equipment will be even more challenging in the end.

The example below is one of a science party (Steven Constable, Geophysics as UCSD) that is actually already in line with Appendix B in their thinking in that they took a common sense approach to what the handling system components (in this case portable deck winches) are actually being used for. Steven can correct me on any of the details if I got them wrong!

The science goal was to tow and test an electromagnetic transmit/receive array for geophysical work. The system generates sub-bottom profiles similar to seismics, but potentially with other benefits to the end user.

The science equipment consisted of:

1. The towed "fish"/array
2. Portable spooling winch with ¼" (or 3/8"?) synthetic braid (high breaking strength, blue line in the photos)
3. Portable SeaMac winch fitted with 0.322 cable for data transmission.
4. Small portable electric capstan

This was a system they put together quickly so they could use the ship during the inspection for their tests. Normally, the array is towed from the ship's 0.680 cable on the fixed traction winch instead of the 0.322/SeaMac. The ship's A-frame is used for deployment over the stern.

I would consider both the spooling winch and SeaMac "light duty" (relatively speaking).

The "fish"/array gets deployed over the stern with slight forward way on the ship. It's streamed off the spooling winch and attached to the synthetic braid only when the array is on or near the surface. Intermittently, "weak links" consisting of ¼" nylon line are inserted at the instruments and between the braid and the 0.322 cable.

When the array is fully deployed, load is transferred to the SeaMac winch and the array lowered to within 50m of the bottom. Water depth was roughly 200m. Also, there was more than 200m of cable/array out.

So, according to Appendix B:

1. The spooling winch would be considered a "Towing-Surface" winch. It would be designed (i.e. Design Line Tension or DLT) equal to a Maximum Anticipated Operating Load (MAOT) based on the drag of the instrument array - NOT the breaking strength (NBL) of the synthetic cable. Science would need to provide SIO with a Maximum Capability Document (MCD) from the vendor which gave the Maximum Permissible Tension (MPT) for the winch and hopefully the deck reactions based on MPT and the winch geometry.

2. Because the cable out on the SeaMac exceeds 75% of the water depth (chance of entanglement with the bottom), it would be classified as a “Towing-Deep Water” winch. It would then normally be designed to the withstand breaking strength of the 0.322 if there weren’t the synthetic cable. However, since there is a synthetic cable on the array, it would need to withstand that breaking load instead. I doubt the SeaMac can withstand that. Fortunately, the science team understood this in principle and (according to section B.4(c) of Appendix B) inserted a weak link. The nylon line reportedly has a breaking strength of 1500lbs. Science would need to provide SIO with a MCD for the SeaMac showing the MPT exceeds 1500lbs and the associated deck reactions. They would also need to provide test documentation that shows their weak link has been “calibrated” to consistently break at a known load (B.10.2). Not sure if that’s possible with nylon line. If not, they might have to change to a different weak link design.
3. SIO would then combine the MCD’s for the A-frame, overboarding block, shackles, and deck bolting pattern with the MCD’s for the winches to develop the Overboard Handling Data Document’s (OHDD’s) for this cruise. Assuming good MCD’s on file for the ship’s components developed by a competent naval architect, and good MCD’s for the winches, the MPT for the “system” is the lowest value of MPT from each component. My guess is that the controlling factor would be the weak links and/or the winches themselves. **No interaction from a naval architect would be required.** The OHDD could be a simple sketch giving the required info with the MCD’s as back-up. DONE!
4. Being portable systems, SIO would need to test both to the MPT for the system prior to departure in the configuration used for deployment (weight hung on the cable that’s reeved from the winch and over the sheave). This would be 1500lbs for the SeaMac and the MPT for the spooling winch. Easily done for these small winches and the ship’s A-frame.
5. The deck capstan and clips that mate the SeaMac to the deck bolting pattern would also need MCD’s. If deck clips supplied by science, science would need to provide.

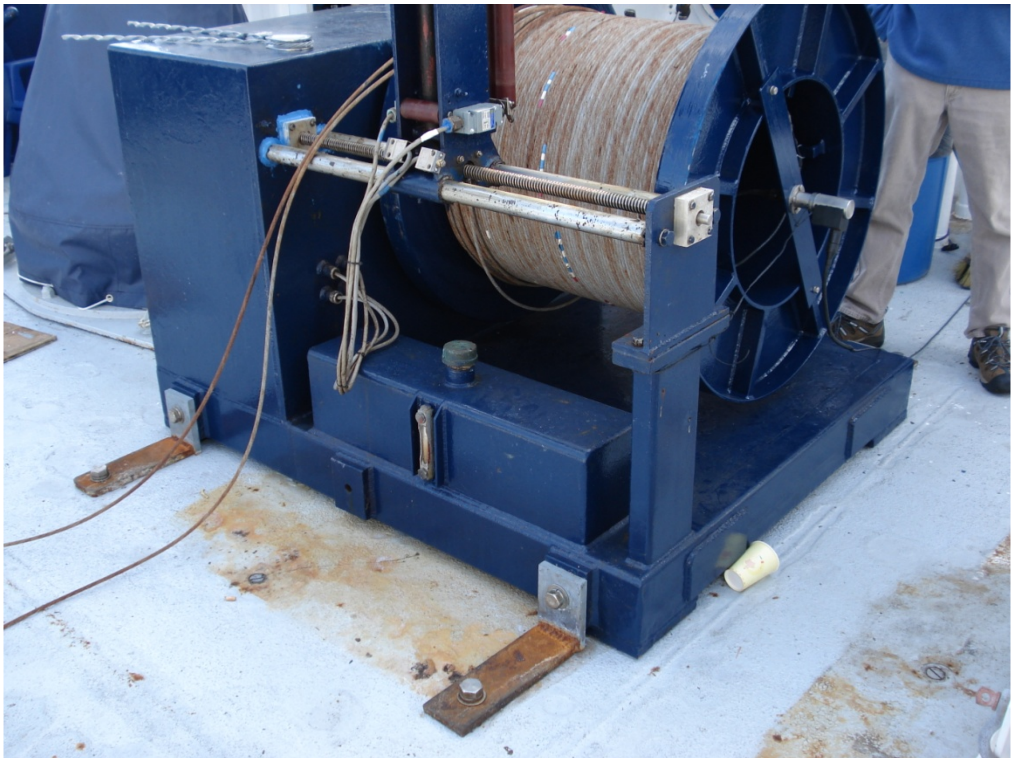
With regard to Appendix A, I noted there wasn’t any monitoring system on either the winches or the portable blocks. However, if a FS = 5.0 is used (i.e. specified/documented by the science party), **then no monitoring system is required.** Given the MAOT, the FS on the synthetic certainly exceeds a FS = 5.0. Given the breaking load of the weak links (1500 lbs) the FS on the 0.322 would equal 10,000lbs/1500lbs = 6.7

In short, **this system meets Appendix A**. The ship would just have to ensure the overboarding block is at least the manufacturer’s minimum diameter (~13” – which it was) and the science party would have to provide a document to the Captain showing that Steven (who ran the winches) was “deemed competent” to do so. On/off switch and single lever for each winch. Looked like he handled it well!

Folks should not fear Appendix B. Here’s a science party that already has the right idea in mind. The trick is going to be developing the MCD’s for the various components. Fortunately, the SSSE program is the right mechanism for that. The winch pools can assist science with getting the documentation together if needed. The other trick will be getting this philosophy approved by USCG for the inspected vessels. I believe that both are possible.

Hope this helps.

Matt

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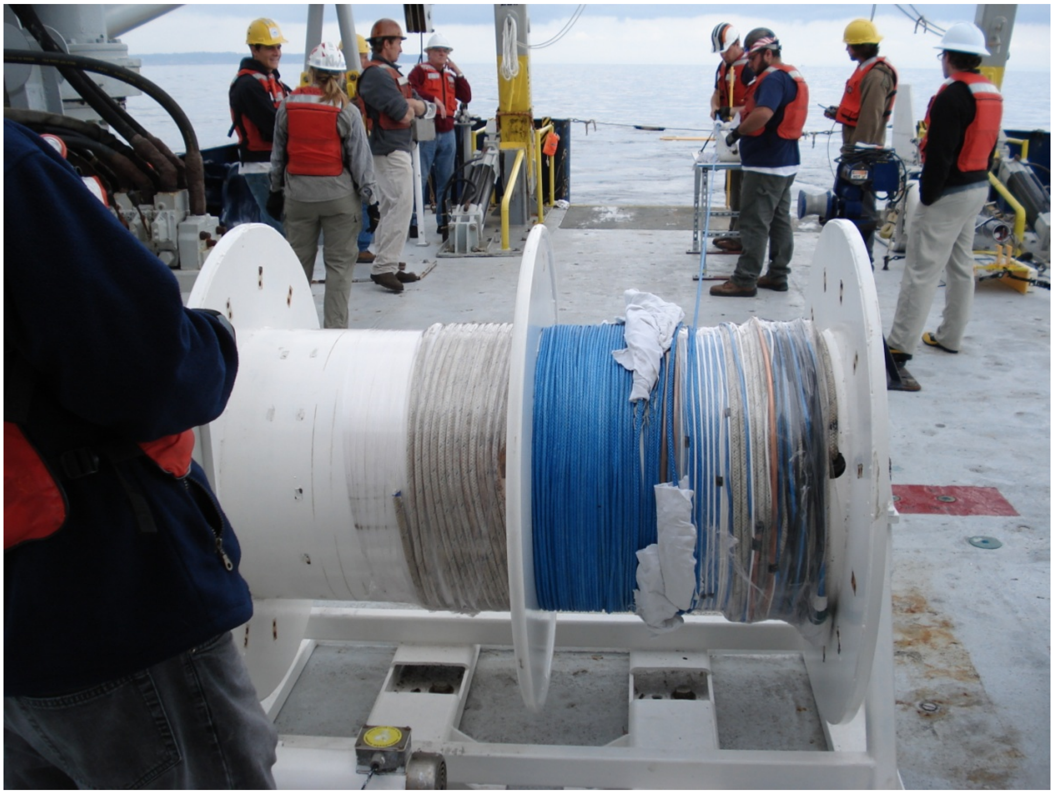

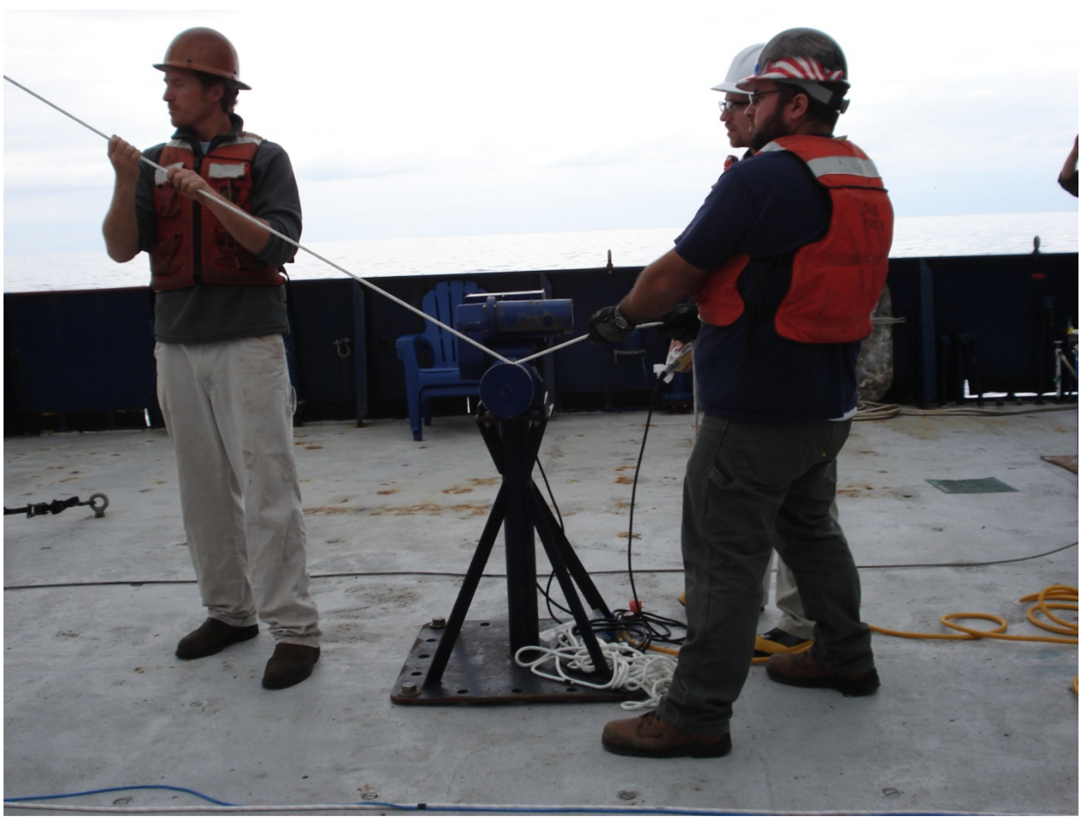

TABLE B.3

REQUIRED DATA	**Operator/Designer Response**
Deployment Type	*Towing-Deep Water*
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.	This system is used to conduct test tows of Steve Constable's electromagetic array aboard the NEW HORIZON during the NSF Inspection in November 2010. It is made up of components provided by the ship and the science party as shown on Sheet 2. The total array length deployed is approximately 600m in a water depth of approximately 200m. The instrument is normally towed approximately 50m off the bottom.
Provide Primary Deployment Information:	
Package Description	Towed Electromagnetic Array
Maximum Package Weight	500 lbs (lifted on synthetic with capstan)
Base Package Mass	500 lbs (lifted on synthetic with capstan)
Added Mass to Include Captured and Entrained Added Mass (E.G., Water/Mud)	0
Maximum Hydrodynamic Resistance	800 lbs (including wire weight. See Appendix A calculations)
Dynamic Factors	0 (long catenary during tow)
Tension Member Type and Breaking Load. Either Nomial Breaking Load (NBL) or Assigned Breaking Load (ABL) per Appendix A	3/8" synthetic (17,500 lbs), 0.322 (10,000 lbs)
Maximum Tension Member Weight (In Water)	See Appendix A calculations
Maximum Tension Member Mass	See Appendix A calculations
Tension Member Factor of Safety per Appendix A	5.0
Tension Member Maxmimum Permissible Tension (MPT) or SWL	3500 (synthetic); 2000 lbs (0.322)
Maximum Anticipated Depth/Length of Deployment	600 m
Maximum Allowable Depths of Water	200m
Deployment/Water Depth Ratio	*>100%*
Principal Loading	*800 lbs (Hydrodynamic drag)*
Secondary Loading	*800 lbs with added side load due to crab*
Worst Case Loading	*10,000 - 17,500 lbs assuming array sinks and entangles with bottom.*
Load Limiting Device or Conditions (Section B.4)	YES - Weak Link (per Section B.4.c)
Maximum Anticipated Operating Tension (MAOT):	1500 lbs (weak link breaking load)
Design Line Tension (DLT):	*n/a*
Ultimate Design Load (UDL):	*n/a*
Maximum Permissimble Tension (MPT):	1500 lbs (See Sheet 2)
MAOT < or = MPT?	**Yes (OK)**
Other Emergency Means of Package or Tension Member Detachment	Fire Axe
Other Means for Package Control	None
Description of Fail Safes in the Event of Power Loss or Mechanical/Electrical Failure of System Components	None

If this were on an Inspected Vessel, MAOT would be 17,500 lbs or the breaking stenth of the synthetic and MAOT > MPT (not OK) unless approval received from USCG for use of weak link.

Constable Towed System - NEW HORIZON (November 2010)

Note: The figures below are estimates and are provided for Appendix B illustration purposes only.

COMPONENT	UDL (LBS)	DLT (LBS)	MPT (LBS)	Comments
1. Handling Apparatus				
NEW HORIZON Stern A-frame	Unknown	40,000 (towing and lifting on the outboard stops)	40,000 (towing and lifting on the outboard stops)	Reportedly designed to withstand 0.680 cable on DYNACON Traction Winch. This needs confirmation with new MCD (including allowable cable geometries, stop positions, padeye ratings, etc.). NH A-frame included in first Appendix B GP.
2. Winch				
Science Provided SEAMAC	Unknown	10,000	2,500 R (per bolt) = 500 lbs vert and 200 lbs horiz. at MPT	Assumed to be line pull of winch. MCD needs development through Science Party or Winch Pool. MCD should also give deck reaction at DLT and MPT with the deck mating clips in place. If needed, reactions a varying tensions can be acheived by simple ratios.
Science Provided Spooling Winch	Unknown	6,000	2,000 R (per bolt) = 800 lbs vert and 200 lbs horiz. at MPT	Assumed to be line pull of winch. MCD needs development through Science Party or Winch Pool. MCD should also give deck reactions at DLT and MPT which can be ratioed to give reactions at varying tensions. Given use of synthetic line and low DLT this winch would be rated for "Towing/Station Keeping-Midwater" only.
Science Provided Capstain	Unknown	6,000	2,000 R (per bolt) = 1000 lbs vert and 500 lbs horiz. at MPT	MCD required development including deck reactions for 4-bolt pattern at MPT. Givne the use of synthetic and the low DLT, for this application the capstain would be rated for "Towing/Lifting-Midwater" only.
3. Tension Member				
Science Provided 0.322	10000	10,000	**2000**	FS = 5.0 due to levelwind design and lack of monitoring system
Science Provided 3/8" synthetic braid (100m)		17,500	3,500	FS = 5.0 due to lack of monitoring system (Note: synthetics not yet covered by Appendix A)
Science Provided Nylon Weak Link	1500	1500	1500	Requires calibration per Appendix B. MPT is at FS = 1.0. Breaking strength chosen to protect the 0.322.
4. Blocks/Sheaves				
SIO Provided Block	Unknown	10,000	10,000 R = 20,000	MCD needs development, but easily available from vendor spec sheets and verified through testing. See standard block MCD format. MCD should include padeye reaction at MPT which is normally 2x MPT
5. Hardware				
SIO Provided 1" SS Deck Bolts			R Vert = 2000 R Horiz = 1500	From deck bolt spec sheet. **Greater than R from winches and capstan - OK**
SIO Provided 1/2" Shackle at Block	Unknown	Unknown	R = 20,000	From Crosby spec sheet
6. Deck Bolting Pattern				
NH 1" 24x24 O/C Deck Sockets			R Vert = 1200 R Horiz = 700	From deck bolting pattern MCD. **Greater than R from winches and capstan - OK**
System Maximum Permissible Tension (MPT)			**1500**	