

# RVSS Appendix A Overview

Presented at  
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by  
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# Definitions

- *WINCH OWNER: The party or their representative who is normally responsible for the operation, inspection, maintenance, and testing of the winch. This could be the vessel operator or the scientific party.*
- *ROPE: A woven, flexible tension member with no internal conductors. It may be made from natural fibers, synthetic fibers, or metal.*
- *CABLE: A woven, flexible tension member with internal conductors or other means of transmitting data such as glass fiber.*

## Definitions (cont.)

- *ULTIMATE LOAD (UL): The theoretical load that produces failure. For the purposes of this standard, the “Ultimate Load” is assumed to be either the Nominal Breaking Load(NBL) or the Actual Breaking Load (ABL) as defined below.*
- *NOMINAL BREAKING LOAD (NBL): Manufacturer’s minimum published breaking load for a rope or cable.*
- *ACTUAL BREAKING LOAD (ABL): The actual load required to pull a rope or cable to destruction as determined by testing.*

# Definitions (cont.)

- *SAFE WORKING LOAD (SWL): The maximum load that is allowed to be supported during normal operation.*
- **SWL = NBL (or ABL) / FS: In practice NBL will be used unless testing shows ABL to be less than NBL. A value greater than the NBL should never be used.**
- *FACTOR OF SAFETY (FS): The Ultimate Load divided by the Safe Working Load. For the purposes of this standard, FS shall be considered the value chosen by the Operator to determine SWL.*
- **FS = Ultimate Load / Safe Working Load (by definition)**

## Definitions (cont.)

- “D” = The root diameter of the sheave.
- “d” = The outside diameter of the cable or rope.
- “d1” = The diameter of largest strand in a rope or cable armor.

# Definitions (cont.)

- *TRANSIENT LOADS: Loads induced which are temporary by nature, including the weight of entrained mud, weight of entrained water, pull out loads, drag due to package characteristics and/or winch speed, etc.*
- *DYNAMIC LOADS: Loads induced due to vessel motion (heave, roll, pitch, etc.)*
- “g” = The vertical acceleration due to gravity. For normal static loading (no dynamic effect), “g” is equal to 1.0. To take into account dynamic effect due to ship’s motion and package drag, the simple static load is multiplied by a factor higher than 1.0 under ABS standards: normally 1.75 or 2.0 for vertical accelerations depending on application.

# General Concept

- OPERATING REQUIREMENTS – FS of .....
- Ropes and cables of *steel construction may be operated to a nominal FS = x.x on the NBL, including transient and dynamic loads, as long as the following precautions* in this section are adhered to.
- The deployment must be halted, or the next level of standards described in Section n.n adhered to, when the subsequent SWL is reached. To some extent this will depend upon sea conditions and the resulting ship motion. Thus the trend in prevailing weather should be assessed before committing to a deployment, which could approach the limits specified above.

# OPERATING REQUIREMENTS

## FS of 5.0 OR GREATER

### Tension Monitoring

- Tension may be determined by calculation, including transient and dynamic loads, as long as the Owner is confident that a FS of 5.0 will not be exceeded. If no other precise information is available on package drag and/or vessel accelerations, the Vessel Operator should use the ABS “g” factor of 1.75 as a minimum.

### Sheave(s)

- D/d ratio must be equal to or greater than the manufacturer’s recommendations.

### Deck

- Personnel on deck should follow good safety practices when working in the vicinity of cables and ropes during use.

### Testing

- No routine break testing is required. Wires shall only be tested every two years to the desired SWL along with the handling system.

### Logbooks

- The Owner shall establish an inspection and cutback procedure. At a minimum, the Owner shall maintain logs showing cutbacks and maximum loading (as determined by monitoring system or by calculation for each cast) for the full service life of the rope or cable. The wire log shall transfer with the cable if it is removed and placed in storage, or transferred to another system (winch) or Owner.

### Operator

- The Owner and the Master of the vessel must deem all winch operators competent. “Deemed competent” means that both parties are confident, given the particulars of the winch and the overall operational scenario (weather conditions, equipment being deployed, etc.), that the operator has the necessary experience to operate the winch safely.



# OPERATING REQUIREMENTS

## FS of 4.9 to 2.5

### Tension Monitoring

- Tension in the cable or rope must be monitored at the winch operator's station with a display resolution of at least 3 Hz (every 330 mS). The system must also be capable of logging tension data at a minimum frequency of 3 Hz (every 330 mS).

### Sheave(s)

- For ropes and cables of steel construction the D/d ratio must be at least 40:1 or 400d1 (whichever is greater) throughout. Grooving of the sheaves should be as close to "d" as practicable, and generally no larger than 1.5d.

### Deck

- The Operator should identify "Danger Zones" around ropes and cables under tension. To the extent possible, given the nature of operations involved, all personnel should be excluded from these zones such that a sudden failure cannot result in injury.

### Testing

- Samples shall be sent for testing every two (2) years and generally in conjunction with handling system SWL tests. If a 10% decrease in ABL is detected, then the testing shall be increased to annually.

### Logbooks

- The Owner should maintain logs showing cutbacks **and load test results** for the full service life of the rope or cable. The archived tension data shall become part of the log and be maintained for the full service life of the cable. The wire log shall transfer with the cable if it is removed and placed in storage, or transferred to another system (winch) or Owner

### Operator

- The Winch Owner must certify that all winch operators are competent. By "**certified competent**" it is meant that the Owner must have written documentation in place showing that the operator has been through and successfully passed a formal training program on the winch, handling apparatus, and monitoring system. The system vendor or the Owner, depending on the complexity of the system, may conduct a formal training program. The master shall verify qualifications and designate the approved winch operators.

# CABLE OPERATING REQUIREMENTS

## FS of 2.4 to 2.0

Tension Monitoring	<ul style="list-style-type: none"><li>• Tension in the cable or rope must be monitored at the winch operator's station with a display resolution of at least <b>10 Hz (every 100 mS)</b>. The system must also be capable of logging tension data at a minimum frequency of <b>20 Hz (every 50 mS)</b>. <b>Tension must be continuously monitored using a "tension trending" graph at the winch operator's station.</b></li></ul>
Alarms	<ul style="list-style-type: none"><li>• <b>The handling system shall be fitted with both audible and visual tension alarms that sound and/or illuminated prior to reaching 45% (FS = 2.2) of a cable's Actual Breaking Load (ABL).</b></li></ul>
Sheave(s)	<ul style="list-style-type: none"><li>• The D/d ratio must be at least 40:1 or 400d1 (whichever is greater) throughout. <b>Grooving should be per HANDBOOK OF OCEANOGRAPHIC WINCH, WIRE AND CABLE TECHNOLOGY, Third Edition, Chapter 1, and Section 11.0 to provide adequate support.</b></li></ul>
Deck	<ul style="list-style-type: none"><li>• The Operator should identify "Danger Zones" around ropes and cables under tension. To the extent possible, given the nature of operations involved, all personnel should be excluded from these zones such that a sudden failure cannot result in injury. <b>Warning notices should be displayed at points of access indicating the danger. Physical and/or visual barriers should be erected as needed. Existing doors and accesses to the area should be secured when possible.</b></li></ul>
Testing	<ul style="list-style-type: none"><li>• <b>Problem 2.4 to 2.0 is not defined.</b></li></ul>
Logbooks	<ul style="list-style-type: none"><li>• Same</li></ul>
Operator	<ul style="list-style-type: none"><li>• ☑Same</li></ul>

# Wire OPERATING REQUIREMENTS

## FS of 2.4 to 1.5

Tension Monitoring	<ul style="list-style-type: none"><li>• Tension in the cable or rope must be monitored at the winch operator's station with a display resolution of at least <b>10 Hz (every 100 mS)</b>. The system must also be capable of logging tension data at a minimum frequency of <b>20 Hz (every 50 mS)</b>. <b>Tension must be continuously monitored using a "tension trending" graph at the winch operator's station.</b></li></ul>
Alarms	<ul style="list-style-type: none"><li>• <b>The handling system shall be fitted with both audible and visual tension alarms that sound and/or illuminated prior to reaching 60% (FS = 1.7) of a wire's Actual Breaking Load (ABL).</b></li></ul>
Haul Back	<ul style="list-style-type: none"><li>• <b>Once a FS = 2.0 is exceeded a regular check on cable loading shall be performed. This will require halting a deployment at regular intervals (~ 500 m) and conducting a slow haul until the nominal and peak tensions are established and verified. A decision on whether to proceed must then be based upon the limiting value of 1.5.</b></li></ul>
Sheave(s)	<ul style="list-style-type: none"><li>• The D/d ratio must be at least 40:1 or 400d1 (whichever is greater) throughout. <b>Grooving should be per HANDBOOK OF OCEANOGRAPHIC WINCH, WIRE AND CABLE TECHNOLOGY, Third Edition, Chapter 1, and Section 11.0 to provide adequate support.</b></li></ul>
Deck	<ul style="list-style-type: none"><li>• The Operator should identify "Danger Zones" around ropes and cables under tension. To the extent possible, given the nature of operations involved, all personnel should be excluded from these zones such that a sudden failure cannot result in injury. <b>Warning notices should be displayed at points of access indicating the danger. Physical and/or visual barriers should be erected as needed. Existing doors and accesses to the area should be secured when possible.</b></li></ul>
Testing	<ul style="list-style-type: none"><li>• <b>Problem 2.4 to 2.0 is not defined.</b></li><li>• <b>When using a FS of 2.0 to 1.5, samples shall be sent for testing annually. If a 10% decrease in ABL is detected, then the testing shall be increased to every six months.</b></li></ul>
Logbooks	<ul style="list-style-type: none"><li>• Same</li></ul>
Operator	<ul style="list-style-type: none"><li>• Same</li></ul>

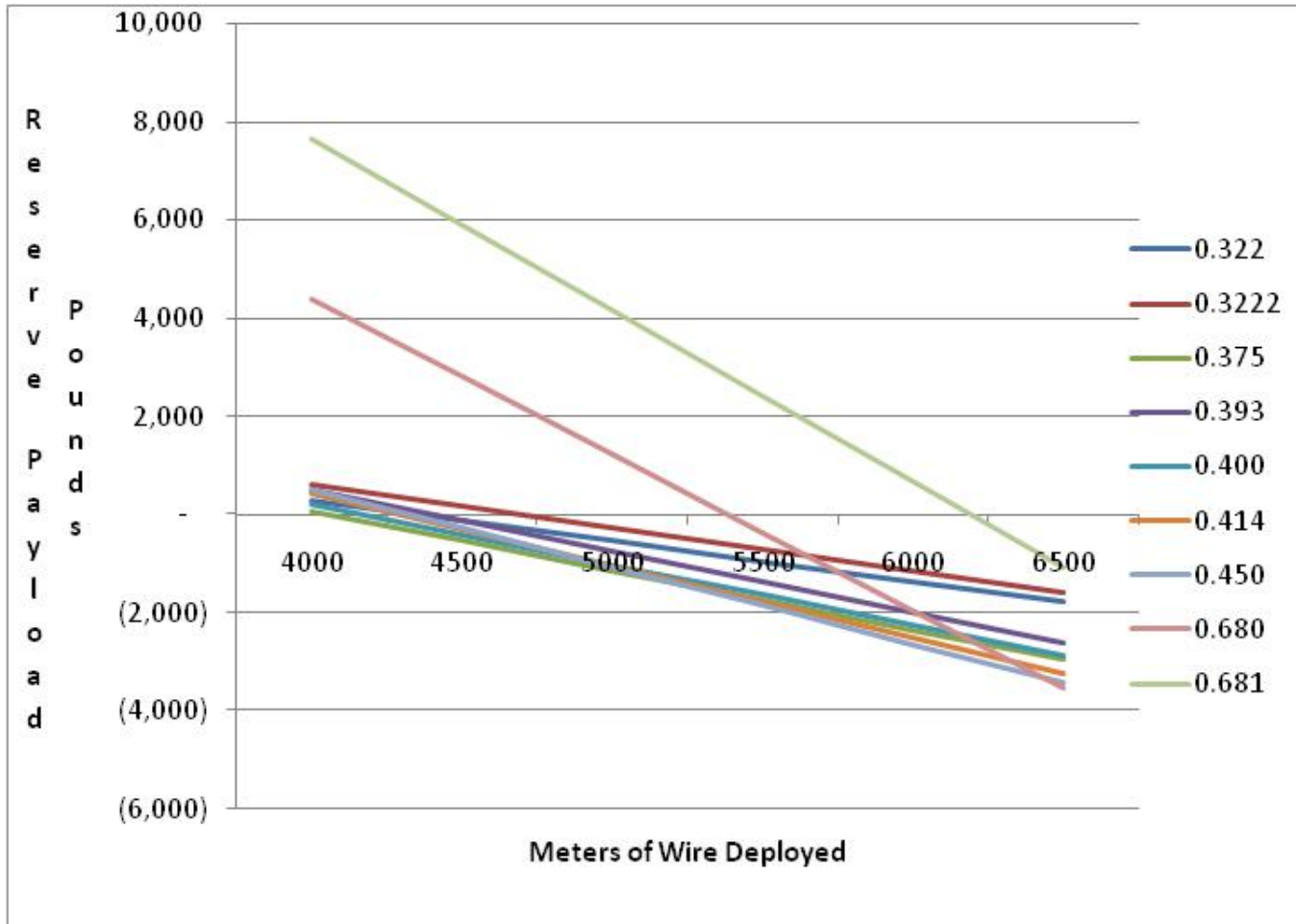
# Summary

Operating Requirements				
Nominal Factor of Safety	Greater or Equal to 5	Greater or Equal to 2.5	Greater or Equal to 2	Greater or Equal to 1.5
Expressed as % of ABL	Up to 20% of ABL	Up to 40% of ABL	Up to 50% of ABL	Up to 66.6% of ABL
Specific to Conductor Cable			Audible and visual alarms at FS = 2.0	<b>Forbidden!</b>
Tension Monitoring	By calculation; multiply static load by 1.75	Display updated at 3 Hz & logged at 3 Hz	Display updated at 10 Hz & logged at 20 Hz, continuously monitored trending graph, audible and visual alarms at FS = 1.7	Audible and visual alarms at FS = 2.0
Sheave Requirements	D/d ratio must meet or exceed manufactures specifications	D/d or D/d1 ratio of 40:1 or 400 d1 (whichever is greater), groove as close to "d" as possible, not to exceed 1.5d	Additional requirement Grooving must be per UNOLS Manual, Chapter, Section 11.0	No additional
Deck Requirements	Good Safety Practices	"Danger Zones" created personnel excluded	Additional requirement physical barriers and signage	No additional
Haul Back See Section 5.3				Halt deployment every 500 meters, retrieval test - FoS not less than 1.5.
Testing	Test wire & system to SWL biannually (Sec 6.4)	Determine ABL biannually, annual if deterioration of 10% (Sec 6.5)	Determine ABL annually, semi-annual if deterioration of 10% (Sec 6.5)	No additional
Logbooks	Record of inspection and cutbacks maintained	Additional requirement for lifetime archive of tension data	No additional	No additional
Operator	Deemed Competent	Certified Competent	No additional	No additional



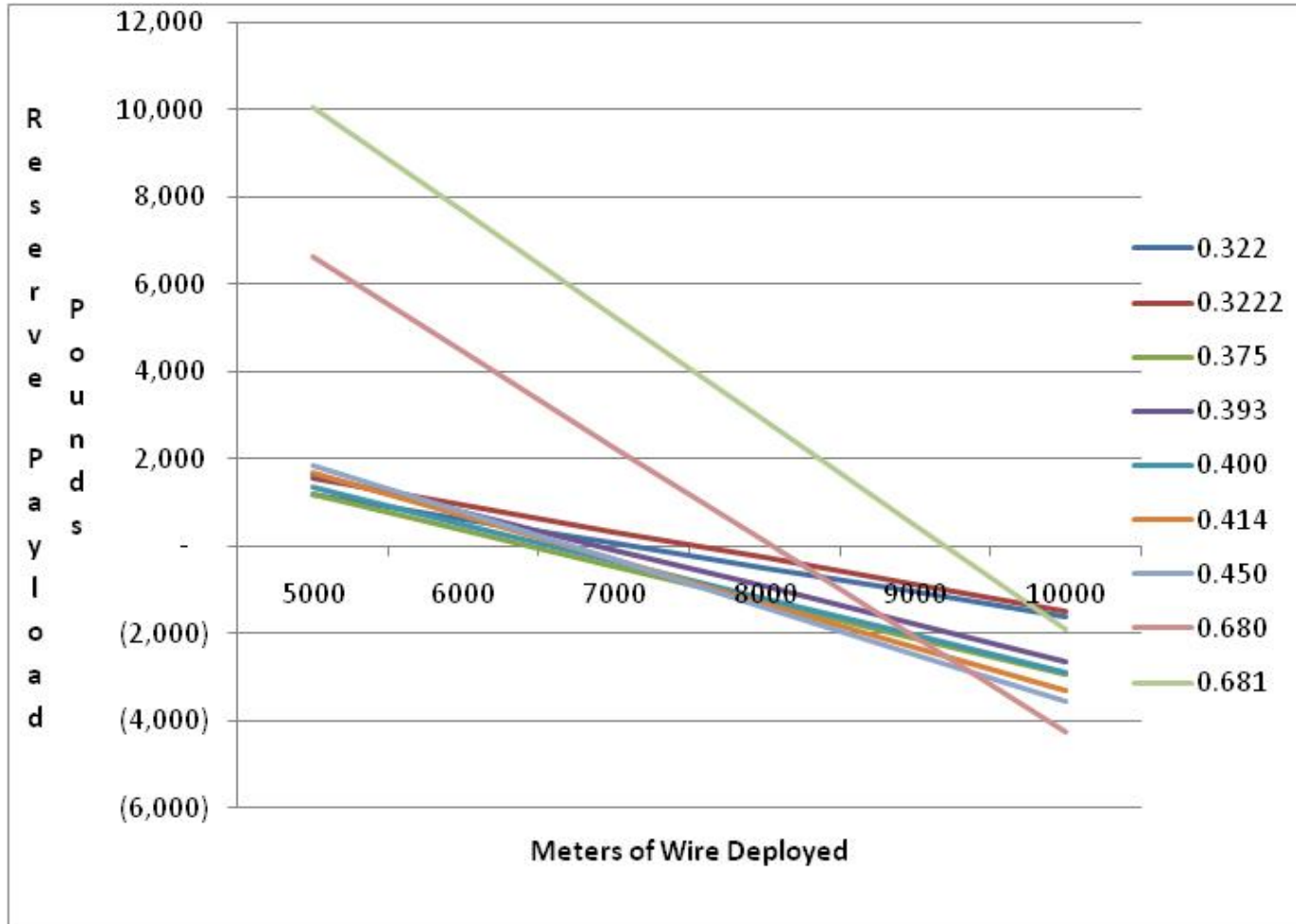
# Cables FS 2

## Package Wt 800 lbs., $g=1.75$



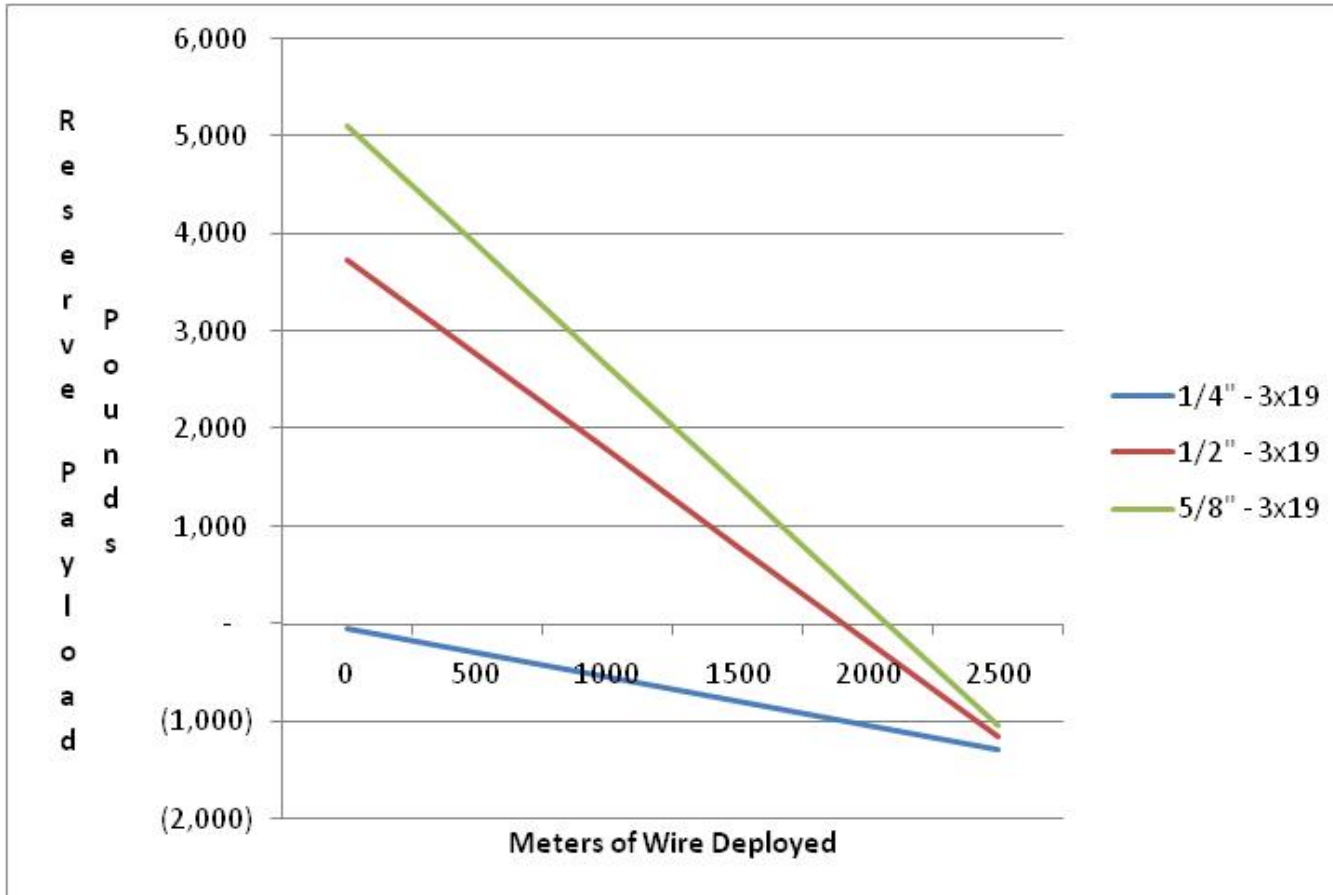
# Cables FS 2

## Package Wt 800 lbs., g=1.2



# Wire Rope FS 5

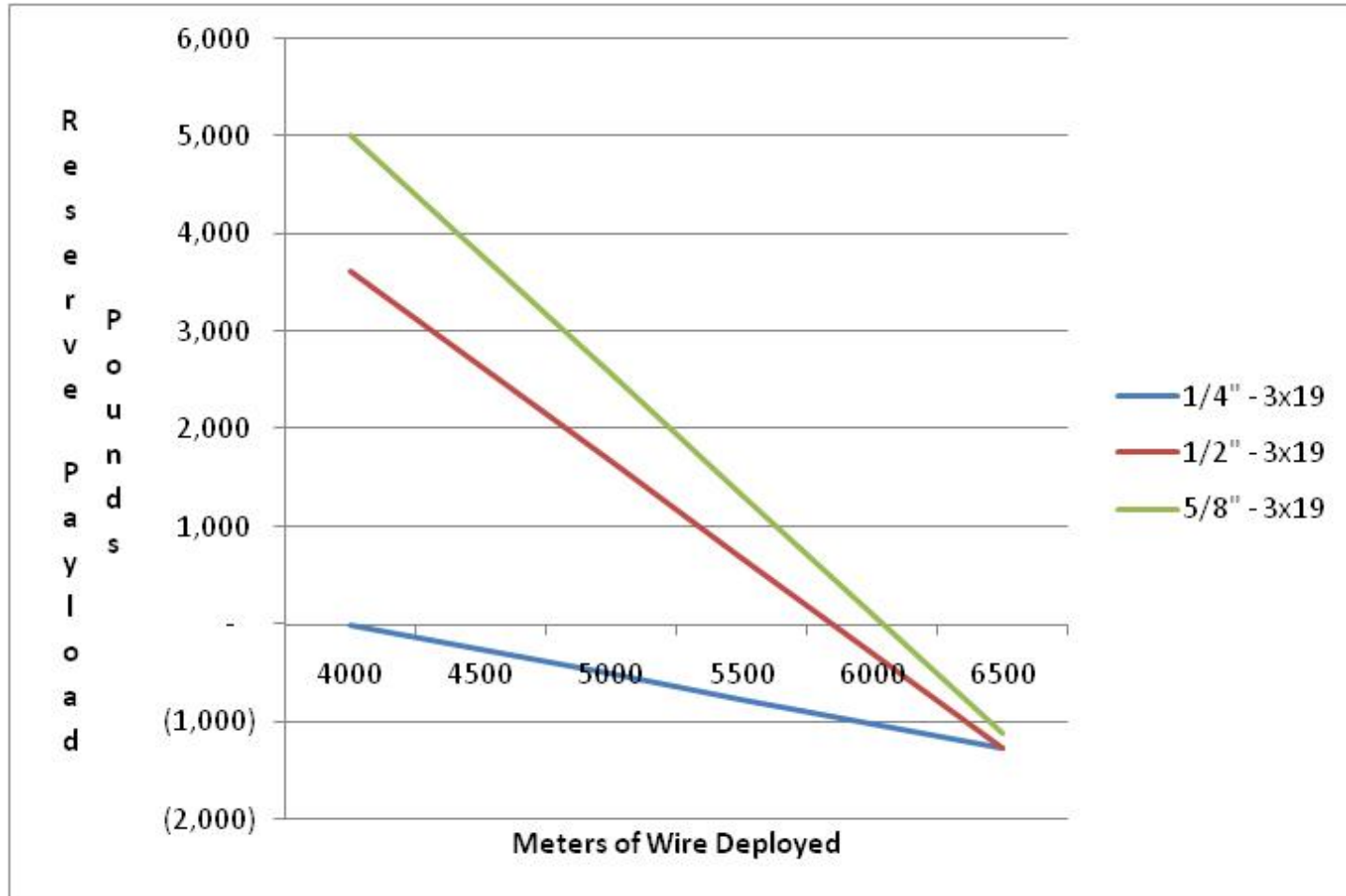
## Package Wt 800 lbs., $g=1.75$





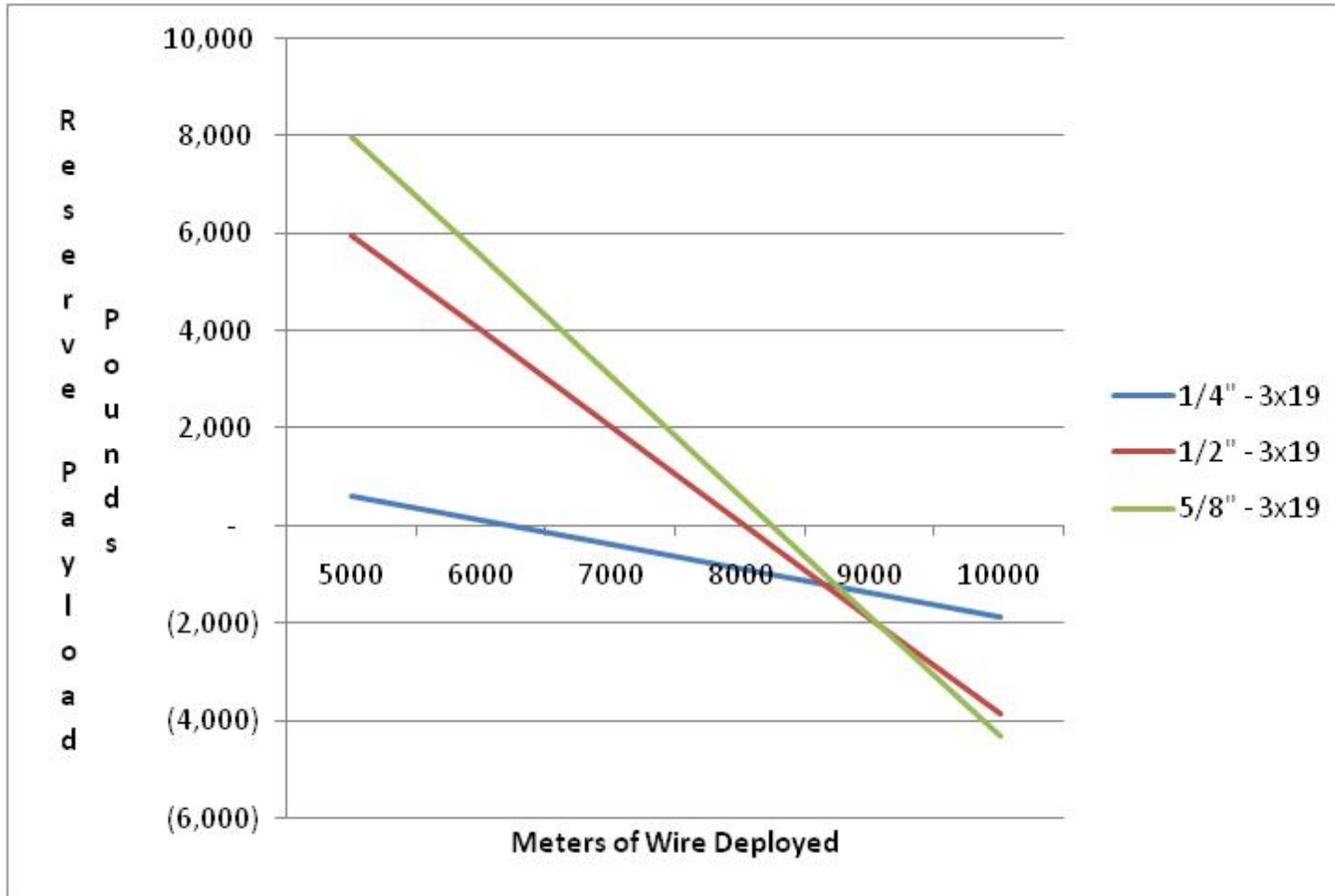
# Wire Rope FS 2

## Package Wt 800 lbs., $g=1.75$



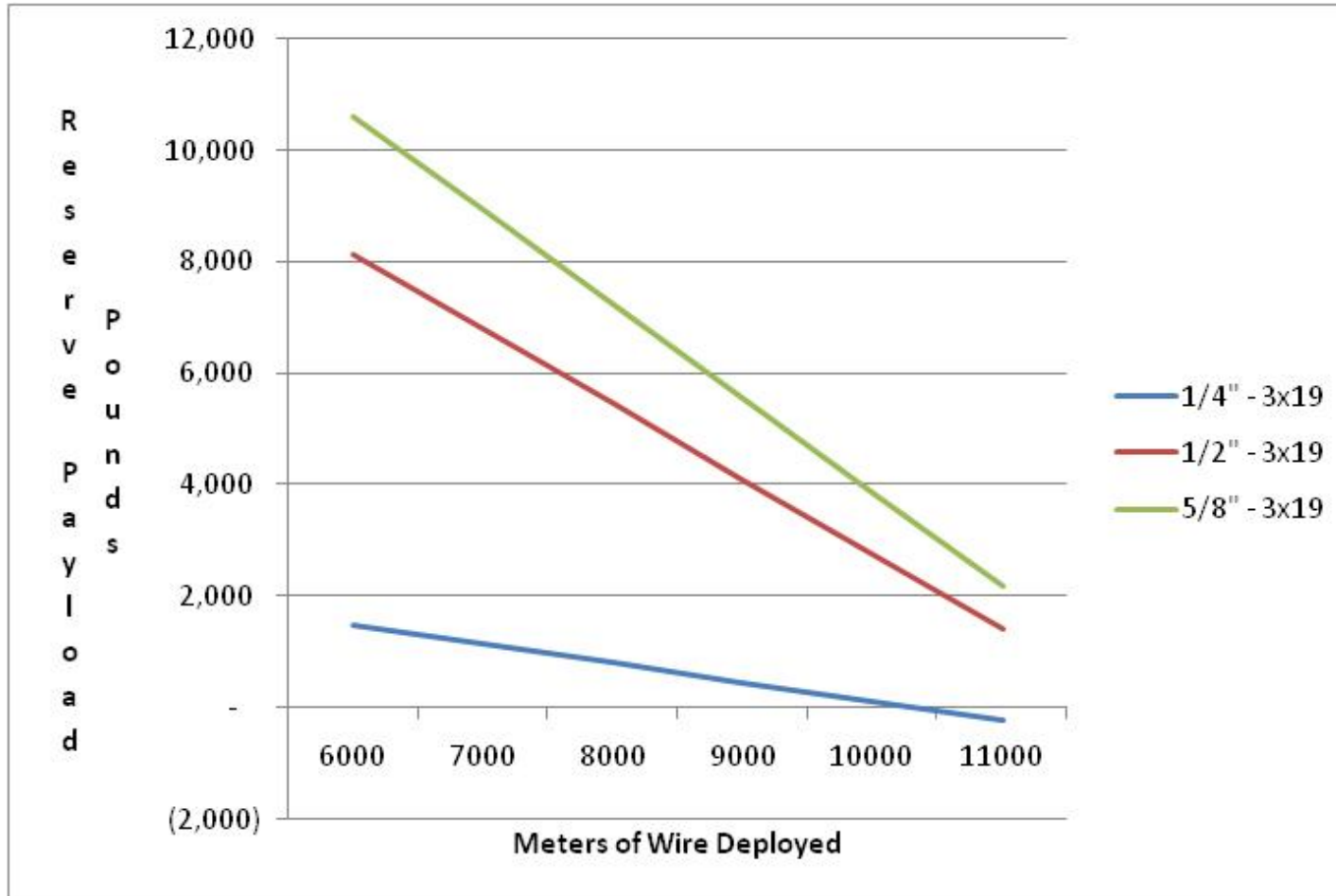
# Wire Rope FS 1.5

## Package Wt 800 lbs., $g=1.75$



# Wire Rope FS 1.5

## Package Wt 800 lbs., g=1.2



# Implications

- Limited to FS of 5 if tensiometer fails!
- Applies to all winches and tension members including those supplied by scientists!
- No logbooks -- you can not operate!

# How Soon?

- This standard will be phased as soon as the appropriate equipment can be funded and purchased and no later than 18 months after the published date of this revision of the RVSS.

# SWL Pre-cruise Estimator

SWL Estimator					
General Information		Value	Units		
Wire Description		.322 Cond FTR			
Manufacturer		Rochester			
Manufacturer Part Number		A30159			
Type (Cond or 3x19)		Cond			
UNOLS Serial Number					
Manufacturer's Breaking Load Specification		10,000	pounds		
Actual Breaking Load		10,000	pounds		
Weight of wire in seawater lb/meter		0.144	pounds/foot		
Diameter of cable/wire (d)		0.322	inches		
Diameter of largest strand (d1)			0.0375 inches		
Manufacturer Recommended # Sheave Diameter			12 inches		
Weight of equipment package in seawater		600	pounds		
Dynamic Load "g"		1.75			
Transient Load (e.g. pullout)			- pounds		
Winch Operator Status		Certified Competent			

Scope	Weight of Wire	Static Load inc. package	Dynamic Load Included	Total Load Including Pullout	PoS	Reserve			
						5	2.5	2	1.5
					% of ABL	20%	40%	50%	66.7%
					Max Load	2,000	4,000	5,000	6,667
Meters	Pounds	Pounds	Pounds	Pounds					
0	6	600	1050	1050		950	2,950	3,950	-
1000	472	1072	1877	1877		123	2,123	3,123	-
2000	945	1545	2705	2705		(703)	1,297	2,297	-
3000	1417	2017	3530	3530		(1,530)	470	1,470	-
3500	1653	2253	3943	3943		(1,943)	57	1,057	-
5000	2362	2962	5183	5183		(3,183)	(1,183)	(183)	-
6000	2834	3434	6009	6009		(4,009)	(2,009)	(1,009)	-
7000	3306	3906	6836	6836		(4,836)	(2,836)	(1,836)	-
8000	3779	4379	7662	7662		(5,662)	(3,662)	(2,662)	-
9000	4251	4851	8489	8489		(6,489)	(4,489)	(3,489)	-
10000	4723	5323	9316	9316		(7,316)	(5,316)	(4,316)	-
Min Sheave Diameter (Larger is always better)						12.00	15.00	15.00	15.00

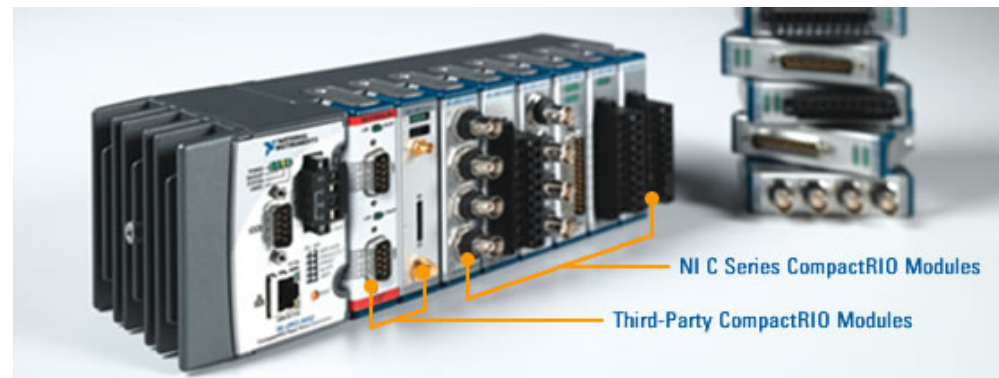
Typical Values										
.322 Cond FTR	.322 Cond FE	.680 Cond FE	.680 Cond FTR	.681 Cond FE&FTR	3/16" 3 x 19	1/4" 3 x 19	1/4" 3 x 19	5/16" 3 x 19	Trawl 1/2"	Trawl 9/16"
Rochester	Rochester	Rochester	Rochester	Rochester	WireCo	WireCo			WireCo	WireCo
A30159	A30159	A301241	A301241	A30251	RP041070	RP041070			RP080410	RP091570
Cond	Cond	Cond	Cond	Cond	3x19	3x19			3x19	3x19
							NSF-02-H26			
10,000	11,600	40,000	37,000	46,000	4,000	6,750	6,750	10,300	25,700	32,500
							7,240			
0.144	0.144	0.553	0.553	0.608		0.0867	0.0867		0.341	0.428
0.322	0.322	0.680	0.680	0.681		0.250	0.250	0.313	0.5	0.5625
0.0375	0.0375	0.060	0.060			0.031	0.031		0.058	0.066
12	12	28	28	48		12.5	12.5		23.5	26.5

**Instructions**  
 Copy the data for the specific cable you are working with from the table above  
 Paste it over cells e3 through e13  
 If the cable you selected does not have a value in e9, you will have to make an estimate based on e8

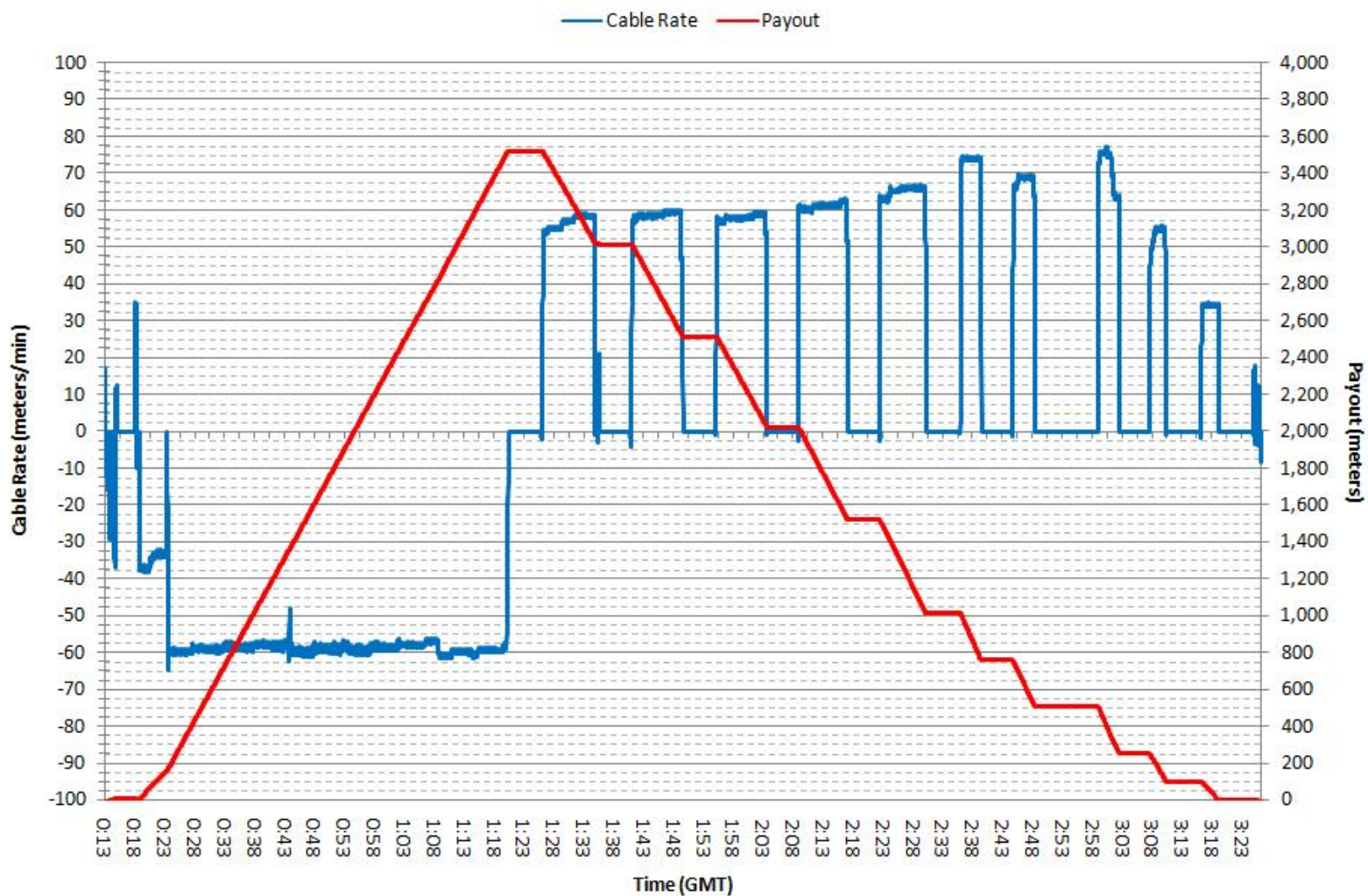
Enter the appropriate values in cells e14 and e16

# Real World Test

- 12 x 12 Carousel with dual LADCP
- Weather conditions moderate SS 2-3
- Deployed 3500 meters of cable, calculated tension of 2253 pounds.
- National Instruments cRIO data acquisition 20 samples/second
- \$3,600

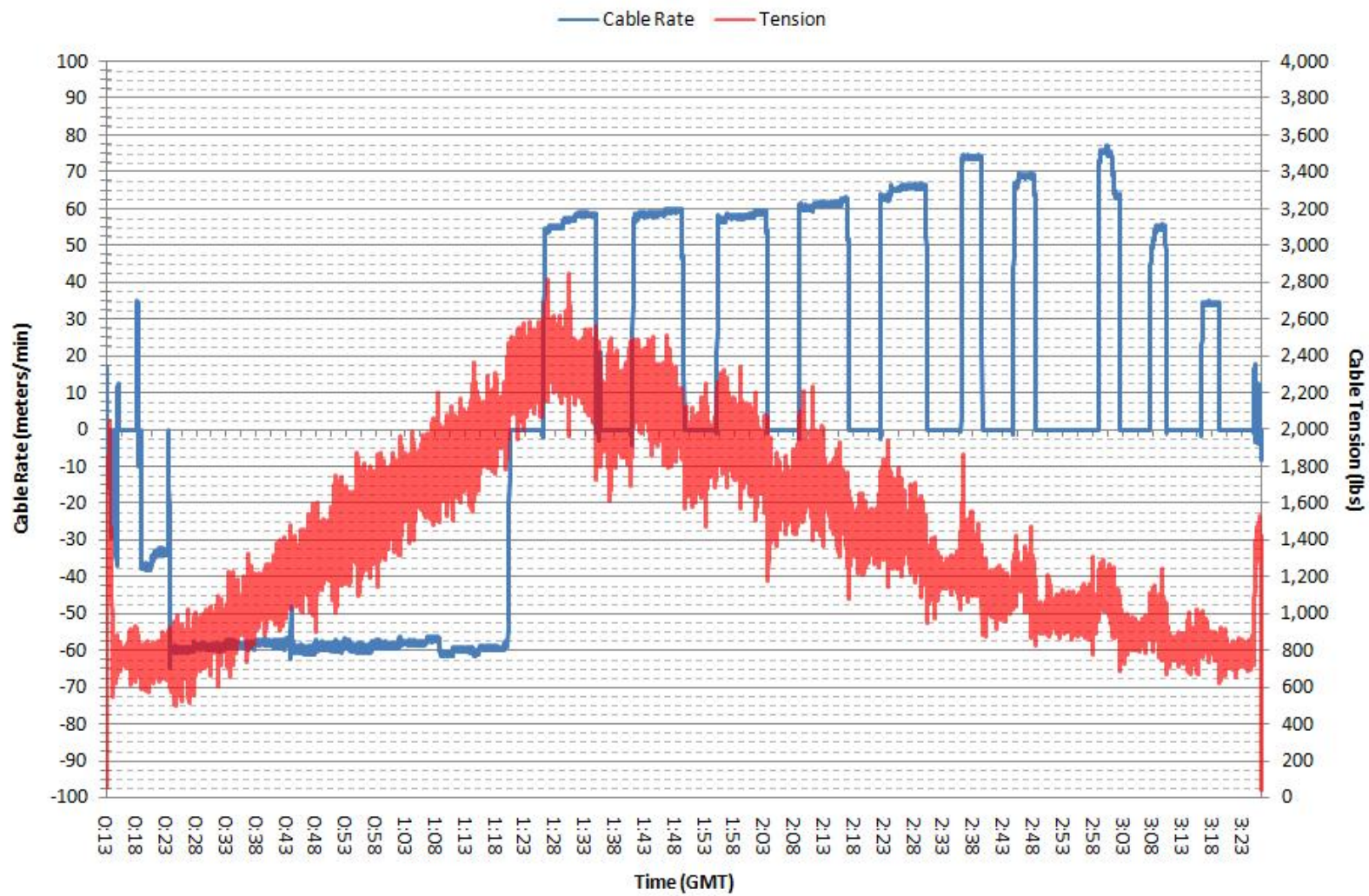


### Cable Rate & Payout for Entire CTD Cast - April 19, 2008 (1/2 second averaged data)

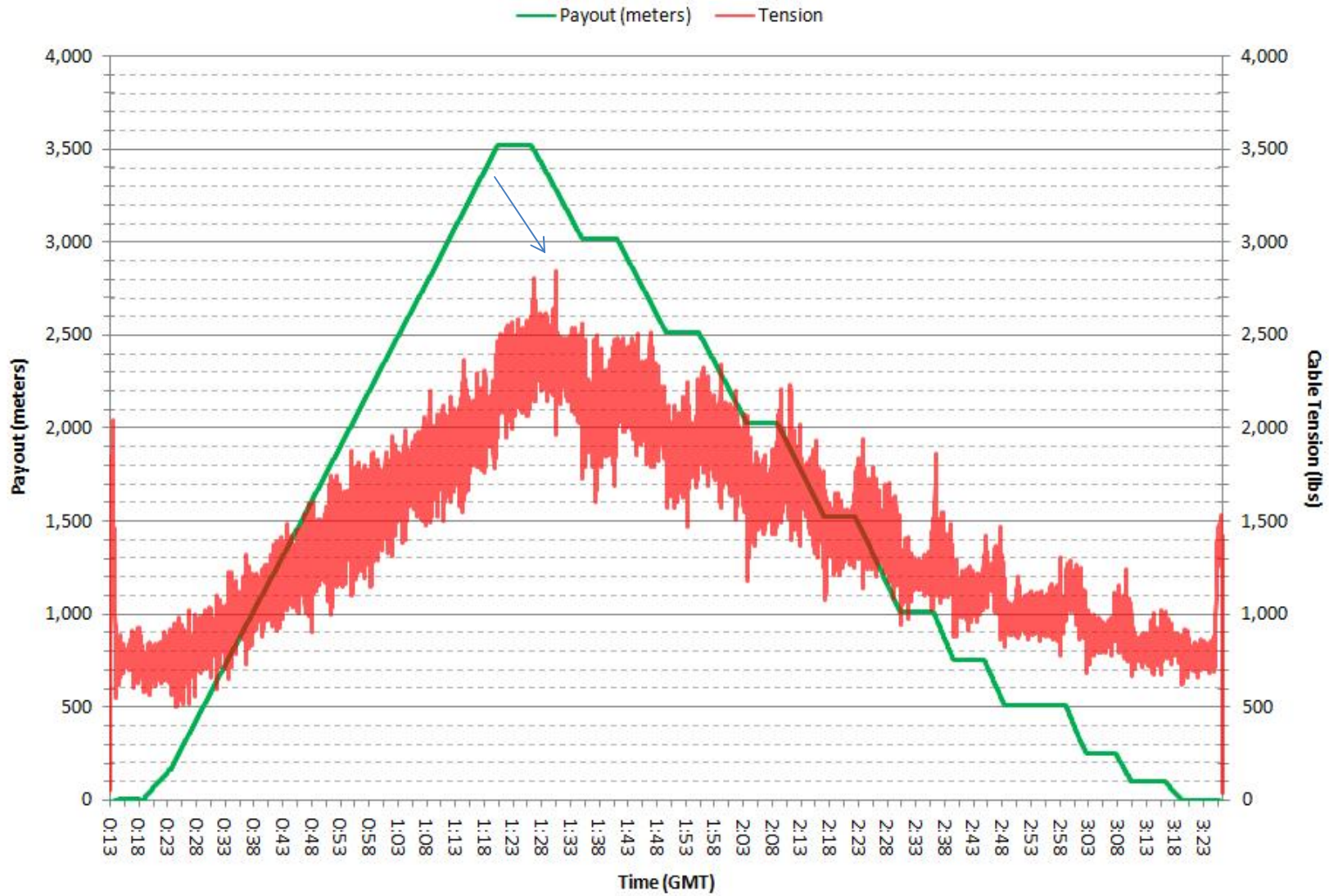




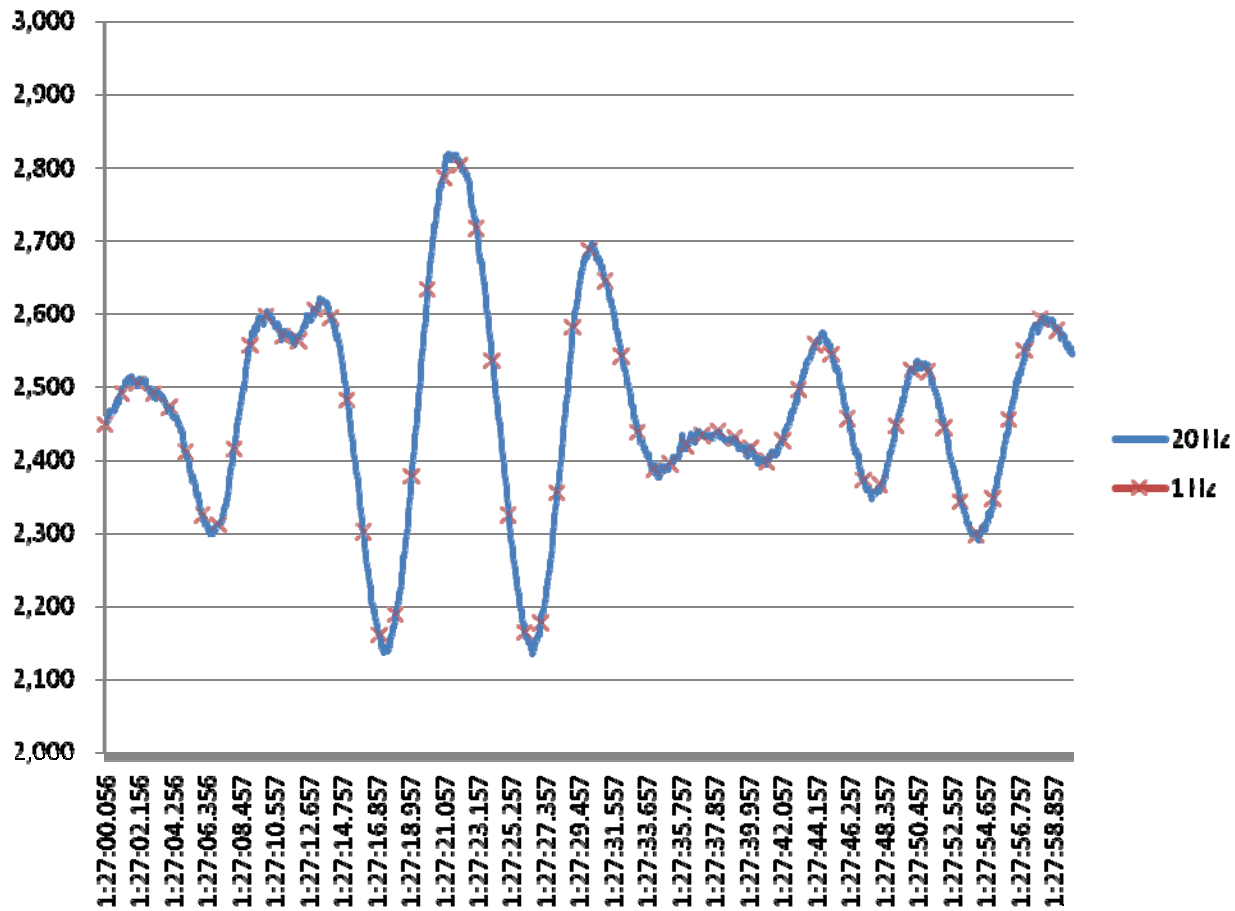
# Cable Rate & Tension for Entire CTD Cast - April 19, 2008 (1/2 second averaged data)



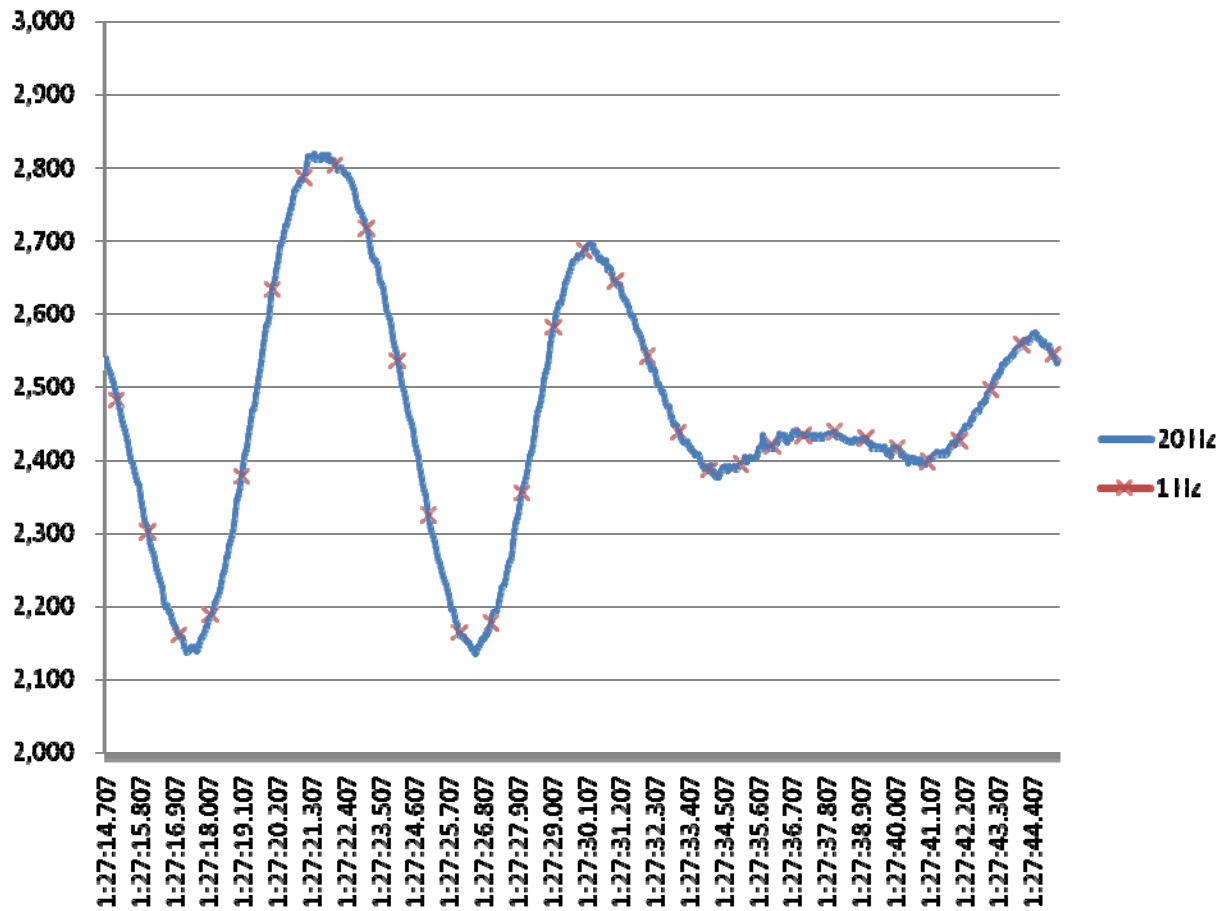
# Payout & Tension for Entire CTD Cast - April 19, 2008 (1/2 second averaged data)



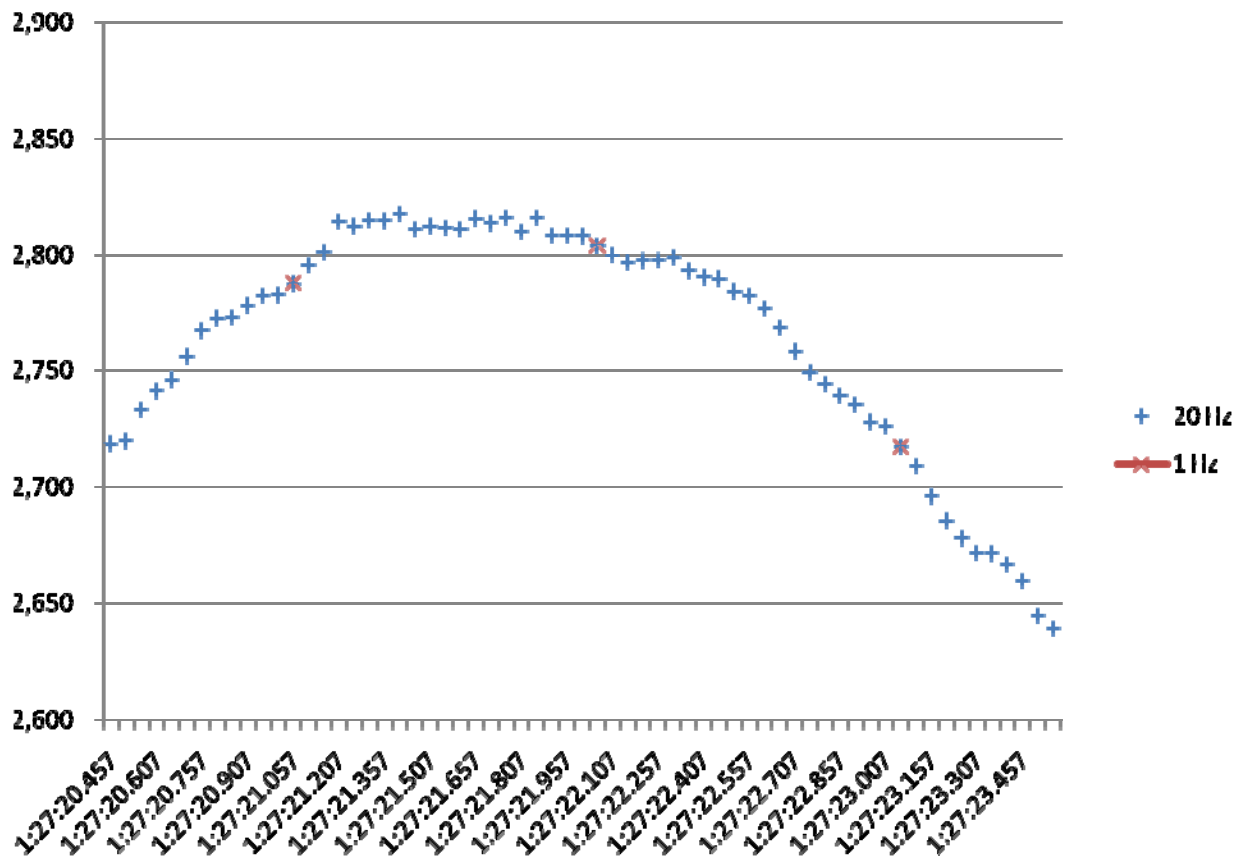
# 60 Seconds



# 30 Seconds

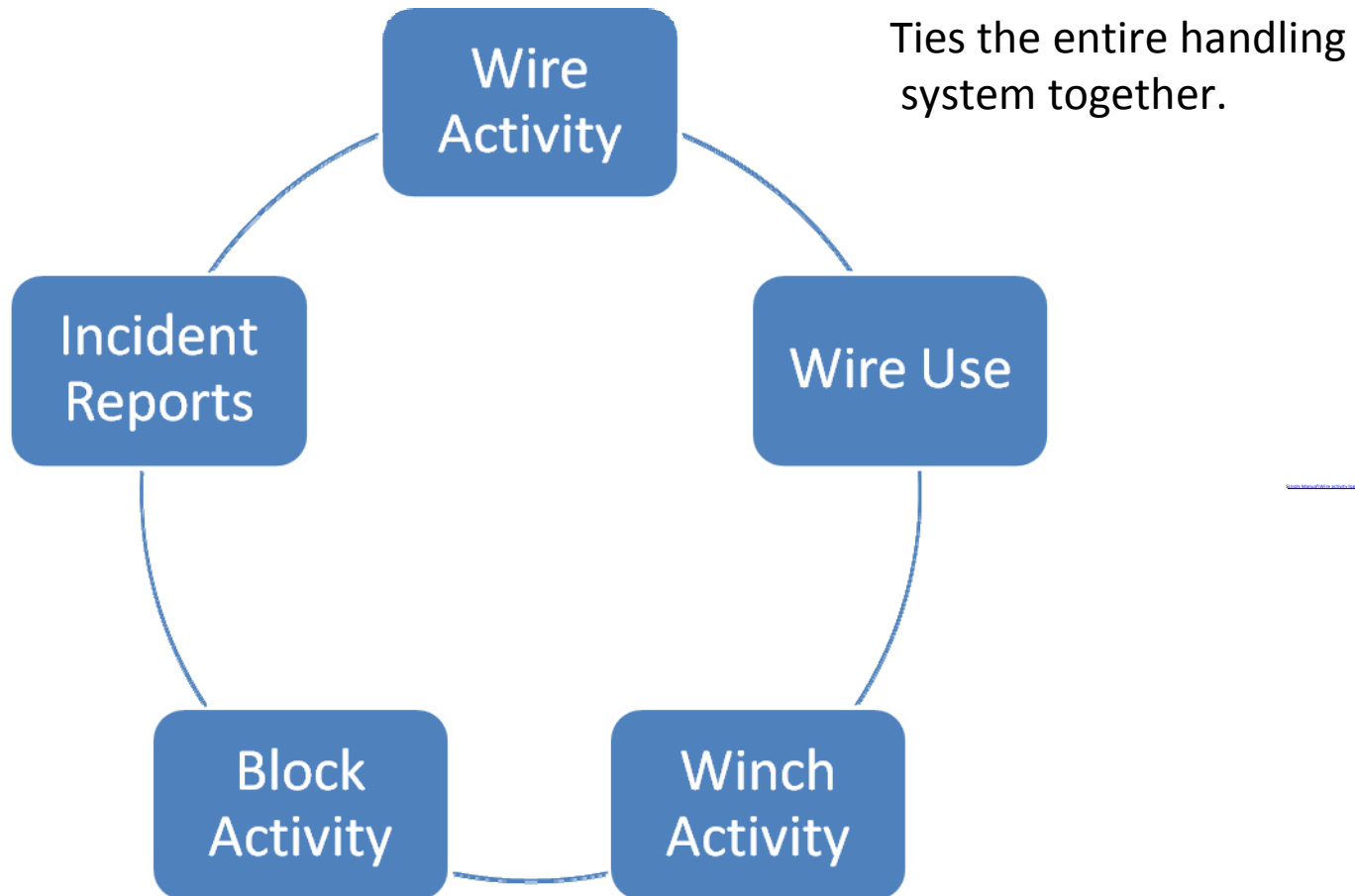


# 4 Seconds



# Winch & Wire Handbook, 3<sup>rd</sup> Edition

## Chapter 7 - Instrumentation Lowering System Documentation

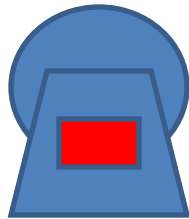
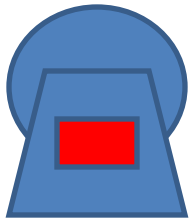


# Challenge

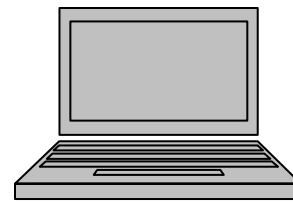
- New responsibilities for ship operators & winch operators to be able to operate at lowest FS
- If you don't keep required records you can not meet the scientist's needs
- Solution is to integrate and automate

# Network Nodes

Web browser display, one control  
multiple view



Operator





# General Description

- Acquisition/logging system attached to winch
- Compatible with installed sensors
- Combination of solid state hard drive and Compact Flash memory
  - Hard drive holds wire log, **stays with wire** (characteristics, test results, deployments, tension, cut backs, etc.)
  - CF holds winch logs, **stays with winch** (SWL, tensiometer cals, sheave characteristics, lubrication etc.)
- Ship network storage holds ship related logs, **stays with ship** (operator certifications, sheave characteristics, frame SWL)
- Outputs - NMEA 183, NMEA 2000, Ethernet, UDP broadcast

# Capabilities

- Takes all the information available and shows real time minimum FoS
  - Operator qualification
  - Last determination of ABL
  - Blocks within specification
- Displays current Operating Requirements
  - Deck cleared, physical barriers etc.
- Predicts load – deviation would indicate approach of slack wire
- Logs everything –winch operator, winch, blocks in use and suitability, bending cycles
- Controls fresh water spray bar
- Could control hydraulic by pass valve for auto render