SWL Estimator & More

Presented at the 2008 RVOC Meeting

BY

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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	Less Than 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	In excess of 66.6% of ABL
Specific to Conductor Cable				**Forbidden!**	**Forbidden! Exceptions to this in case of emergency situation declared by the master or other officer in charge of the vessel, or with the express written consent of the owner of the cable.**
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 (2.0 for Conductor Cable)	Alarm when FoS < 1.7	
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 deteriation of 10% (Sec 6.5)	Determine ABL annually, semi-annual if deteriation of 10% (Sec 6.5)	No additional	See section 6.13 iii
Logbooks	Record of inspection and cutbacks maintained	Additional requirement for lifetime achive of tension data	No additional	No additional	Red flag
Operator	Deemed Competent	Certified Competent	No additional	No additional	No additional

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		
Manufactrer's Breaking Load Specification	10,000	pounds
Actual Breaking Load	10,000	pounds
Weight of wire in seawater lb/meter	0.144	pounds/foo t
Diameter of cable/wire (d)	0.322	inches
Diameter of largest strand (d1)	0.0375	inches
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	Reserve FoS	5	2.5	2	1.5
					% of ABL	20%	40%	50%	66.7%
Meters	Pounds	Pounds	Pounds	Pounds	Max Load	2,000	4,000	5,000	6,667
0	0	600	1050	1050		950	2,950	3,950	-
1000	472	1072	1877	1877		123	2,123	3,123	-
2000	945	1545	2703	2703		(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		RP04107 0	RP041070		RP08041 0	RP09157 0
Cond	Cond	Cond	Cond	Cond	3x19	3x19	3x19 NSF-02-H26	3x19	3x19	3x19
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

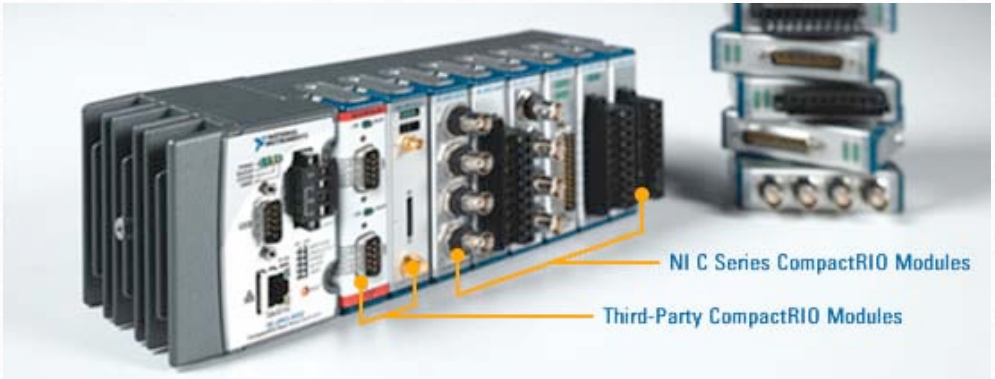
Paste it over cells e3 through e13
If the cable you selected does not have a value in e9, you will have to make an estimate based on e8

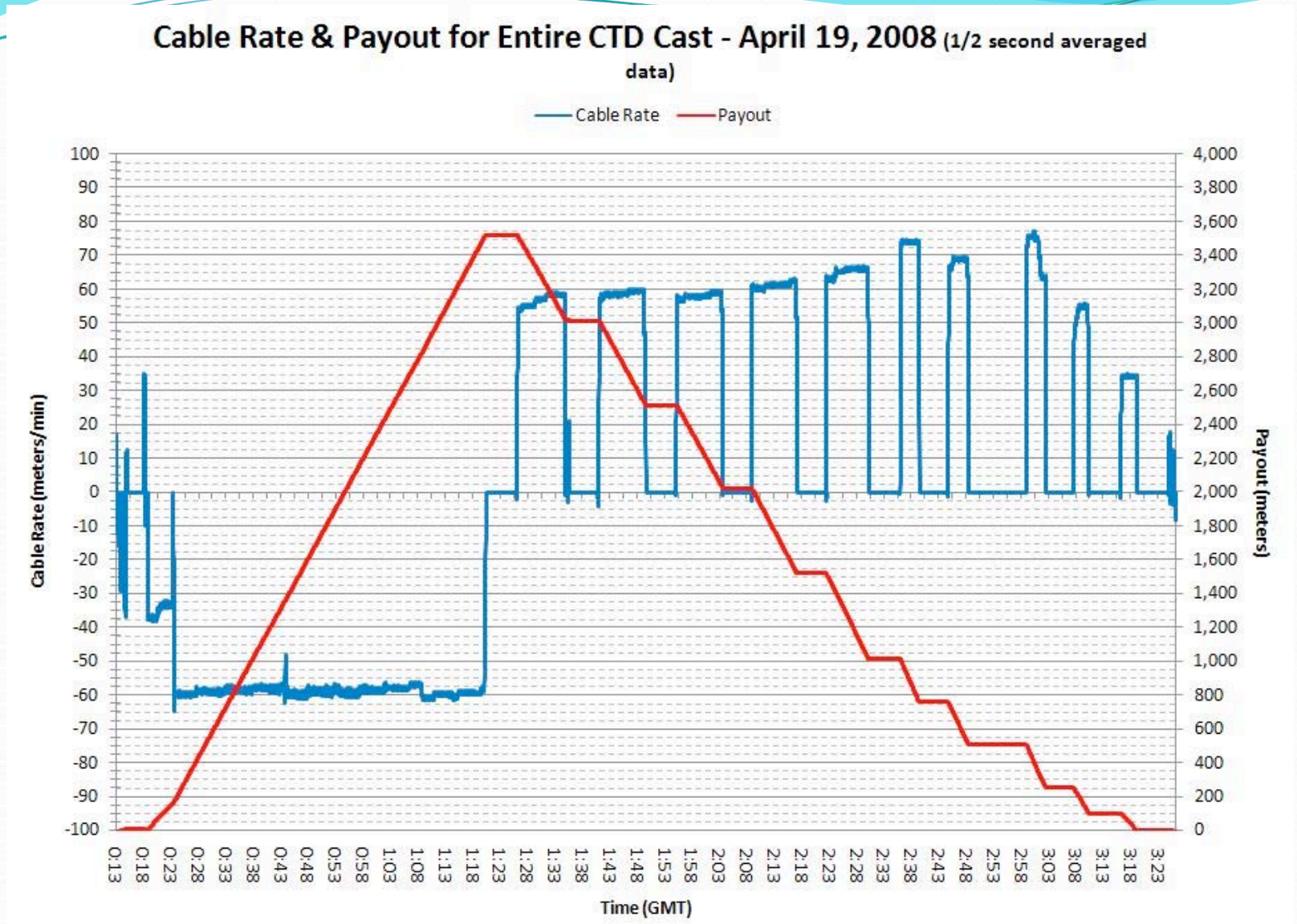
Enter the appropriate values in cells e14 and e16

*FoS calculatios.xlsx

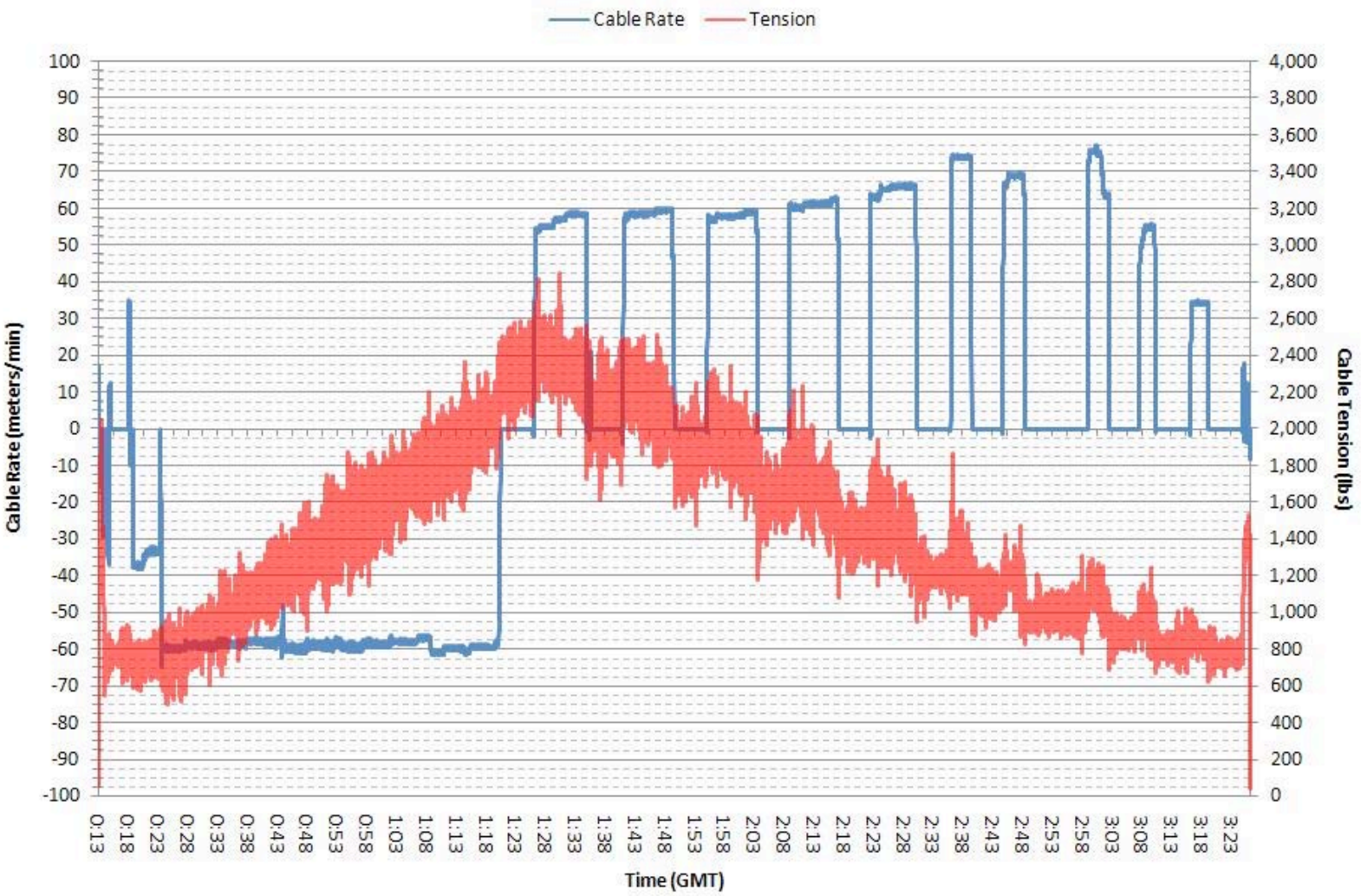
Real World Test

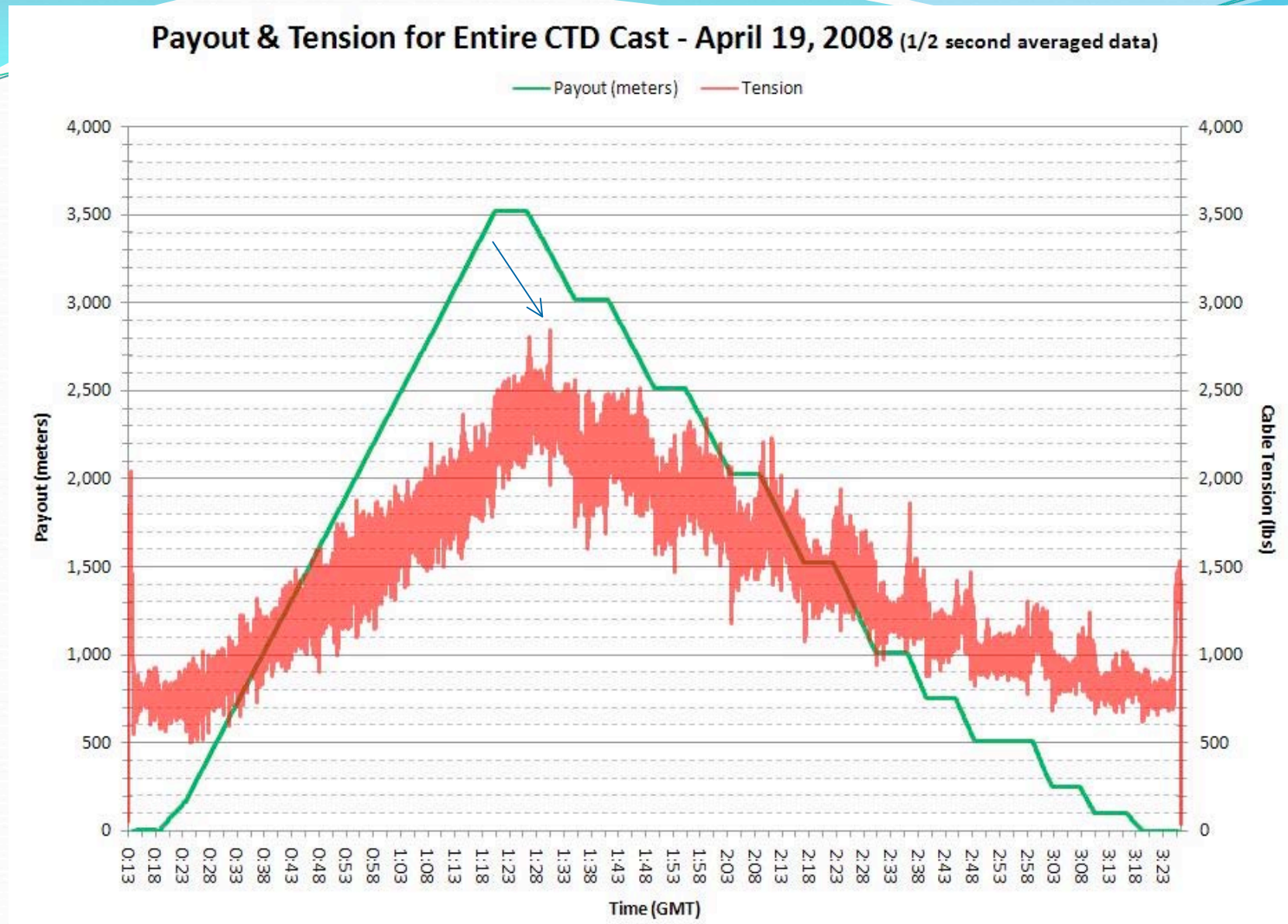
- 12 x 12 Carousel with dual LADCP
- Weather conditions moderate SS 2-3
- Deployed 3500 meters of cable, calculated tension of 2253 pounds.
- National Instruments cRIO data acquisition 20 samples/second
- $3,600



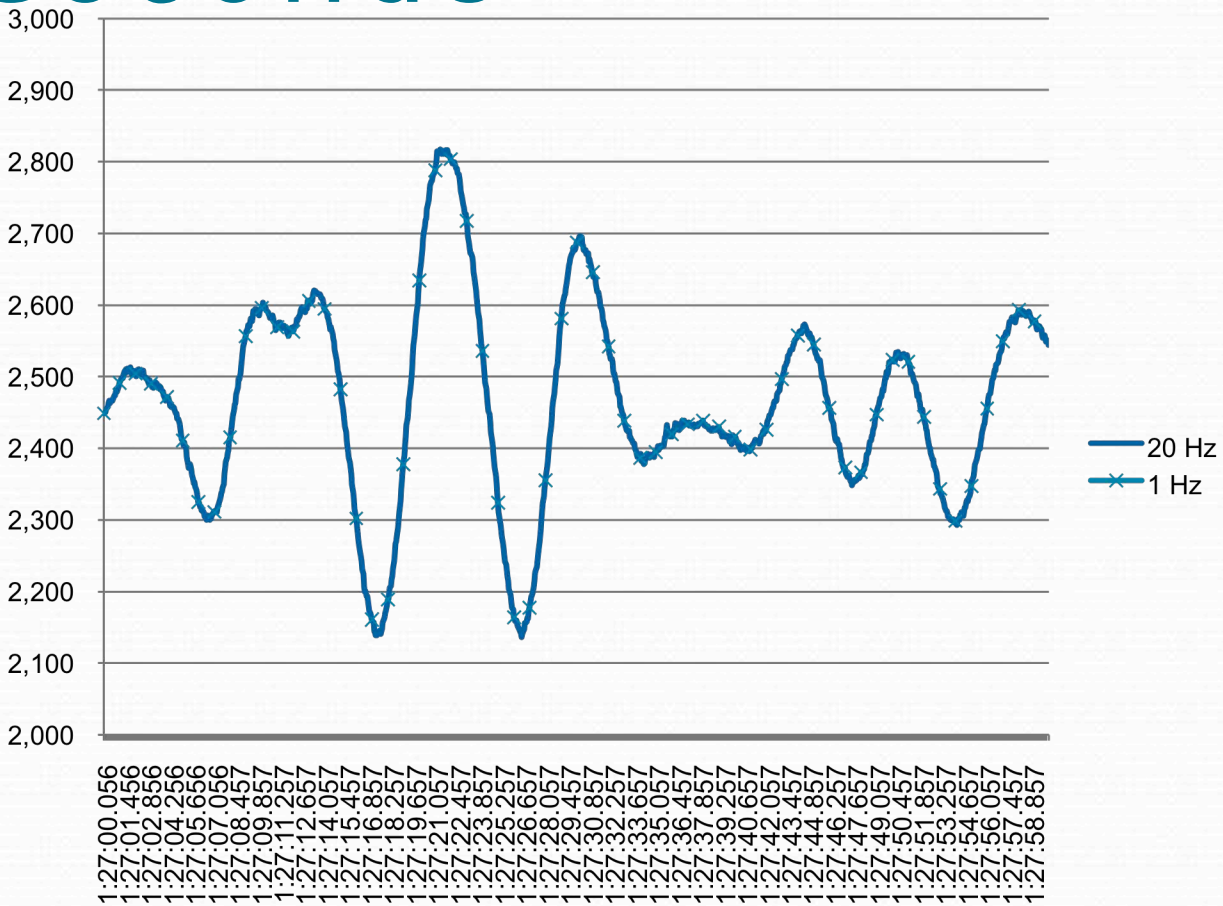

Cable Rate & Payout for Entire CTD Cast - April 19, 2008 (1/2 second averaged data)
Cable Rate
Payout
Cable Rate (meters/min)
Payout (meters)
Time (GMT)
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
0:13
0:18
0:23
0:28
0:33
0:38
0:43
0:48
0:53
0:58
1:03
1:08
1:13
1:18
1:23
1:28
1:33
1:38
1:43
1:48
1:53
1:58
2:03
2:08
2:13
2:18
2:23
2:28
2:33
2:38
2:43
2:48
2:53
2:58
3:03
3:08
3:13
3:18
3:23

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

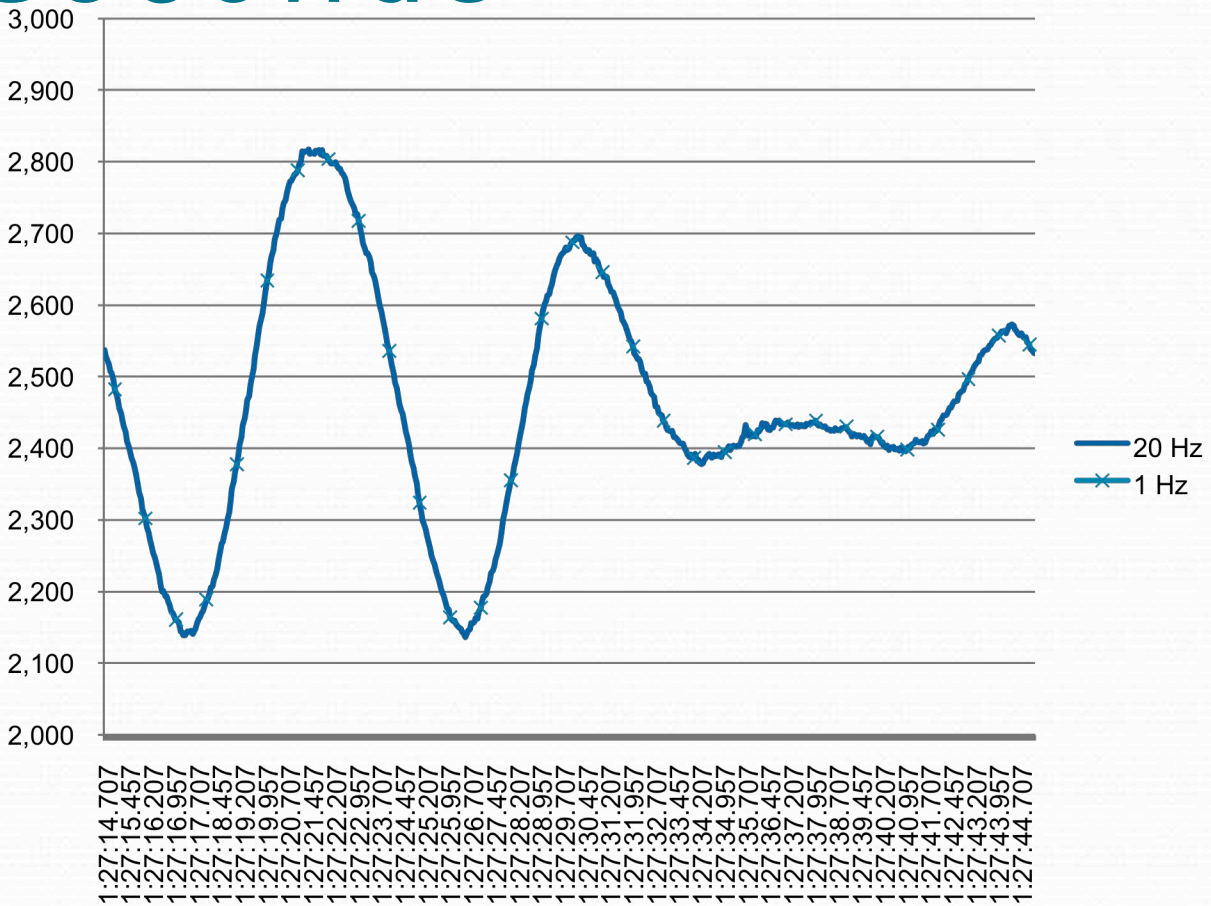



Payout & Tension for Entire CTD Cast - April 19, 2008 (1/2 second averaged data)
Payout (meters)
Tension
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Payout (meters)
Cable Tension (lbs)
0:13
0:18
0:23
0:28
0:33
0:38
0:43
0:48
0:53
0:58
1:03
1:08
1:13
1:18
1:23
1:28
1:33
1:38
1:43
1:48
1:53
1:58
2:03
2:08
2:13
2:18
2:23
2:28
2:33
2:38
2:43
2:48
2:53
2:58
3:03
3:08
3:13
3:18
3:23
Time (GMT)

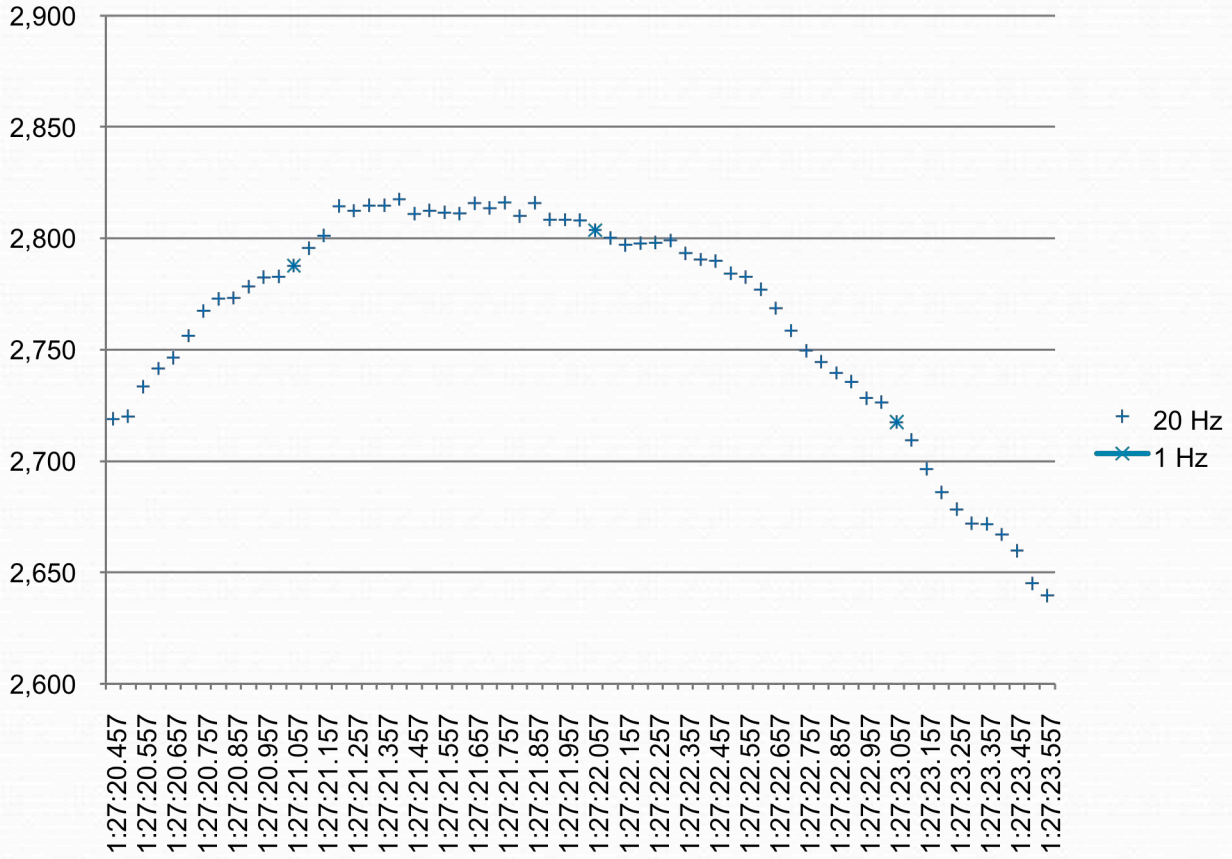
60 Seconds


3,000
2,900
2,800
2,700
2,600
2,500
2,400
2,300
2,200
2,100
2,000
1:27:00.056
1:27:01.456
1:27:02.856
1:27:04.256
1:27:05.656
1:27:07.056
1:27:08.457
1:27:09.857
1:27:11.257
1:27:12.657
1:27:14.057
1:27:15.457
1:27:16.857
1:27:18.257
1:27:19.657
1:27:21.057
1:27:22.457
1:27:23.857
1:27:25.257
1:27:26.657
1:27:28.057
1:27:29.457
1:27:30.857
1:27:32.257
1:27:33.657
1:27:35.057
1:27:36.457
1:27:37.857
1:27:39.257
1:27:40.657
1:27:42.057
1:27:43.457
1:27:44.857
1:27:46.257
1:27:47.657
1:27:49.057
1:27:50.457
1:27:51.857
1:27:53.257
1:27:54.657
1:27:56.057
1:27:57.457
1:27:58.857
20 Hz
1 Hz

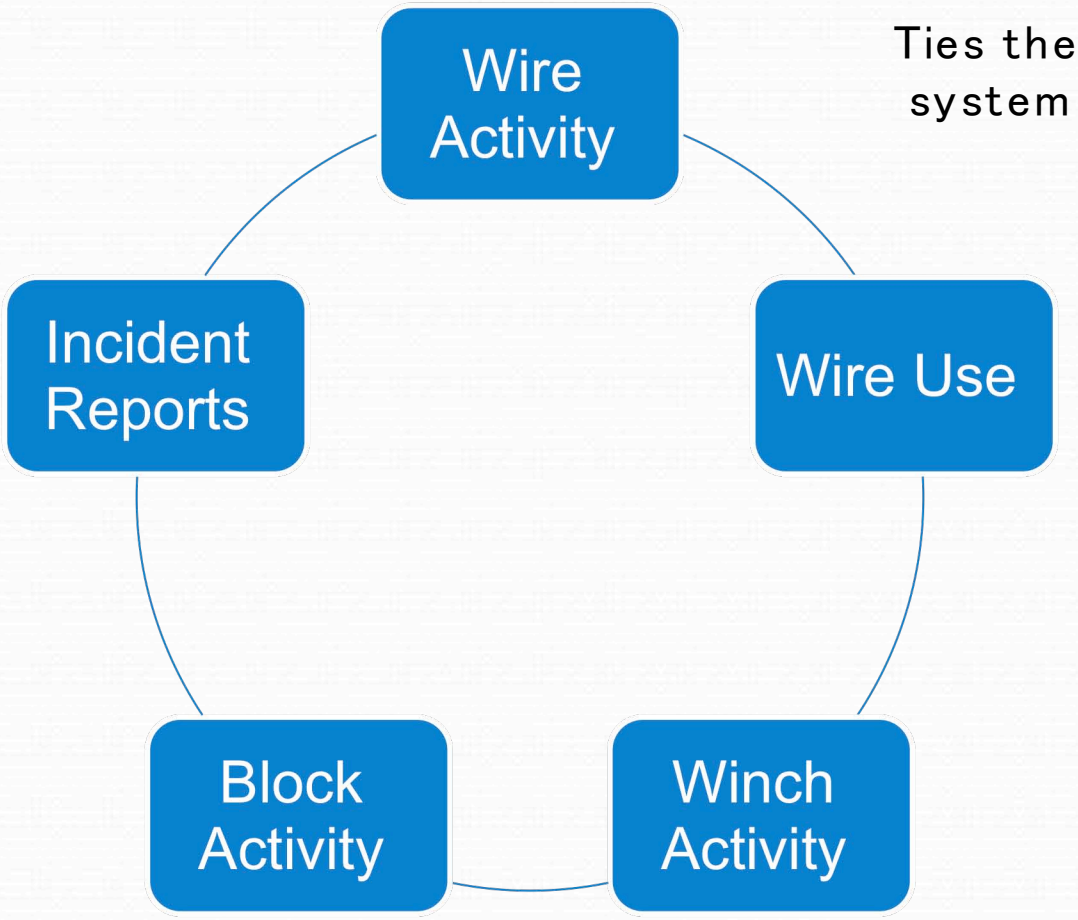
30 Seconds


3,000
2,900
2,800
2,700
2,600
2,500
2,400
2,300
2,200
2,100
2,000
1:27:14.707
1:27:15.457
1:27:16.207
1:27:16.957
1:27:17.707
1:27:18.457
1:27:19.207
1:27:19.957
1:27:20.707
1:27:21.457
1:27:22.207
1:27:22.957
1:27:23.707
1:27:24.457
1:27:25.207
1:27:25.957
1:27:26.707
1:27:27.457
1:27:28.207
1:27:28.957
1:27:29.707
1:27:30.457
1:27:31.207
1:27:31.957
1:27:32.707
1:27:33.457
1:27:34.207
1:27:34.957
1:27:35.707
1:27:36.457
1:27:37.207
1:27:37.957
1:27:38.707
1:27:39.457
1:27:40.207
1:27:40.957
1:27:41.707
1:27:42.457
1:27:43.207
1:27:43.957
1:27:44.707
20 Hz
1 Hz

4 Seconds


2,900
2,850
2,800
2,750
2,700
2,650
2,600
1:27:20.457
1:27:20.557
1:27:20.657
1:27:20.757
1:27:20.857
1:27:20.957
1:27:21.057
1:27:21.157
1:27:21.257
1:27:21.357
1:27:21.457
1:27:21.557
1:27:21.657
1:27:21.757
1:27:21.857
1:27:21.957
1:27:22.057
1:27:22.157
1:27:22.257
1:27:22.357
1:27:22.457
1:27:22.557
1:27:22.657
1:27:22.757
1:27:22.857
1:27:22.957
1:27:23.057
1:27:23.157
1:27:23.257
1:27:23.357
1:27:23.457
1:27:23.557
20 Hz
1 Hz

Winch & Wire Handbook, 3rd Edition
Chapter 7 – Instrumentation Lowering System Documentation



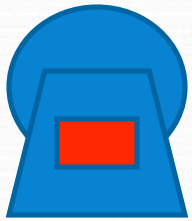
Ties the entire handling system together.

Challenge

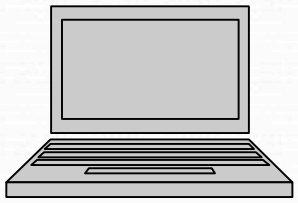
- New responsibilities for ship operators & winch operators to be able to operate at lowest FoS
- If you don't keep required records you can not meet the scientist's needs
- Solution is to integrate and automate

Network Nodes

Web browser display, one control multiple view



Operator
Touch Screen



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

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