

Scientific Handling System: Winch and Wire Data Monitoring + Special Features

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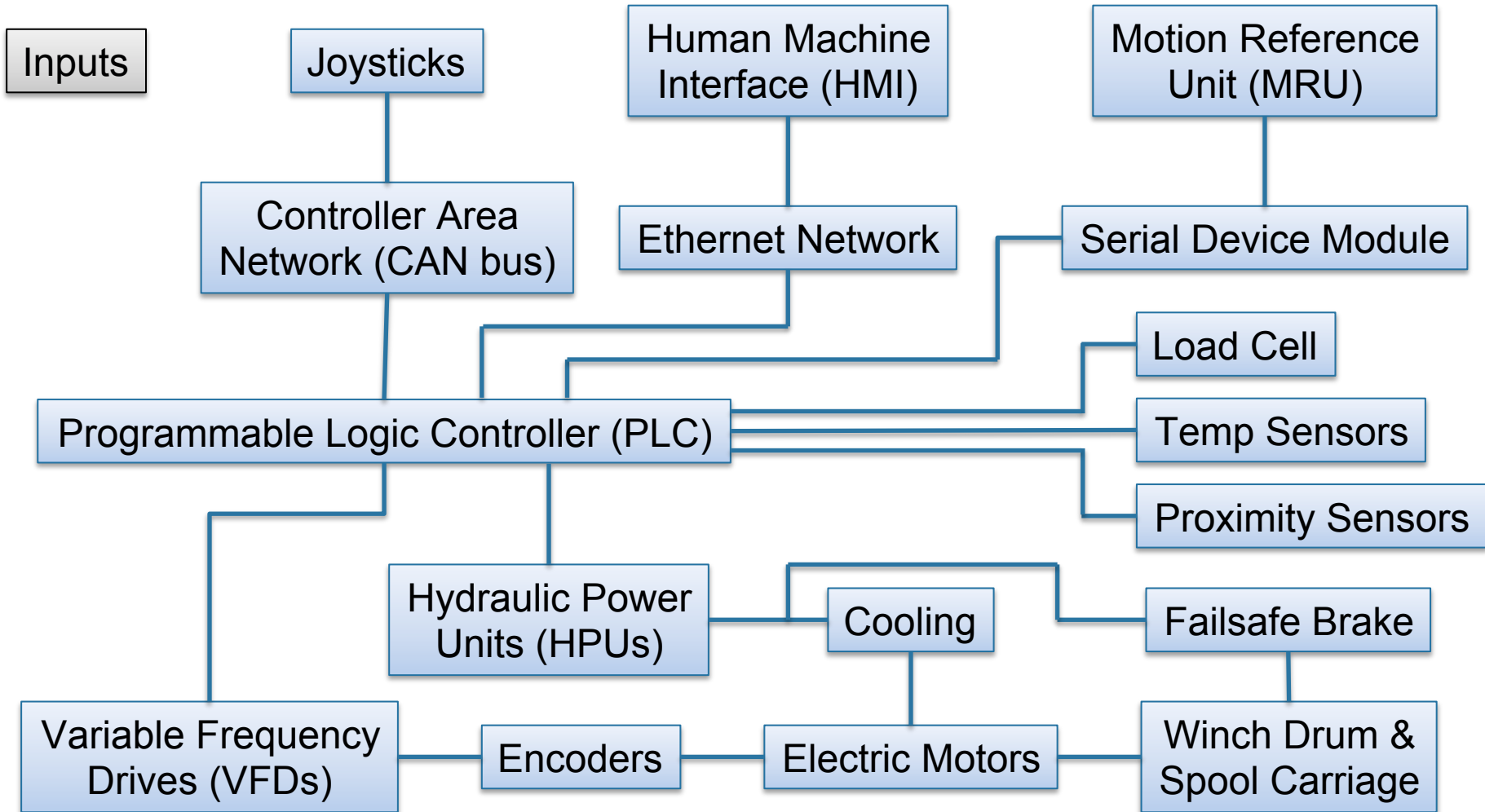
R/V Sikuliaq

College of Fisheries
and Ocean Sciences

<https://www.sikuliaq.alaska.edu>

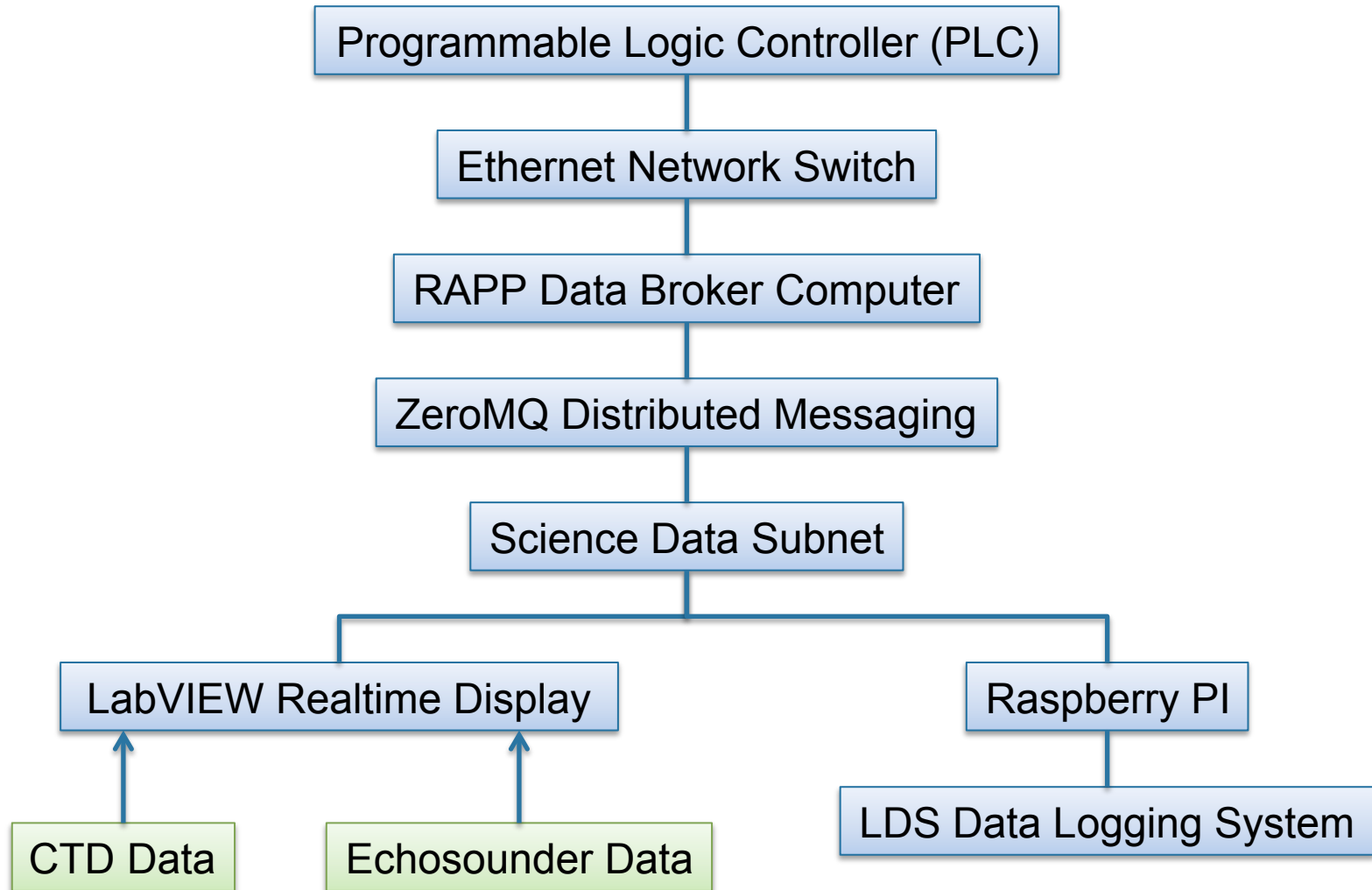


RAPP MARINE Direct Drive Electric Winch



Where does the data come from?

Where does the data go to?



Data Broker Function Test

TCP Speed Test

- Data Broker can receive information from PLC and send to end-user under 90 msec. Most messages are received under 75 msec.
- Suggested cycle time for Data Broker with TCP is 90 msec
- Note: Serial communication could not go below 1.6 sec

20 Hz Test

- Read at least 20 different values per second from addresses incrementing for each PLC cycle
- Data Broker writes to PostgreSQL database over 21 times per second, using PLC program Cbus Research SVN revision 97.

Parameter	Value
Database Logging Cycle time	0.005 ms
PLC Scan time	0.005 ms

Sample Rate = 20 Hz

NMEA Message Format

<Talker ID> = @RCWD

<Winch Number> = 1, 2, 6, 7

<Winch Mode> = 1 (Manual), 2 (Auto Payout), 3 (Auto Haul In), etc.

<Length> (meters) – Motor calculated

<Tension> (metric tons) – Motor calculated

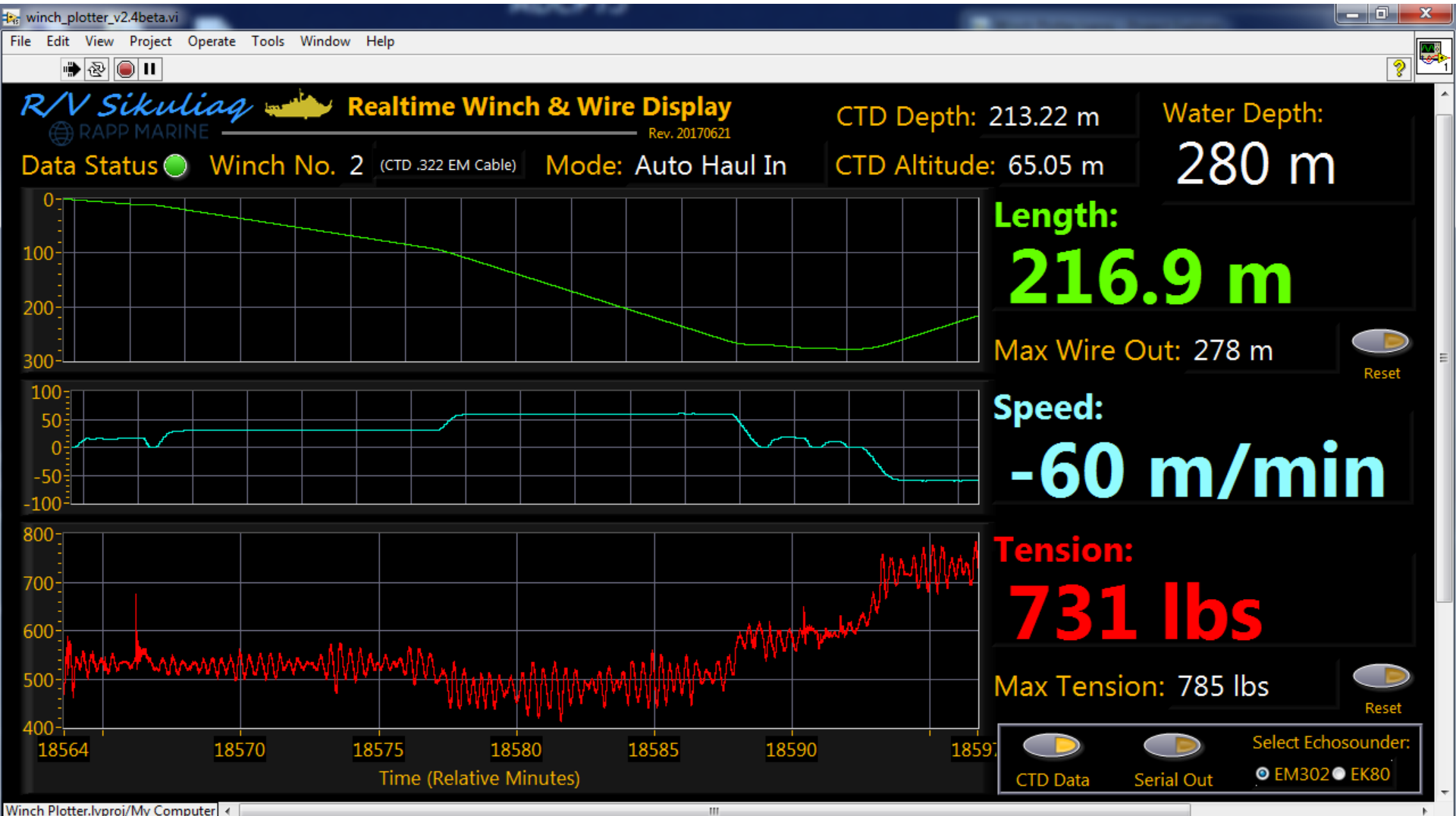
<Velocity> (meters per minute)

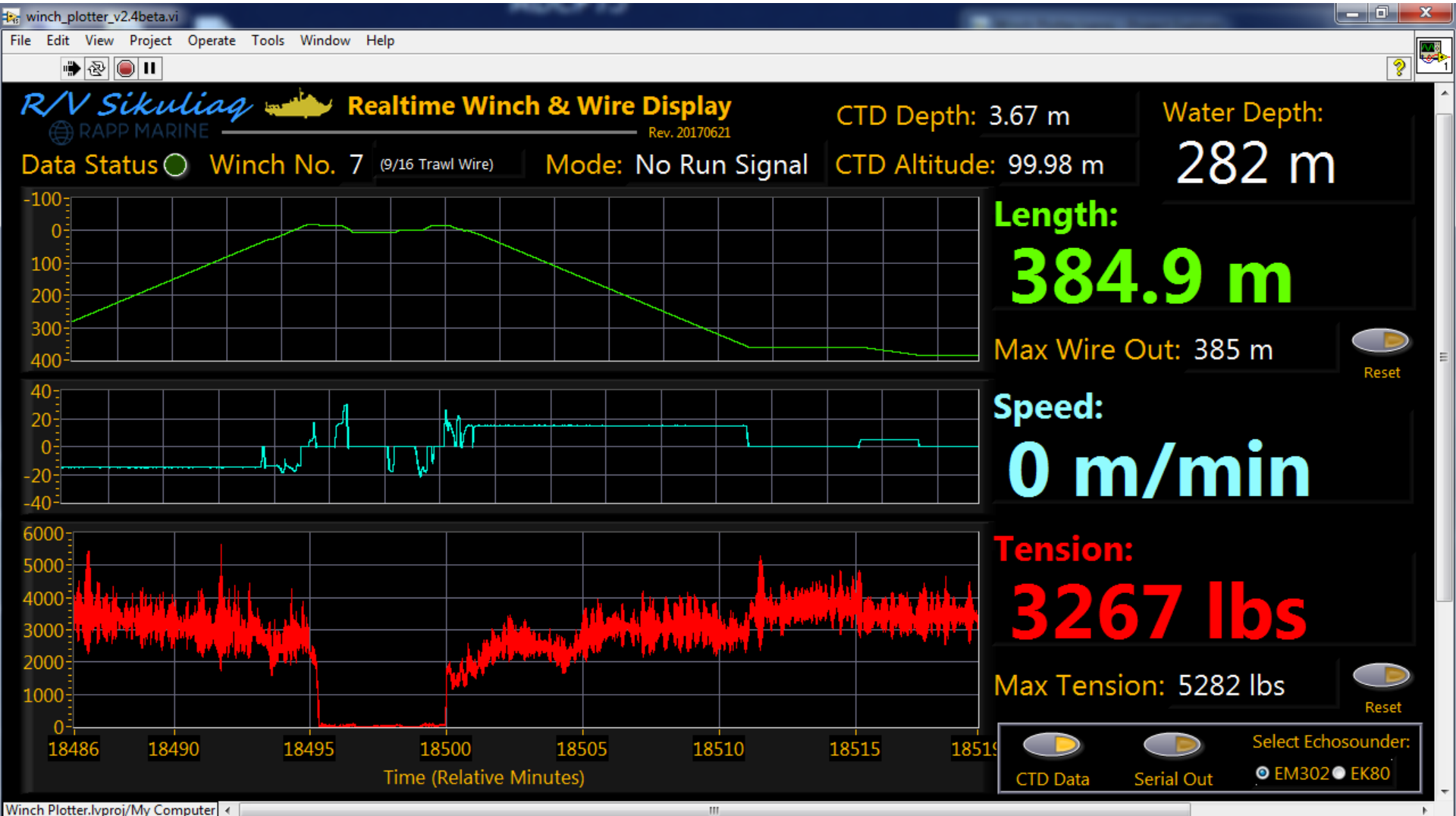
<Alarm> = 1 (Wire End), 4 (Over Speed), 6 (Min/Max), 8 (Tension), etc.

<Length> (meters) – Block counting

<Tension> (metric tons) – Block counting, i.e. load cell

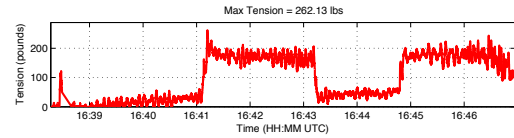
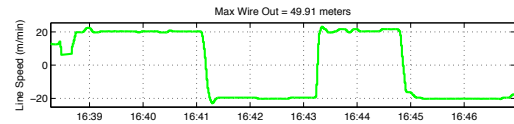
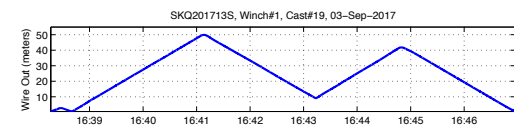
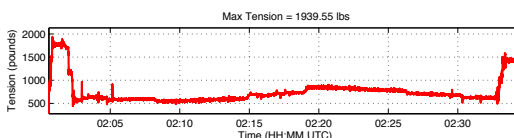
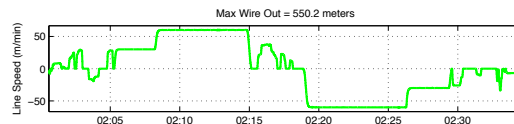
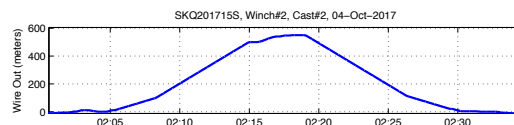
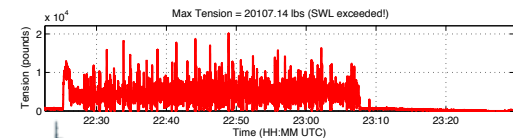
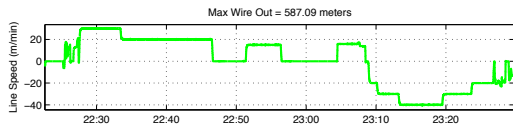
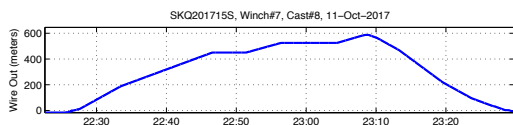
<Checksum>





Wire Log Summaries and Plots

	A	B	C	D	E	F	G	H	I	J	K	L
1	Wire Summary	14-Oct-17										
2												
3	NSF Reel Number:	NSF-OTH-063 (9/16" 3x19 Trawl Wire)										
4	System Description:	Winch #7 - Traction System, Storage drum #2										
5	Current Length (m):	11950										
6	Est. Usable Length (m):	11380.95										
7	Nominal Breaking Load (lbs):	32500										
8	Tested Breaking Load (lbs):	33325 [11-Dec-2015]										
9	Safe Working Load (lbs):	16600 [FS = 2.0075]										
10												
11	Total No. of Deployments:	11										
12	Total Duration (HH:MM:SS):	8:04:35										
13	Maximum Wire Out (m):	587.09										
14	Maximum Line Speed (m/min):	50.35										
15	Maximum Tension (lbs):	24185.1										
16	Safe Working Load Exceeded:	TRUE										
17												
18	Wire Deployment Log:											
19	Cruise ID	Cast ID	TimeIn	TimeOut	Duration (HH:MM:SS)	Max WireOut (m)	Max LineSpeed (m/min)	Max Tension (lbs)	Time (@ max tension)	WireOut (@ max tension)	Time (@ SWL exceeded)	
20	SKQ201715S	1	20171003T154808	20171003T162459	00:36:50	94.73	30.4	12558.87	20171003T155455	-0.05		
21	SKQ201715S	2	20171004T171212	20171004T181516	01:03:04	552.61	50.35	6131.36	20171004T172253	332.87		
22	SKQ201715S	3	20171004T225935	20171004T235756	00:58:21	568.71	40.4	11865.71	20171004T230824	-8.14		
23	SKQ201715S	4	20171005T230902	20171005T233801	00:28:58	34.03	22.76	12068.26	20171005T231459	-8.77		
24	SKQ201715S	5	20171006T041529	20171006T045523	00:39:54	100.42	17.92	1702.32	20171006T041818	-7.97		
25	SKQ201715S	6	20171011T015114	20171011T023238	00:41:24	85.75	22.06	17127.44	20171011T022104	65	20171011T022104	
26	SKQ201715S	7	20171011T080751	20171011T085235	00:44:44	160.08	20.29	3772.81	20171011T084614	94.49		
27	SKQ201715S	8	20171011T222236	20171011T232947	01:07:11	587.09	40.48	20107.14	20171011T224853	449.87	20171011T020458	
28	SKQ201715S	9	20171012T100640	20171012T104824	00:41:44	159.89	20.23	2971.62	20171012T104600	24.15		
29	SKQ201715S	10	20171012T111956	20171012T120214	00:42:18	159.89	21.62	4042.87	20171012T115928	34.25		
30	SKQ201715S	11	20171012T173419	20171012T175427	00:20:07	28.65	21.21	24185.1	20171012T174513	15.1	20171012T101528	



Active Heave Compensation (AHC)

Geometry – MRU location relative to ship's center of gravity and monitoring point

MRU Data – Acceleration, Speed, and Deviation of winch overboard point

PID controller – Tune regulator performance so winch follows to correct the position

REGULATOR SETTINGS

Winch No.

1

Towing regulator

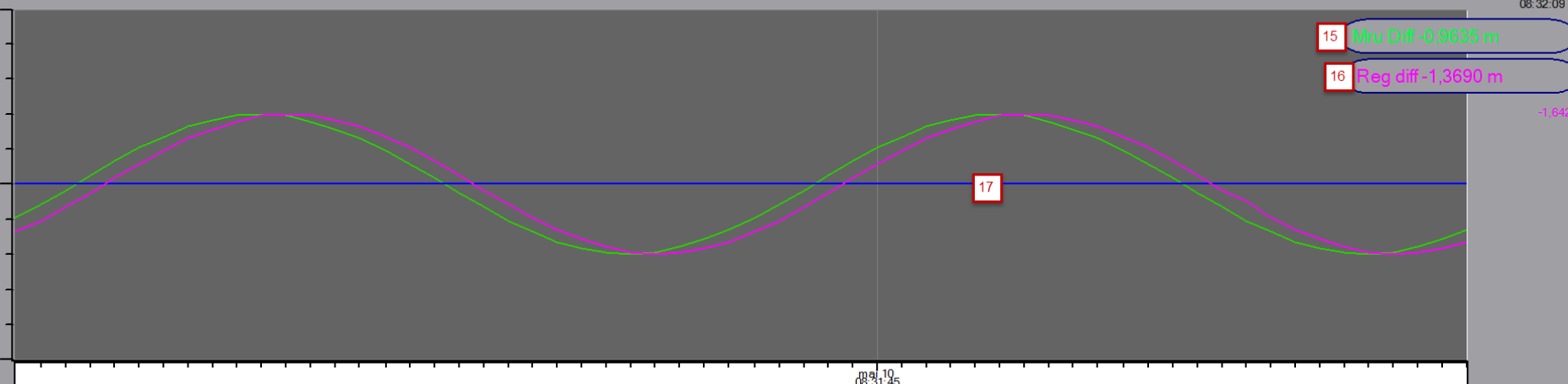
Proportional Gain	1,0	Units
Max Tension	10,00	Tons
Min Tension	1,00	Tons
Towing max Velocity haul in	10	m/min

Heave compensation

Velocity max	110	10	m/min
Speed Gain	0,430	11	Units
Acceleration Gain	0,255	12	Units

Length regulator

Proportional Gain	0,3	13	Units
Integral time	100	14	Sec



?

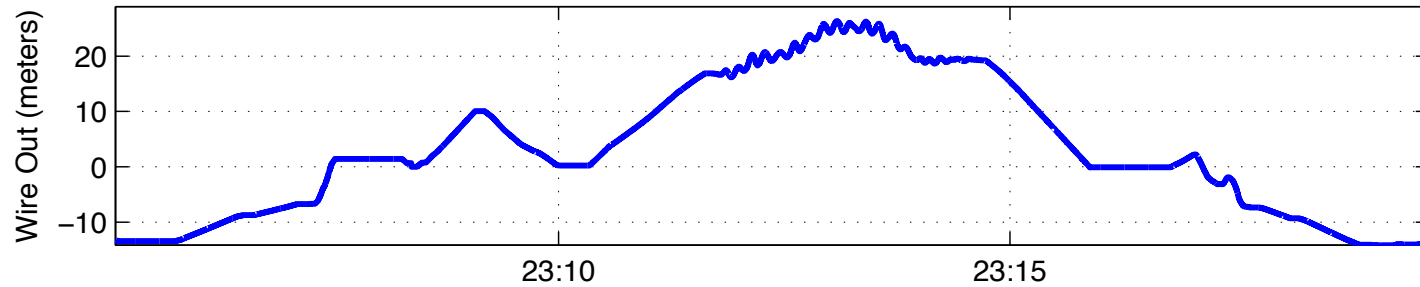
Set 440,8 winch 440,8

MRU Setting

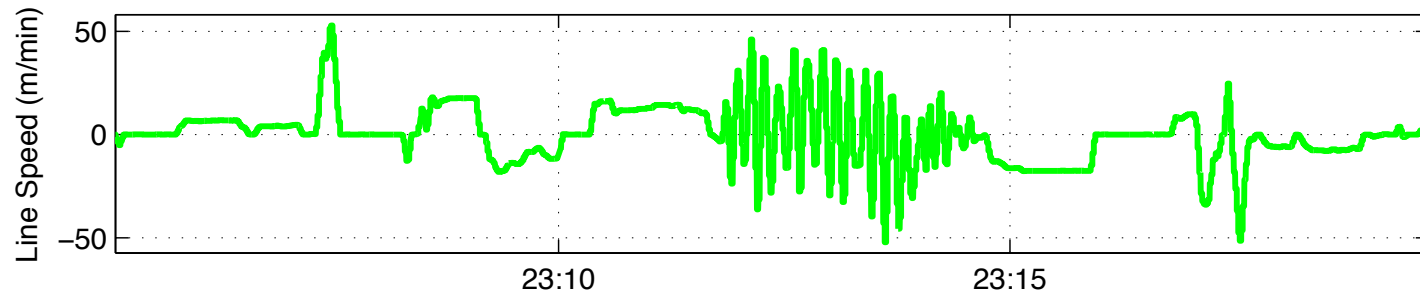
EXIT

Active Heave Compensation (AHC)

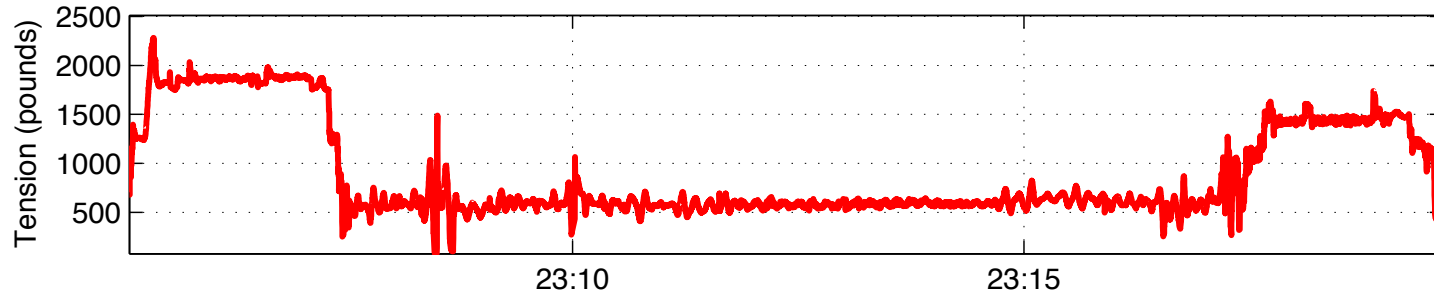
SKQ201713S, Winch#2, Cast#74, 07-Sep-2017



Max Wire Out = 26.32 meters



Max Tension = 2283.1 lbs



Time (HH:MM UTC)

Single Thread (Calculated) Spooling

Pentagon_Research

SPOOLING SETTINGS

Low end encoder value	-4858680	Value
Delta encoder value	4938015	Value
Wire diameter	8.330	Units
Deviation Gain	0.400	Units
Velocity Gain	0.400	Units
Torque Limit	20.0	%
Manual Speed	50.0	Hz
Auto max Speed	90.0	Hz

Calibrate Spooling End stops

Deviation	0.0	mm
Set val. frequency	7.10	Hz
Actual frequency	7.30	Hz
Actual torque	0.00	%
Spool count pulses	-742147	
Winch count pulses	34504465	

Winch No. 1

Spooling **Installed**

Make ABB=1 Yaskawa=2 E mair on SX=3

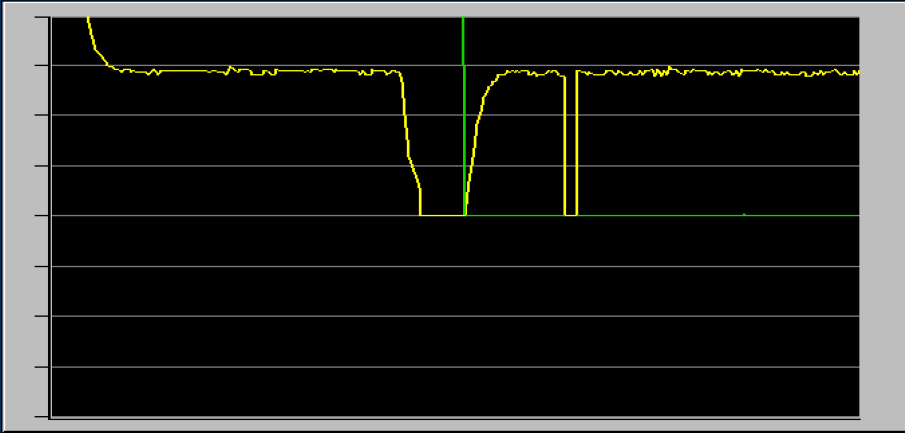
Spoolingtype 2

0=Single thread spooling.
1= Single thread with follow up.
2= Double thread.
5= Single thread spooling End stop turning

Alarm Run Ready

Spool Automatic Spool Up Spool Down

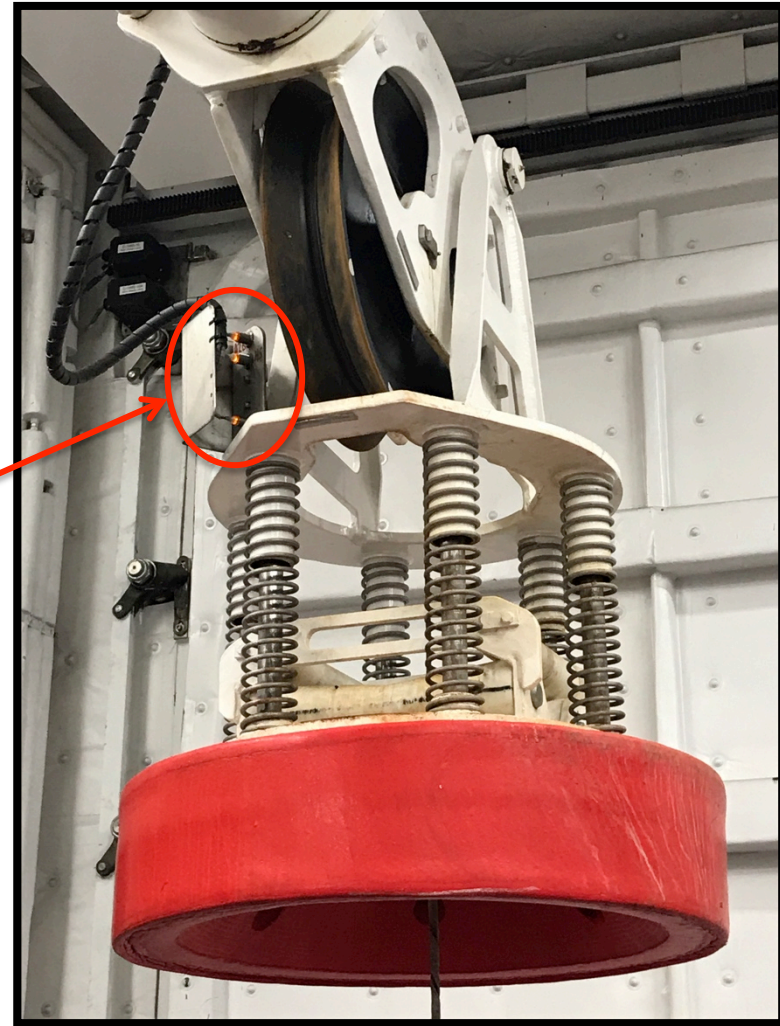
Confirm Position Spool carriage direction > Spool count direction >



? Spooling Digital inputs EXIT

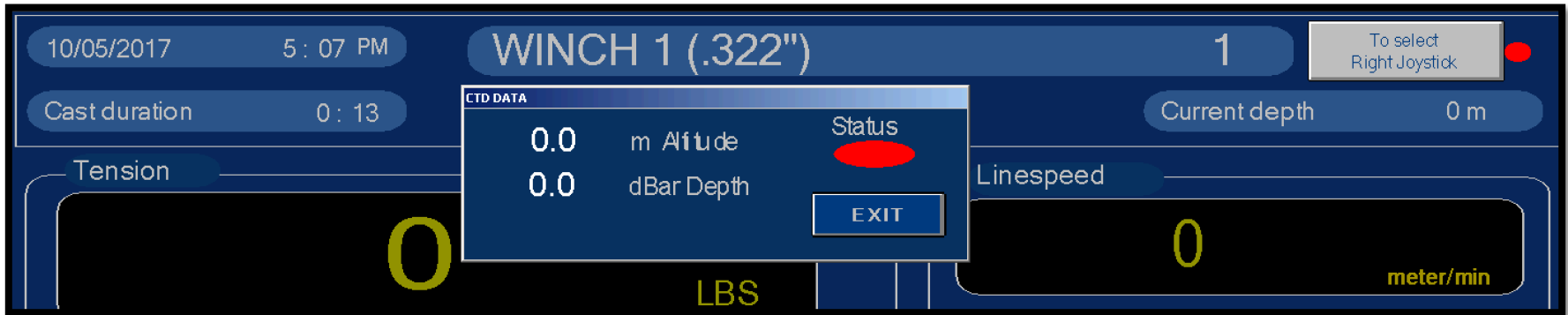
Failsafe Overrides

- Load Handling System (LHS)
- Constant Tension
- Docking Head
 - Hook Stop
 - Anti Two Block
- Auto-Rendering



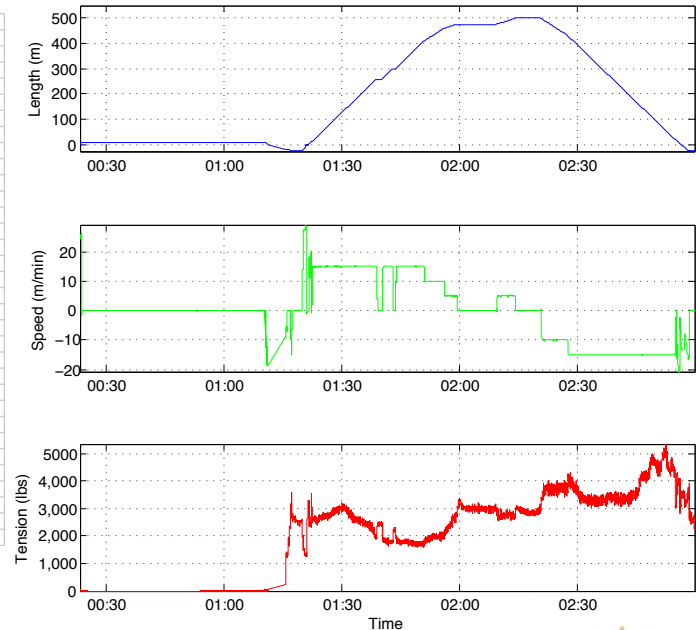
Future Work

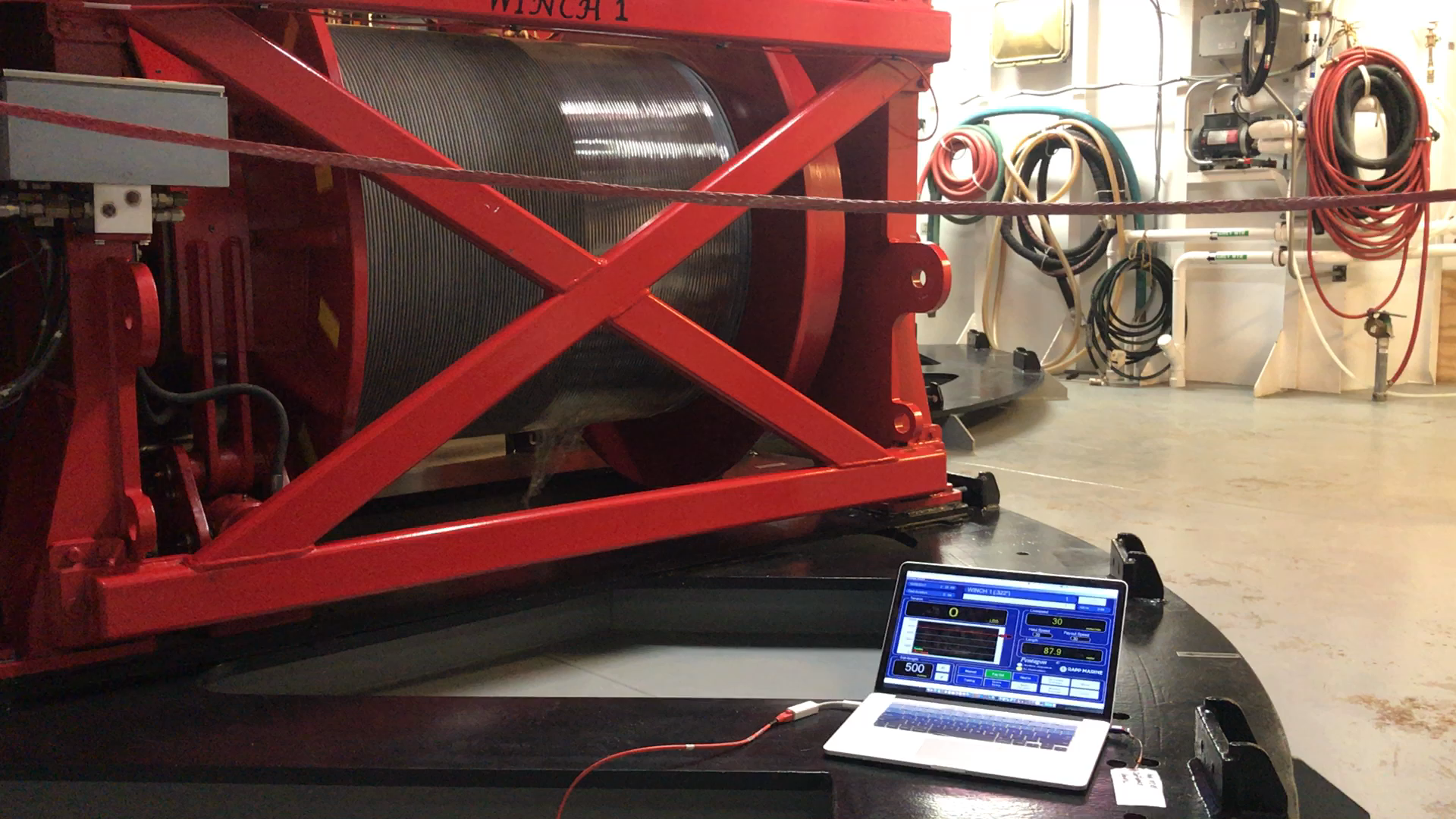
- Send CTD and Echosounder data messages to HMIs via Data Broker



- Improve code to generate wire log summaries and plots via MATLAB

Wire Deployment Log:									
Cruise ID	Cast ID	Duration (Hrs)	Max WireOut (m)	Max LineSpeed (m/min)	Max Tension (lbs)	Time (@ max tension)	WireOut (@ max tension)	Events	
SKQ201401S	1	2.38	1011.1024	51.040039	1802.9033	11/27/14 23:43	-4.9445	CTD	
SKQ201401S	2	2.00	1000.9423	51.04126	1842.96774	12/1/14 19:18	-9.5381002	CTD	
SKQ201401S	3	1.50	1000.0331	54.230003	1642.64524	12/2/14 13:44	-9.7614002	CTD	
SKQ201401S	4	0.83	252.61612	58.058006	1602.58066	12/2/14 15:48	217.1752	CTD	
SKQ201401S	5	0.92	292.95364	61.248009	2003.2258	12/3/14 23:07	-4.60955	CTD	
SKQ201401S	6	1.75	1385.2097	51.04126	2003.2258	12/4/14 01:28	-6.4597502	CTD	
SKQ201401S	7	1.33	1489.8577	60.929108	1682.7097	12/4/14 02:34	-10.95765	CTD	
SKQ201401S	8	1.70	1232.297	60.930176	2003.2258	12/6/14 07:03	-5.4867997	CTD	
SKQ201401S	9	2.48	1476.97	61.567383	2003.2258	12/9/14 08:18	-6.0769501	CTD & wire wash	
SKQ201510S	1	0.67	160.138	61.567078	1522.45164	7/26/15 13:25	-11.4202	CTD	
SKQ201510S	2	1.42	1021.7252	61.567383	1802.9033	7/27/15 19:31	-10.9098	CTD	
SKQ201510S	3	3.00	3964.5164	70.498047	2243.613	7/28/15 22:36	3841.9404	CTD	
SKQ201510S	4	2.67	3372.6274	61.889648	2003.2258	8/3/15 18:05	3274.6465	CTD	
SKQ201510S	5	2.67	3693.7009	62.84668	2163.4838	8/6/15 17:32	3646.0266	CTD	
SKQ201510S	6	2.50	3308.4128	78.473999	1923.0969	8/10/15 17:30	3296.1152	CTD	
SKQ201510S	7	1.00	536.78131	125.686	1522.45164	8/12/15 16:26	-12.345301	CTD	
SKQ201510S	8	1.83	2399.4541	61.572266	1522.45164	8/12/15 17:28	-8.8362999	CTD	
SKQ201510S	9	3.08	3903.3479	91.872009	2163.4838	8/17/15 03:47	3783.5635	CTD & wire wash	
SKQ201510S	10	0.58	184.27036	61.247864	1522.45164	8/18/15 03:57	-7.0339503	CTD	
SKQ201510S	11	0.58	89.431648	34.771042	1522.45164	8/18/15 13:41	-6.5235505	CTD	
SKQ201511S	1	2.67	3501.1528	139.722	2043.2904	8/31/15 19:37	3490.7212	CTD/ADCP	
SKQ201511S	2	2.25	3243.4485	61.569824	2003.2258	9/2/15 11:24	3166.8088	CTD/ADCP	
SKQ201511S	3	0.58	349.25714	114.521	1802.9033	9/6/15 05:08	-5.9972005	CTD/ADCP	
SKQ201511S	4	0.67	372.41656	61.567078	1802.9033	9/6/15 08:31	-7.2253504	CTD/ADCP	
SKQ201511S	5	0.50	216.15439	60.929108	1722.77426	9/6/15 12:40	-11.02145	CTD/ADCP	
SKQ201511S	6	0.42	175.83281	61.248169	1923.0969	9/6/15 14:14	-4.4022002	CTD/ADCP	
SKQ201511S	7	0.92	414.47672	132.70386	1802.9033	9/6/15 22:33	-5.9334002	CTD/ADCP	
SKQ201511S	8	0.75	493.49301	61.248779	1802.9033	9/7/15 01:45	-2.9507501	CTD/ADCP	
SKQ201511S	9	0.67	597.80603	61.248779	1722.77426	9/7/15 04:24	-10.7184	CTD/ADCP	
SKQ201511S	10	0.83	673.82373	82.940002	1923.0969	9/7/15 06:58	-14.642101	CTD/ADCP	
SKQ201511S	11	0.92	799.14288	61.248779	1842.96774	9/7/15 09:30	-3.8439503	CTD/ADCP	





Thank you