USCG Healy Hydrographic Systems Testing

CTD/Autosal/TSG/XBT/SSS Test Report
Sea Trials Leg - Seattle to Victoria
22 – 28 March 2004

Rev 2.2 2 April 2004

1. Summary

The following sections describe the work and follow up tests that were performed on hydrographic equipment and data acquisition systems on USCGC Healy during Spring 2004 Sea trials. All work and tests were performed by SIO Shipboard Technical Support in conjunction with the shipboard MST group.

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2. CTD EM cable and Slip Rings

2.1 Primary CTD Cable

The Primary CTD cable is located on the Starboard Winch forward in winch room.
Inspected CTD cable and slip rings. Visual inspection of the conductors on the termination end showed signs of oxidation. This indicates that salt water has wicked up the conductor core. This can happen when the core of the wire is not completely sealed when the wire is submerged. The portion of the cable where this is evident was required to be cut off. Performed conductivity check on all three conductors. End to end resistance of each conductor was measured at the slip ring end of the drum to the termination end. Insulation breakdown tests were also performed on each conductor to the armor and on each conductor to the other conductors.

Measured values are:

Conductor	Resistance End to End	Insulation test 500V to Armor	Insulation test 500V to 1st cond	Insulation test 500V to 2nd cond
White	275 ohms	>999Mohms	>999Mohms	>999Mohms
Black	275 ohms	>999Mohms	>999Mohms	>999Mohms
Red	275 ohms	>999Mohms	>999Mohms	>999Mohms

CTD Winch:
Make: Interocean
Model: 712178100
Date: 8/97
Capacity: 10,000 lbs
Max load: 11,840 lbs

UNOLS Rochester Cable
Slip Ring end tape reading 23774.0
Termination end tape reading: 14346.5 (18-Mar-04)

After cutting the cable:
Termination end tape reading: 14379.0 (22-Mar-04)
Total length of cable: 9395.0 Meters (22-Mar-04)
Conductor wires at termination end have normal color.

Conducted frequency test of the sea cable using ship's Wavetek signal generator and Tektronix oscilloscope. Connected frequency in on one end of the cable between conductor and armor. Signal out was measured out of the other end. The results are the same no matter if the test was done on one of the three conductors or if all three conductors are ganged together.
Frequency Test with change in load:

Frequency Sine Wave (HZ)	Voltage OUT 3.0VPP Input 1M ohm load	Voltage OUT 3.0VPP Input 1K ohm load	Voltage OUT 0.5VPP Input 1M ohm load	Voltage OUT 10.0VPP Input 1M ohm load
100.0	3.0	2.6	0.50	10.0
500.0	3.0	2.6	0.50	10.0
1,000.0	2.8	2.4	0.45	9.2
2,000.0	1.9	1.9	0.30	6.1
,5000.0	0.96	0.92	0.16	3.2
10,000.0	0.45	0.40	0.07	1.4
15,000.0	0.23	0.22	0.03	0.74
20,000.0	0.11	0.11	0.02	0.35
25,000.0	0.055	0.050	0.0	0.18
30,000.0	0.020	0.020	0.0	0.10
40,000.0	0.005	0.005	0.0	0.04
50,000.0	0.0	0.0	0.0	0.02
100,000.0	0.0	0.0	0.0	0.02
200,000.0	0.0	0.0	0.0	0.03
500,000.0	0.0	0.0	0.0	0.05

All Test results – Normal.

2.2 Backup CTD Cable

Performed the same conductivity and insulation resistance tests as on primary CTD cable.

Conductor	Resistance End to End	Insulation test 500V to Armor	Insulation test 500V to 1st cond	Insulation test 500V to 2nd cond
White	332 ohms	>999Mohms	>999Mohms	>999Mohms
Black	332 ohms	>999Mohms	>999Mohms	>999Mohms
Red	332 ohms	>999Mohms	>999Mohms	>999Mohms

The backup cable has never been used.
The internal tape marking on termination end is 11,724.0
Cable length is >11,000.0 Meters
Calculated length based on measurements: 11,400.0 Meters

Frequency Test:

Frequency Sine Wave (HZ)	Voltage OUT 3.0VPP Input 1M ohm load	Voltage OUT 3.0VPP Input 1K ohm load
100.0	3.0	3.0
500.0	2.9	2.9
1,000.0	2.3	2.3
2,000.0	1.5	1.5
5,000.0	0.70	0.70
10,000.0	0.27	0.27

15,000.0	0.12	0.12
20,000.0	0.055	0.054
25,000.0	0.025	0.022
30,000.0	0.010	0.010
40,000.0	0.002	0.002
50,000.0	000.0	000.0

The backup CTD cable was only tested to 50,000.0 HZ with a 3.0VPP input signal.

All Test results – Normal.

2.3 Slip Rings

Tested slip rings for continuity and 500V insulation breakdown on each contact. Insulation breakdown measured between each contact to housing and between each contact to the other contacts. Continuity measured while slip rings were rotated around.

USCGC Healy Slip Rings and test results:

MFG	Model	Serial	Location	Continuity	Breakdown
Meridian	MXO-6	1516	CTD Winch#1	Ok	Ok
Meridian	MXO-6	9190	Spare	Ok	Ok
Meridian	MXO-6	6583	Spare	Ok	Ok
Meridian	MXO-6	6586	Trawl Winch	Not tested	Not Tested

All Test results – Normal.

3. Autosal

Description	**MFG**	**Model**	**Serial no.**
Autosal	**Guildline**	**8400B**	**65-715**

Autosal #65-715
The following checks were performed.

1. Visual inspection
2. Bath temperature check
3. Pump operation
4. ACI 2000 interfaces
5. Conductivity Zero and Gain adjustment
6. Sample water analysis and stability of conductivity ratio

Corrective action taken:

1. Repaired loose tubing connection to cell discharge (inside bath)
2. Replaced worn tygon tubing
3. Fixed broken ground strap – inside rear of cabinet
4. STD dial does not lock correctly – needs replacing
5. Replaced burned out heater lamp
6. Replaced Pump air filters
7. Replaced IC Z311 on Meter PCB

Measured bath temperature using Seabird precision temperature sensor SBE35 on all ranges. Checked each of the two bath thermistors for proper operation. Bath temperature measurements on all ranges meet specifications.

Bath Temp Setting	Normal	CK1	CK2
18	18.008	18.007	18.007
21	21.008	21.007	21.008
24	24.006	24.006	24.006
27	27.008	27.007	27.008
30	30.008	30.006	30.010
33	33.006	33.003	33.010

Recommendation: Replace STD dial

4. CTD Systems

4.1 CTD/Rosette System

CTD acquisition computer was checked for proper setup of hardware, software and .CON file that is used by the software for each of the CTD configurations.

There are two CTD/rosette systems on Healy.

CTD/Rosette System#1 12 Place 30 Liter bottles 22 March 2004

Description	MFG	Model	Serial no.	Calibration Date
Carousel 12 Bottle Frame	**Seabird**	**SBE32**	**3224152-0347**	**N/a**
CTD	**Seabird**	**SBE9Plus**	**09P24152-0638**	
CTD Pressure	**Paroscientific**	**Digiquartz**	**83009**	**05-Mar-04**
Primary Temperature	**Seabird**	**SBE3Plus**	**03P2796**	**22-Nov-03**
Primary Conductivity	**Seabird**	**SBE4C**	**042545**	**21-Nov-03**
Secondary Temperature	**Seabird**	**SBE3Plus**	**03P2824**	**22-Nov-03**
Secondary Conductivity	**Seabird**	**SBE4C**	**042568**	**21-Nov-03**
Pump1	**Seabird**	**SBE5T**	**053112**	**N/a**
Pump2	**Seabird**	**SBE5T**	**053114**	**N/a**
Oxygen	**Seabird**	**SBE43**	**0430459**	**08-Dec-03**
Altimeter	**Benthos**	**916D**	**843**	**N/a**
Water Samplers 12 EA 30 Liters External springs	**OceanTest Equipment Inc.**	**110**	**N/a**	**N/a**

Performed precruise calibration check by inserting the sensors into a calibration tank filled with salt water. Temperature readings were compared to the SBE35 secondary reference standard. Salinity samples were taken at the same time the conductivity readings were recorded. Samples were analyzed on the autosal.

CTD# 0638 Sensor Pair#1

SBE35 Temperature	2796 Temperature	Difference	2545 Conductivity	2545 Salinity	Autosal Salinity	Difference
17.768	17.768	0.000	3.8443	28.881	28.880	0.001

CTD# 0638 Sensor Pair#2

SBE35 Temperature	2824 Temperature	Difference	2568 Conductivity	2568 Salinity	Autosal Salinity	Difference
17.770	17.770	0.000	3.8443	28.881	28.879	0.002

CTD/Rosette System#2 24 Place 12 Liter bottles 22-March-2004

Description	MFG	Model	Serial no.	Calibration Date
Carousel 24 Bottle Frame	**Seabird**	**SBE32**	**3224152-0348**	**N/a**
CTD	**Seabird**	**SBE9Plus**	**09P24152-0639**	
CTD Pressure	**Paroscientific**	**Digiquartz**	**83012**	**09-Jan-01**
Primary Temperature	**Seabird**	**SBE3Plus**	**03P2841**	**21-Nov-03**
Primary Conductivity	**Seabird**	**SBE4C**	**042561**	**21-Nov-03**
Secondary Temperature	**Seabird**	**SBE3Plus**	**03P2945**	**22-Nov-03**
Secondary Conductivity	**Seabird**	**SBE4C**	**042575**	**21-Nov-03**
Pump1	**Seabird**	**SBE5T**	**053115**	**N/a**
Pump2	**Seabird**	**SBE5T**	**053116**	**N/a**
Oxygen	**Seabird**	**SBE43**	**0430456**	**08-Dec-03**
Altimeter	**Benthos**	**916D**	**872**	**N/a**
Water Sampler 24 EA 12 Liters External Springs	**OceanTest Equipment Inc.**	**110**	**N/a**	**N/a**

The results of the test casts showed that all of the 30L bottles leaked. This is due to the inability of the springs to support the weight of the water in the bottle. It may be necessary to replace the springs that are currently installed. It may be worthwhile to consider converting the bottles to utilize an internal spring rather than the current external spring configuration. In the external spring arrangement the lanyard angle from spring to cap increases when the bottle is closed reducing the ability of the spring to keep the end cap closed tight. This situation does not exist in an internal spring bottle.

Recommendation:

1. **Repair 30L bottles.**
2. **Convert 30L bottles to use internal springs**

4.2 CTD deck units

Description	MFG	Model	Serial no.
Deck Unit	**Seabird**	**SBE11Plus**	**11P10730-0416**
Deck Unit	**Seabird**	**SBE11Plus**	**11P10730-0417**

CTD deck units checked for proper operation. Deck unit #0416 has a NMEA card installed, deck unit #0417 does not. Both deck units are Version 1 SBE11Plus.
Both deck units are set to advance primary conductivity sensor 1.75 frames.

If the deck units were upgraded to version 2 then the NMEA and surface PAR interfaces are included. Also, version 2 gives the ability to advance secondary conductivity lag to temperature. Version 1 deck units only allow the primary sensor pair to advance the conductivity response.

Recommendation:
Upgrade both deck units to full Version 2 with Surface PAR, NMEA and remote output options.

4.3 CTD Acquisition Computer

Description	MFG	Model	Serial no.
Windows XP PC			**P02B0102670033**

There is only one CTD acquisition computer. The Acquisition computer is Windows XP based. It does not have a GPIB board for acquiring data from the deck unit. Instead it uses the built-in COMM 1 port for CTD data acquisition at 19200. The modem channel for bottle tripping commands is connected to a serial to USB converter (COMM 3). The Seabird acquisition and processing software has been updated from the previous version (5.27).

Current version (after update 03-22-04)
Seasave 5.30b
Processing 5.30a
SeaTerm 1.44

Recommendations:

1. **Acquire a GPIB card and a two-port RS232 serial card for the computer to facilitate a more fault tolerant communications installation.**
2. **Acquire a backup CTD acquisition computer with all the same cards and features as the primary computer. Install in rack near primary unit.**

4.4 Oxygen Sensors

Description	MFG	Model	Serial no.	Cal Date	Operational Tests	Comments
Oxygen	**Seabird**	**SBE43**	**0430459**	**08-Dec-03**	**Ok**	**System#1**
Oxygen	**Seabird**	**SBE43**	**0430458**	**08-Dec-03**	**Ok**	**System#2**
Oxygen	**Seabird**	**SBE43**	**430456**	**08-Dec-03**	**Not Tested**	**Spare**
Oxygen	**Seabird**	**SBE13**	**130583**	**22-May-03**	**Rejected by Seabird 12/03**	**NonOp**
Oxygen	**Seabird**	**SBE13**	**130573**	**18-Nov-03**	**Not Tested**	**Spare**

There are no SBE43 to SBE9 cables onboard. There are SBE13 cables that work on the SBE43 but with a reduced capability.
Recommendations:
Acquire 4 SBE43 sensor cables, SBE Part No. 171491

4.5 Spare CTD Sensors

Several CTD spare sensors are onboard. Sensor types and calibration dates are as follows:

Description	MFG	Model	Serial no.	Cal Date
***Temperature**	**Seabird**	**SBE03**	**031838**	**22-Nov-03**
Temperature	**Seabird**	**SBE03Plus**	**03p2855**	**21-Nov-03**
Temperature	**Seabird**	**SBE-03S**	**034063**	**22-Nov-03**
Conductivity	**Seabird**	**SBE-04C**	**042619**	**21-Nov-03**

* SBE03 #1838 is usually the bow intake sensor for the forward thermosalinograph.

Peripheral Sensors

Fluorometer	**Chelsea**	**Aquatrack A**	**088233**	**21-Jan-04**
Fluorometer	**Chelsea**	**Aqua track A**	**088234**	**21-Jan-04**
Transmissometer	**Wet Labs**	**Cstar**	**CST-390DR**	**20-Nov-03**
Transmissometer	**Wet Labs**	**Cstar**	**CST-436DR**	**20-Nov-03**
Altimeter	**Benthos**	**916D**	**843**	**System#1**
Altimeter	**Benthos**	**916D**	**872**	**System#2**

4.6 CTD Test Casts

The ship ran into heavy seas and 60 knot winds at the scheduled time and place for doing CTD casts. It was decided to head back into a sheltered area to do the CTDs. CTD casts were further delayed due to inoperable winches. The winch problems were repaired late in the day and the CTD casts started late in the evening. At the station site the water depth averaged 175 Meters. The original CTD site had a water depth of about 1000 Meters. 1000 Meters was the preferred and desirable depth to do the test CTD station. At 1000 Meters depth it would be possible to take water samples that could be stable enough to check and/or calibrate the CTD conductivity sensors.

CTD Test Cast #1
Start: March 26, 2004 0435 GMT
End: March 26, 2004 0506 GMT
CTD/Rosette system#1 12PL 30L
Deployed Rosette/CTD ok
CTD acquisition computer ok
CTD signal ok
NMEA input ok
All sensors ok
All instrumentation ok
Altimeter detected bottom at a distance of 70Meters DAB.
All bottles tripped, but all of them came out of the water leaking.
No data errors
Rosette/CTD safely recovered on deck

On deck pressure reading –0.1

* System UpLoad Time = Mar 26 2004 04:35:34
* NMEA Latitude = 48 15.29 N

* NMEA Longitude = 123 03.00 W
* NMEA UTC (Time) = 04:35:28
** Ship: USCGC Healy
** Cruise: March 2004 Seatrials
** 12 Place, 30l rosette

Bottle	Time	PrDM	T090C	T190C	T2-T190C	ML/L	Sal00	Sal11	SecS-priS
1	04:57:17	164.461	7.8823	7.8829	0.0006	3.66669	32.6124	32.6130	0.0006 (avg)
2	04:57:56	164.211	7.8827	7.8830	0.0004	3.66600	32.6103	32.6133	0.0030 (avg)
3	04:58:09	164.367	7.8826	7.8831	0.0005	3.66392	32.6111	32.6132	0.0021 (avg)
4	04:58:15	164.354	7.8821	7.8828	0.0007	3.66266	32.6135	32.6139	0.0004 (avg)
5	04:58:19	164.370	7.8810	7.8817	0.0007	3.66235	32.6200	32.6202	0.0001 (avg)
6	04:58:29	164.374	7.8825	7.8827	0.0002	3.66314	32.6117	32.6148	0.0031 (avg)
7	04:58:37	164.378	7.8812	7.8815	0.0003	3.65860	32.6187	32.6213	0.0026 (avg)
8	04:58:47	164.314	7.8809	7.8816	0.0007	3.65609	32.6200	32.6209	0.0009 (avg)
9	04:58:57	164.179	7.8806	7.8810	0.0004	3.65225	32.6214	32.6233	0.0019 (avg)
10	04:58:09	164.066	7.8798	7.8800	0.0003	3.64870	32.6265	32.6295	0.0030 (avg)
11	04:59:24	164.176	7.8809	7.8815	0.0006	3.65469	32.6185	32.6192	0.0007 (avg)
12	04:59:31	164.234	7.8812	7.8817	0.0005	3.66364	32.6057	32.6069	0.0012 (avg)

No salinity samples taken

CTD Test Cast # 2
Start: March 26, 2004 0530 GMT
End: March 26, 2004 0608 GMT
CTD/Rosette system#1 12PL 30L
Deployed Rosette/CTD ok
CTD acquisition computer ok
CTD signal ok
NMEA input ok
All sensors ok
All instrumentation ok
Altimeter detected bottom at a distance of 70Meters DAB.
All bottles tripped, but all of them came out of the water leaking.
No data errors
Rosette/CTD safely recovered on deck

0613 GMT Launch XBT T-7

On deck pressure reading –0.1

* System UpLoad Time = Mar 26 2004 05:30:20
* NMEA Latitude = 48 15.63 N
* NMEA Longitude = 123 03.66 W
* NMEA UTC (Time) = 05:30:12
** Ship: USCGC Healy
** Cruise: March 2004 Seatrials
** LAT:
** LON:
** STA#: Wet-Test 2
** DEPTH: 160m
** 12 place, 30l rosette

Bottle	Time	PrDM	T090C	T190C	T2-T190C	ML/L	Sal00	Sal11	SecS-priS	Autosal

1	05:58:54	150.328	7.8784	7.8780	-0.0004	3.65210	32.6179	32.6237	0.0058 (avg)	32.609
2	05:59:00	150.394	7.8779	7.8781	0.0002	3.64888	32.6202	32.6233	0.0030 (avg)	32.617
3	05:59:08	150.443	7.8799	7.8810	0.0011	3.65327	32.6126	32.6126	0.0001 (avg)	32.612
4	05:59:17	150.339	7.8812	7.8816	0.0005	3.66114	32.6077	32.6099	0.0022 (avg)	32.616
5	05:59:23	150.403	7.8788	7.8792	0.0004	3.65725	32.6172	32.6197	0.0025 (avg)	32.615
6	05:59:33	150.447	7.8786	7.8789	0.0003	3.65260	32.6181	32.6211	0.0030 (avg)	32.613
7	06:04:12	54.926	8.1805	8.1814	0.0009	4.91534	31.2647	31.2656	0.0009 (avg)	31.256
8	06:04:20	54.937	8.1812	8.1814	0.0003	4.91484	31.2644	31.2662	0.0018 (avg)	31.255
9	06:04:28	54.905	8.1824	8.1826	0.0002	4.91706	31.2642	31.2662	0.0020 (avg)	31.262
10	06:04:38	54.964	8.1826	8.1836	0.0009	4.91582	31.2615	31.2624	0.0010 (avg)	31.254
11	06:04:47	54.904	8.1903	8.1906	0.0004	4.92423	31.2384	31.2407	0.0023 (avg)	31.252
12	06:04:54	54.827	8.1936	8.1945	0.0009	4.95339	31.2321	31.2333	0.0012 (avg)	31.249

Salinity samples taken from bottles 1-12.

All of 30L bottles had come up leaking so salinity values may have been contaminated. Additionally, samples were taken at relatively shallow depths. Salinities were drawn for the purpose of using the water for Autosal training. These salinities cannot be used to check the CTD sensors on this cast.

CTD Test Cast # 3
Start: March 26, 2004 0721 GMT
End: March 26, 2004 0800 GMT
CTD/Rosette system#1 24PL 12L
Deployed Rosette/CTD ok
CTD acquisition computer ok
CTD signal ok
NMEA input ok
All sensors ok
All instrumentation ok
Altimeter detected bottom at a distance of 70Meters DAB.
All bottles tripped ok. No leakers
No data errors
Rosette/CTD safely recovered on deck

*Noticed A-Frame moving while control is off, possibly due to a problem in the hydraulic system.

On deck pressure reading 0.18

* System UpLoad Time = Mar 26 2004 07:21:44
* NMEA Latitude = 48 15.55 N
* NMEA Longitude = 123 03.71 W
* NMEA UTC (Time) = 07:21:38
** Ship: USCGC Healy
** Cruise: March 2004 Seatrials
** LAT:
** LON:
** STA#: Wet-Test 3
** DEPTH: 190m
** 24 Place, 12l rosette

Bottle	Time	PrDM	T090C	T190C	T2-T190C	ML/L	Sal00	Sal11	SecS-priS	Autosal
1	07:46:28	184.244	7.8588	7.8586	-0.0001	3.56173	32.7311	32.7342	0.0031 (avg)	32.719
2	07:46:37	184.392	7.8537	7.8570	0.0033	3.55886	32.7537	32.7412	-0.0125 (avg)	32.723
3	07:46:37	184.208	7.8544	7.8570	0.0026	3.56861	32.7509	32.7419	-0.0089 (avg)	32.722
4	07:46:55	184.171	7.8514	7.8510	-0.0003	3.53437	32.7629	32.7665	0.0036 (avg)	32.722
5	07:47:04	184.329	7.8532	7.8531	-0.0000	3.53881	32.7557	32.7581	0.0024 (avg)	32.731
6	07:47:12	184.320	7.8532	7.8530	-0.0002	3.53948	32.7554	32.7588	0.0033 (avg)	32.737
7	07:47:21	184.202	7.8535	7.8548	0.0014	3.53888	32.7541	32.7502	-0.0040 (avg)	
8	07:47:27	184.097	7.8582	7.8582	-0.0000	3.55241	32.7341	32.7366	0.0025 (avg)	
9	07:47:33	184.290	7.8577	7.8582	0.0005	3.55603	32.7365	32.7365	-0.0000 (avg)	
10	07:47:38	184.134	7.8585	7.8586	0.0001	3.56153	32.7330	32.7347	0.0016 (avg)	
11	07:47:42	184.212	7.8588	7.8589	0.0001	3.55925	32.7316	32.7337	0.0021 (avg)	
12	07:47:49	184.099	7.8595	7.8599	0.0005	3.56092	32.7293	32.7301	0.0008 (avg)	
13	07:51:26	94.858	7.9422	7.9428	0.0006	3.99898	32.2710	32.2719	0.0009 (avg)	
14	07:51:32	94.772	7.9419	7.9421	0.0003	3.99989	32.2723	32.2736	0.0013 (avg)	
15	07:51:37	94.820	7.9414	7.9418	0.0003	3.99757	32.2760	32.2749	-0.0011 (avg)	
16	07:51:48	94.930	7.9411	7.9413	0.0001	3.99524	32.2810	32.2816	0.0006 (avg)	
17	07:51:57	94.732	7.9413	7.9410	-0.0003	3.99250	32.2818	32.2850	0.0032 (avg)	
18	07:52:07	94.773	7.9414	7.9415	0.0001	3.99342	32.2839	32.2831	-0.0008 (avg)	
19	07:52:17	94.733	7.9409	7.9408	-0.0000	3.98878	32.2868	32.2880	0.0012 (avg)	32.274
20	07:52:24	94.729	7.9408	7.9407	-0.0001	3.98653	32.2923	32.2951	0.0027 (avg)	32.277
21	07:52:35	94.798	7.9405	7.9405	-0.0000	3.97836	32.2955	32.2980	0.0025 (avg)	32.272
22	07:52:43	94.837	7.9396	7.9396	-0.0000	3.97831	32.2897	32.2919	0.0022 (avg)	32.279
23	07:52:50	94.882	7.9396	7.9396	0.0000	3.98362	32.2908	32.2945	0.0037 (avg)	32.282
24	07:53:04	94.938	7.9387	7.9387	-0.0000	3.98031	32.2944	32.2963	0.0018 (avg)	32.283

Salinity samples taken from bottles 1-6 and 19-24.

Salinity samples taken at relatively shallow depths in a fast changing upper ocean layer. More casts at deeper depths are needed to take salinity samples for conductivity sensor calibration purposes.

CTD Test Cast # 4
Start: March 26, 2004 0822 GMT
End: March 26, 2004 0847 GMT
CTD/Rosette system#1 24PL 12L
Deployed Rosette/CTD ok
CTD acquisition computer ok
CTD signal ok
NMEA input ok
All sensors ok
All instrumentation ok
Altimeter detected bottom at a distance of 70Meters DAB.
All bottles tripped ok. No leakers
No data errors
Rosette/CTD safely recovered on deck

0847 GMT Launch XBT Probe T-5

On deck pressure reading 0.18

* System UpLoad Time = Mar 26 2004 08:22:14
* NMEA Latitude = 48 15.56 N

* NMEA Longitude = 123 03.71 W
* NMEA UTC (Time) = 08:22:08
** Ship: USCGC Healy
** Cruise: March 2004 Seatrials
** LAT:
** LON:
** STA#: Wet-Test 4
** DEPTH: 190m
** 24 Place, 12l rosette

Bottle	Time	PrDM	T090C	T190C	T2-T190C	ML/L	Sal00	Sal11	SecS-priS
1	08:34:48	183.230	7.8771	7.8777	0.0006	3.60848	32.6701	32.6705	0.0004 (avg)
2	08:34:55	183.185	7.8775	7.8772	-0.0002	3.62116	32.6684	32.6718	0.0034 (avg)
3	08:35:02	183.182	7.8772	7.8769	-0.0003	3.62293	32.6691	32.6727	0.0035 (avg)
4	08:35:06	183.162	7.8777	7.8784	0.0008	3.62352	32.6682	32.6689	0.0007 (avg)
5	08:35:10	183.176	7.8787	7.8785	-0.0002	3.62204	32.6655	32.6691	0.0036 (avg)
6	08:35:13	183.151	7.8785	7.8785	-0.0000	3.62776	32.6663	32.6691	0.0028 (avg)
7	08:35:18	183.134	7.8786	7.8785	-0.0001	3.62879	32.6661	32.6689	0.0028 (avg)
8	08:35:23	183.188	7.8782	7.8781	-0.0001	3.62675	32.6669	32.6698	0.0030 (avg)
9	08:35:30	183.174	7.8779	7.8778	-0.0000	3.62254	32.6680	32.6709	0.0029 (avg)
10	08:35:36	183.098	7.8776	7.8778	0.0003	3.62793	32.6688	32.6707	0.0019 (avg)
11	08:35:42	183.111	7.8776	7.8777	0.0001	3.62507	32.6686	32.6710	0.0024 (avg)
12	08:35:47	183.116	7.8772	7.8773	0.0001	3.62422	32.6697	32.6721	0.0024 (avg)
13	08:35:55	183.200	7.8754	7.8752	-0.0002	3.61867	32.6750	32.6781	0.0031 (avg)
14	08:36:00	183.147	7.8750	7.8747	-0.0003	3.61523	32.6762	32.6798	0.0036 (avg)
15	08:36:05	183.194	7.8730	7.8731	0.0001	3.61678	32.6829	32.6850	0.0022 (avg)
16	08:36:13	183.129	7.8721	7.8722	0.0001	3.60846	32.6854	32.6876	0.0022 (avg)
17	08:36:19	183.212	7.8715	7.8714	-0.0001	3.60996	32.6876	32.6905	0.0028 (avg)
18	08:36:28	183.284	7.8713	7.8714	0.0000	3.60420	32.6878	32.6903	0.0025 (avg)
19	08:36:38	183.253	7.8708	7.8711	0.0002	3.59962	32.6891	32.6909	0.0018 (avg)
20	08:36:46	183.194	7.8703	7.8710	0.0007	3.60337	32.6911	32.6914	0.0003 (avg)
21	08:36:54	183.172	7.8702	7.8699	-0.0003	3.60586	32.6915	32.6950	0.0036 (avg)
22	08:37:03	183.161	7.8699	7.8699	0.0001	3.60402	32.6926	32.6950	0.0024 (avg)
23	08:37:11	183.081	7.8700	7.8700	0.0000	3.60515	32.6919	32.6943	0.0024 (avg)
24	08:37:19	183.207	7.8697	7.8696	-0.0001	3.60063	32.6927	32.6957	0.0030 (avg)

No salinity samples taken.

After cast 4 the bottles were left full of water overnight. The next day the water level in each bottle was checked to determine if there was any long term leakage. There was no detectable leakage found in any of the bottles. Spigots were opened with vents closed to check the seal of the top cap. All bottles checked ok.

5. XBT System

Discovered improper ground connection on the handheld launcher junction box. There is no ground wire from seawater (ship's hull) ground connected to the ground point connection on the Sippican junction box. Instead the ground is coming from the NMEA signal return line on the XBT PC's com port. When the NMEA connection is removed the XBT system fails to operate. According to Sippican the XBT ground connection must be made to seawater ground. A proper ground point needs to be installed on the handheld launcher connection. The aft thru-hull launcher has a ground strap connected at the launcher.

XBT system tested normally when using T-7 XBT probes. Several tests were performed with normal results. However, when testing the system using XCTD-1 test canister the acquisition program occasionally hangs up and sometimes the computer crashes. A program (DR. Watson) was found running in the background. This process was removed. Without this application running

the XBT acquisition program operates normally with the XCTD-1 probe. No more crashes were observed.

Performed precruise calibration check by inserting a T-7 XBT, loaded into the hand launcher, into a calibration tank filled with salt water. Temperature readings were compared to an SBE35 secondary reference standard.
At the same time CTD #0639 Primary and secondary temperatures were compared. The hand-held launcher was used with a T7 probe. These readings were obtained after a temporary seawater ground strap was placed at the launcher connection box. Measurements were not taken using the original ground path from the NMEA signal return line as per above.

SBE35 Temperature	T7 064312 Temperature	Difference	CTD 0639 T1	CTD 0639 T2
17.835	17.82	0.01	17.835	17.835
17.813	17.80	0.01	17.813	17.813

During the CTD casts XBTs were dropped. The following table shows how the XBT compares to the CTD.
CTD Cast #2 using rosette System #1 XBT Probe T-7 Drop T7_00177
CTD start 0530 END 0610 XBT Start 0613

Pressure	CTD T1	CTD T2	XBT
5.4	8.254	8.254	8.27
20.0	8.228	8.228	8.22
40.0	8.171	8.171	8.22
60.0	8.130	8.130	8.19
80.0	8.072	8.072	8.10
100.0	7.949	7.951	7.97
120.0	7.925	7.925	7.93
140.0	7.883	7.883	7.91
160.0	7.883	7.883	7.89

CTD Cast #4 using rosette System #2 XBT Probe T-5 Drop T5_00177
CTD start 0822 END 0845 XBT Start 0835

Pressure	CTD T1	CTD T2	XBT
4.8	8.264	8.261	8.36
20.0	8.241	8.236	8.29
40.0	8.196	8.197	8.25
60.0	8.071	8.071	8.16
80.0	8.030	8.030	8.02
100.0	7.968	7.963	7.99
120.0	7.936	7.932	7.97
140.0	7.916	7.916	7.95
160.0	7.915	7.914	7.93

Recommendations:

1. **Connect ground strap to seawater ground on Sippican connection box on the handheld launcher as per installation manual.**
2. **Suggest installing an RS232 Optical isolator on the PC Comm port used to input NMEA data. This will ensure only one ground point.**

6. Thermosalinographs and Flo-thru systems

6.1 Thermosalinographs

There are two thermosalinograph's (TSG). The forward thermosalinograph, #1864, is located in the BIO-CHEM lab. It is considered the primary thermosalinograph as it continuously monitors the uncontaminated seawater(UCW) line. The UCW flows through a Vortex debubbler before going to the SBE21. The aft thermosalinograph, #3107, is located in the aft Fueling Hose Room. This TSG is used only when an intake hose is deployed out the aft end of the ship. An Air Operated Pump, (AOP), then pumps the water through a Vortex debubber and TSG. The flow rate to the AFT TSG has been measured at 5.0 LPM.

Description	**MFG**	**Model**	**Serial no.**	**Cal Date**
Thermosalinograph	**Seabird**	**SBE21**	**219266 -1864**	**21-Nov-03**
Thermosalinograph	**Seabird**	**SBE21**	**2125795-3107**	**22-Nov-03**
Bow Intake Temperature	**Seabird**	**SBE03**	**031838**	**22-Nov-03**
New UCW Intake Temperature	**Seabird**	**SBE03**	**034469**	**unknown**

Both TSG's are operational. Each TSG acquisition computer runs Seabird Seasave software to acquire data. This computer then transmits the data to the central SCS acquisition system.

SBE21 #1864 has firmware version 3.1K
SBE21 #3107 has firmware version 4.06

The command set between the two firmware versions are slightly different. TSG 3107 can be set to autorun on power up. TSG1864 needs to be started using startup commands.

Performed precruise calibration check by inserting the sensors into a calibration tank filled with salt water. Temperature readings were compared to an SBE35 secondary reference standard. Salinity samples were taken at the same time the conductivity readings were recorded. Samples were analyzed on the autosal.

SBE21 #1864

SBE35 Temperature	3107 Temperature	Temperature Difference	3107 Conductivity	3107 Salinity	Autosal Salinity	Salinity Difference
17.698	17.696	0.002	3.8370	28.872	28.874	-0.002

SBE21 #3107

SBE35 Temperature	3107 Temperature	Temperature Difference	3107 Conductivity	3107 Salinity	Autosal Salinity	Salinity Difference
17.729	17.729	0.0	3.8391	28.865	28.874	-0.010

The software on the Forward and AFT TSG acquisition computers has been updated from the previous version 5.27.

Current version (after update 03-22-04):
Seasave 5.30b
Processing 5.30a
SeaTerm 1.44

Forward TSG System Notes:

1. Changed data output interval rate from 6 seconds to 10 seconds to reduce occasional data glitches that can sometimes occur if an SBE21 Interval is set at or near it's fastest possible data rate.
2. On the existing seawater system the intake temperature sensor is a SBE03S s/n 1838. On the new seawater system located in the motor room the intake temperature sensor is a SBE03 s/n 4469.
3. There is no flowmeter on this system.
4. There are no anti-foulant devices installed.

AFT TSG System Notes:

1. Changed data output interval rate from 6 seconds to 10 seconds.
2. The SCUFA Fluorometer had previously been plumbed into this system. The output signal was connected to the SBE21 A/D channel 1.
3. There is no flowmeter on this system.
4. There is no remote temperature sensor.
5. There are no anti-foulant devices installed.
6. The measured flow rate to the AFT TSG is 5 Liters Per Minute(LPM). Seabird recommends a flow rate of 60 LPM.

As noted above, there are no anti-foulant devices installed. These devices help keep marine growth from forming in the conductivity cell. Such growth can change the calibration of the cell over a short period of time. It is recommended that these devices be installed. However, one must be aware that these devices are poisonous. Proper handling procedures must be used which includes wearing gloves. Furthermore, there must be no instrumentation plumbed into the outflow of the thermosalinograph – especially fluorometers.

On an SBE21 it is difficult to tell by looking at the data output if the SBE21 is getting proper flow from the Science seawater system. If the water system is off, the SBE21 can still see water that is setting in it's tank. Suggest adding a flowmeter so that data people can tell if the TSG readings are valid or not if the pump is shut down or if there is water in the line.

Recommendations:

1. **Install anti-foulant devices in both thermosalinograph units. Install one device on each end of the conductivity cell per SBE Application Note 70 using Seabird part no. AF24173**
2. **Install flowmeter in the intake plumbing near the SBE21 and integrate water flow data with thermosalinograph data.**

6.2 Debubblers (Flo-thru system)

Debubbler, Vortex	**MSRC**	**VDB-1F**	**None**	**#1 Bio-Chem lab**
Debubbler, Vortex	**MSRC**	**VDB-1F**	**None**	**#2 Bio-Chem Lab**
Debubbler, Vortex	**MSRC**	**VDB-1F**	**None**	**Aft Hose Room**

There are two Vortex debubblers in the BIO-Chem lab. Each one is fed from the UCW intake line. The output of Vortex debubbler #1 feeds the SBE21 thermosalinograph. The output of the Vortex debubbler #2 feeds the Turner 10-AU-005 Fluorometer.

In the aft Hose Room a vortex debubbler feeds the aft SBE21 thermosalinograph.

All three debubblers checked out operational.

6.3 Fluorometers (Flo-thru system)

There are two fluorometers that can measure surface seawater fluorescence while underway.

Fluorometer	**Turner Designs**	**10-AU-005**	**5590-FRXD**	**Bio-Chem**
Fluorometer	**Turner Designs**	**SCUFA**	**0299**	**Bio-Chem (after March 04)**

The Turner 10-AU fluorometer is installed in the Bio-Chem lab. The cell was removed from the Turner 10-AU-005 and cleaned. The cell was reinstalled and the fluorometer was checked for operation. This fluorometer is fed from the output of vortex debubbler #2.

The SCUFA fluorometer was installed in the aft Hose Room in the outflow of the vortex debubbler in the aft room.
A second Turner SCUFA fluorometer was placed on order but this unit has not yet been received. This new unit was to have been installed in the Bio-Chem lab.
Therefore, It was decided to relocate the SCUFA that was located in the aft TSG system and move it to the Bio-Chem lab. The SCUFA was installed on the outflow of the same debubbler (Vortex debubbler #1) that feeds the intake of the fwd SBE21 thermosalinograph. A Tee was installed on the output of Vortex debubbler #1. One side of the Tee goes to the SBE21, the other side goes to the SCUFA. A ball valve was installed on the intake of the SCUFA to allow adjusting the flow through the fluorometer. The outflow of the SCUFA goes into the drain.

The SCUFA was checked for operation. The SCUFA was found to be non-operational. Further testing revealed that there is an internal short between the power and ground pins.

Recommendation:
Return SCUFA to Turner labs for repair and calibration.

7. Science Seawater System

The Science Seawater System was tagged secured during the sea trials. Therefore, none of the planned checks were performed.

Appendix A CTD Spare Parts Inventory

LOCATION - Forward VIDMAR A Bottle Repair Parts Drawer 4			
Universal Spares Kit for 2L, 5L and 12L sample botles -	50135	20	Kits have buna-N O-rings and black elastic surgica tubing spring band material. ** Check shelf-life of surgical tubing
Copper fish line crimps for 1mm to 2mm line		3000	Approximate count
#0 Brass snap hooks		20	Approximate count
Vent cap O-rings - silicon	312	120	Approximate count w/ 20 used in separate bag
Bottle end cap O-rings for 2L, 5L, and 12L sample bottles	336	140	Approximate count w/ 40 used in separate bag
Small spigot O-rings - silicon	A-012	100	
Lanyard balls	30773	100	Approximate count
Trimmer line 1500 ft. of 0.080 in. line	30665	4 spools - not all full. Used for bottle lanyards.	
Bottle springs		6	External spring - two required per side of 30l bottle - one required per side of 12l bottle.
LOCATION - Forward VIDMAR A Cables Drawer 3			
RMG-2FS-HP pigtail	17027	6	SBE Sea cable pigtail
RMG-2FS to RMG-2FS cable	17133	3	SBE cable
RMG-3FS to RMG-3FS cable	17086	10	SBE temp/ cond sensor cable
AG-206 WYE to IL-4FS and IL-4FS	17871	2	SBE Y cable to dual Chelsea Fluorometers
AG-206 to AG-206	171099	1	SBE Sea Point fluorometer cable
AG-206 WYE to VMG-4FP and VMG-4FP	17178	2	SBE WetLabs fluorometer & transmissomter dual cable
AG-206 to AG-206	17198	4	SBE Carousel cable
RMG-3FS 2m pigtail	17030	2	SBE pigtail
RMG-2FS to RMG-2MP cable	171090	1	SBE sea cable extension cable
RMG-2FS WYE to RMG-2FS and RMG-2FS	17799	3	SBE Pump Y cable
RMG-2FS WYE to RMA-FS and RMA-FS	171510	4	SBE Sea Cable w/ RMA single pin connectors to winch cable
RMA-MP	17381	42	2 ft. pigtails
RMA-FS	17725	20	15 ft. pigtails
RMG-4FS 2m pigtail	17031	1	SBE21 Pigtail
AG-206 to VMG-4MP	17876	2	SBE to WetLabs fluorometer or Transmissometer
AG-206 to RMG-4FS	17546	3	SBE13 Oxygen sensor cable OBSOLETE SENSOR)
Bendix 2pin to RMG-2FS	80591	3	SBE deck unit to fish test cable
AG-206 to IL-4FS	17602	3	Chelsea fluorometer cable
IL-4 pigtail N/A		2	Chelsea fluorometer pigtail

RMG-6FS pigtail	N/A		2	Benthos 916 Altimeter pigtail
AG-206 to RMG-6FS		171130	2	Benthos 916 Altimeter cable
IL-6 to IL-6 21m cable	N/A		1	Unknown cable
LOCATION - Forward VIDMAR A Assorted CTD and Sensor Hardware Drawer 2				
SBE32 24-Place Installation Hardware Kit		50163	2	
SBE32 24-Place Spare Hardware Kit		50116	2	
SBE9/9 Plus Universal Hardware Kit		50024	2	
SBE32 24-place, Cage Flange		23715	8	
SBE9/9 Plus hoseclamp insulation tape		30409	3	
SBE9 Cage Clamp part. B		23756	6	
Dissolved Oxygen Hose Clamp		30041	5	
SBE32 Cage U-bolt		23714	6	
SBE25 Dual Sensors Retainer Strap		23385	3	
O-Ring Lube Silicon grease		30457	2	
Conductivity Disconnect O-Ring		50246	18	
SBE9 Universal O-Ring Kit		50070	5	
SBE21 Termosal O-Ring Spares Kit		50010	2	
Pressure Sensor Capillary Assembly		50029	3	
SBE9 02 CTD O-Ring Spares Kit		50015	1	For SBE-13 OBSOLETE PART
SBE9 Universal Hardware Kit (carousel)		50024	1	
SeaCat-Anode		30044	12	Also for SBE 32 carousel and SBE 9
Zinc Anode Ring, WBO		23548	3	4C conductivity sensor
Anode Ring, WBO		23041	3	3C temperature sensor
SBE32 Large Bail Insulator		23922	2	
SBE32 Large Bail Insulator		23923	2	
Cable Tie, 4"		30389	20	
Cable Tie, 15"		30458	10	
LOCATION - Forward VIDMAR A Computer Board/ Wiring Kits/ Plugs Drawer 1				
Male Dummy Plug LP		17171	2	
RMG-2MP Dummy Plug HP		17172	7	
RMG-3MP Dummy Plug HP		17173	6	
RMG-4MP Dummy Plug HP		17174	12	
AG-206MP Dummy Plug HP		17175	8	
Connector, 6 pin female dummy, AG206-FSD-LP		17047	14	
Plastic Connector Locking Sleeve		17043	13	

Plastic Sensor protective cap	17420	15	
SBE11 NMEA interface cable	80877	2	w/DB25 connectors
NMEA Deck unit amphenol connector	17315	2	2 pin female
Amphenol locking collar	17316	2	Use with SBE Part No's.:17315 and 50086
Amphenol connector insulating sleeve	17317	2	Use with SBE Part No's.:17315 and 50086
SBE11 NMEA input connector kit	50173	15	Combines one each: 17315, 17316, 17317
SBE11 Sea Cable interface kit	50086	18	Deck unit sea cable connectors
Plastic Locking Sleeve male	17888	13	
Connector, RMG-2-FSD-LP, 2 pin female dummy	17044	7	
Connector, 3 pin female dummy, RMG-3-FSD-LP	17045	2	
SBE9-?? Interface Board	801084	1	
SBE11plus Multi-Water Sampler Modem Card	80673	1	
SBE9 AP Counter Card	80609	1	
SBE9 plus Logic Card	80621	1	
SBE9 ?? Interface Board	80581	1	
SBE9 ?? Interface Board	801017	1	
SBE9 ?? Interface Board	80935	1	
SBE9 A/D Card	801042	1	
SBE11 NMEA Interface cable	80687	1	
SBE11 Modem Interface cable	80719	1	
Connector, 6 pin blkhd, 1/2-20, AG306-HP-SS-1	17628	3	
Connector, 2 pin blkhd, 1/2-20, XSG-2BCL-HP-SS	17652	3	
Connector, 3 pin blkhd, 1/2-20, XSG-3BCL-HP-SS	17653	6	
SBE11 NMEA Interface Bulkhead mount kit	80932	2	