SEA-BIRD ELECTRONICS, INC.
13431 NE 20th St. Bellevue, Washington 98005 USA
Phone: (425) 643-9866 Fax: (425) 643-9954 www.seabird.com

Service Report

RMA Number: 89690

Customer Information:

Company	WEBB RESEARCH CORPORATION	Date	6/30/2016
Contact	CHARLES STILL		
PO Number	PW05088		

Serial Number	SLOCUM-9086
Model Number	SLOCUM

Services Requested:

1. Evaluate/Repair Instrumentation.
2. Perform Routine Calibration Service.

Problems Found:

1. bad endcap. Anodizing in poor condition and damaged screw hole.

Services Performed:

1. Performed initial diagnostic evaluation.
2. Calibrated the pressure sensor.
3. Performed "Post Cruise" calibration of the temperature & conductivity sensors.
4. WEBB PAYLOAD CTD, ENDCAP, HARDCOATED
5. Performed complete system check and full diagnostic evaluation.

Special Notes:

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SENSOR SERIAL NUMBER: 9086
CALIBRATION DATE: 21-Jun-16

Slocum Payload CTD CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

g = -9.812300e-001	CPcor = -9.5700e-008
h = 1.373538e-001	CTcor = 3.2500e-006
i = -3.060588e-004	WBOTC = 1.1824e-006
j = 4.070468e-005	

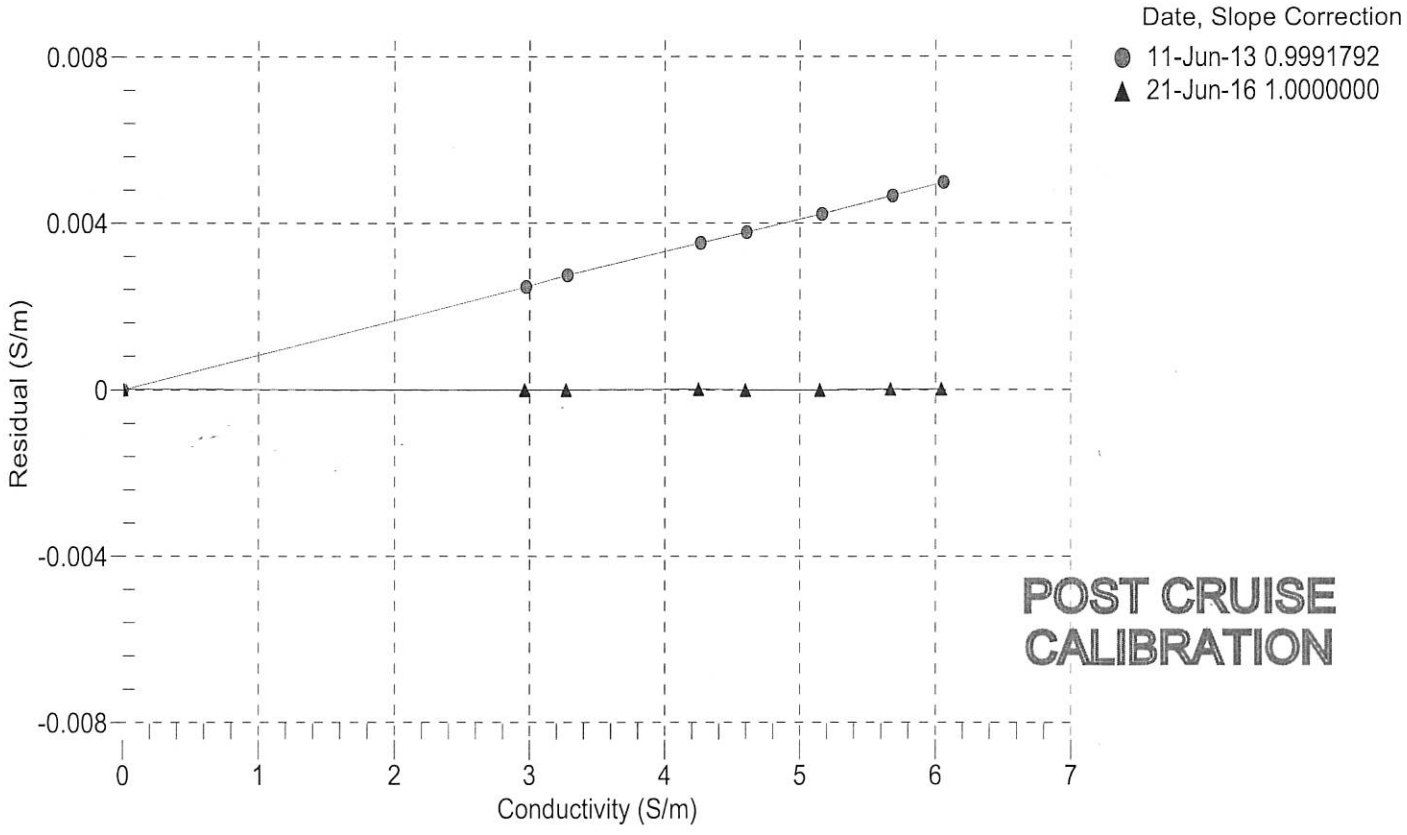
BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (Hz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
22.0000	0.0000	0.00000	2677.91	0.00000	0.00000
1.0000	34.6915	2.96631	5370.16	2.96631	-0.00000
4.5000	34.6717	3.27242	5573.92	3.27242	-0.00000
15.0000	34.6294	4.25110	6179.68	4.25112	-0.00001
18.5000	34.6208	4.59522	6378.72	4.59522	-0.00000
24.0000	34.6115	5.15152	6687.64	5.15151	-0.00001
29.0000	34.6070	5.67188	6963.88	5.67188	0.00000
32.4999	34.6052	6.04332	7154.32	6.04332	0.00000

f = Instrument Output(Hz) * sqrt(1.0 + WBOTC * t) / 1000.0

t = temperature (°C); p = pressure (decibars); δ = CTcor; ε = CPcor;

Conductivity (S/m) = $(g + h * f^2 + i * f^3 + j * f^4) / 10 (1 + \delta * t + \varepsilon * p)$

Residual (Siemens/meter) = instrument conductivity - bath conductivity



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SENSOR SERIAL NUMBER: 9086
CALIBRATION DATE: 21-Jun-16

Slocum Payload CTD TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

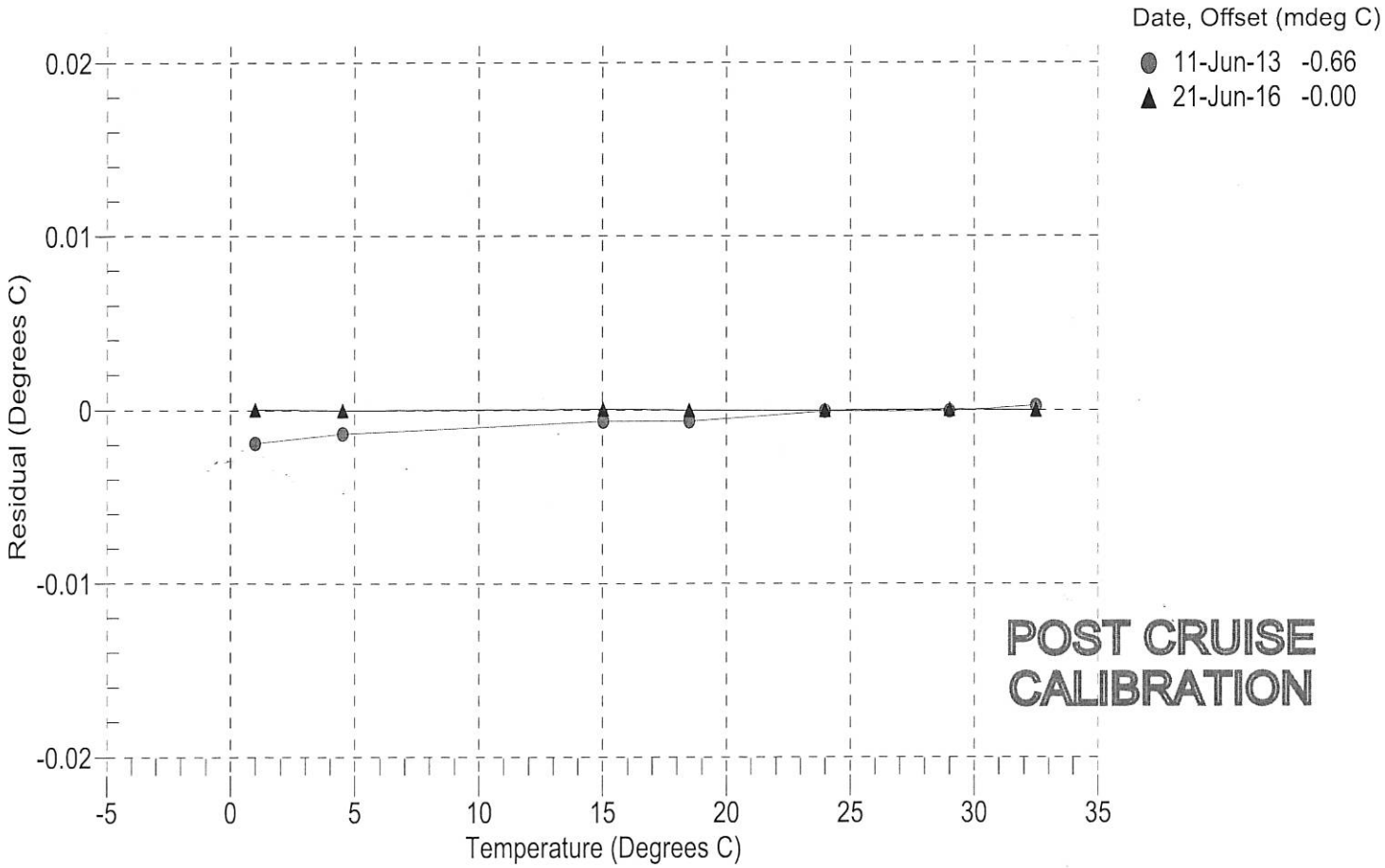
a0 = -1.080080e-004
a1 = 3.093869e-004
a2 = -4.762222e-006
a3 = 2.092634e-007

BATH TEMP (° C)	INSTRUMENT OUTPUT (counts)	INST TEMP (° C)	RESIDUAL (° C)
1.0000	578912.5	1.0000	0.0000
4.5000	494828.2	4.5000	-0.0000
15.0000	315156.3	15.0000	0.0000
18.5000	272858.0	18.5000	-0.0000
24.0000	218870.4	24.0000	-0.0000
29.0000	180221.2	29.0000	0.0000
32.4999	157832.9	32.4999	-0.0000

n = Instrument Output (counts)

Temperature ITS-90 (°C) = $1/\{a0 + a1[ln(n)] + a2[ln^2(n)] + a3[ln^3(n)]\} - 273.15$

Residual (°C) = instrument temperature - bath temperature



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SENSOR SERIAL NUMBER: 9086
CALIBRATION DATE: 16-Jun-16

Slocum Payload CTD PRESSURE CALIBRATION DATA
1450 psia S/N 3846545

COEFFICIENTS:

PA0 =	-3.057858e-001	PTCA0 =	5.237789e+005
PA1 =	4.592741e-003	PTCA1 =	-3.856183e+000
PA2 =	-1.860757e-011	PTCA2 =	3.913964e-002
PTEMPA0 =	-7.712954e+001	PTCB0 =	2.536613e+001
PTEMPA1 =	5.087796e-002	PTCB1 =	-1.750000e-004
PTEMPA2 =	-6.304203e-007	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE (PSIA)	INSTRUMENT OUTPUT (counts)	THERMISTOR OUTPUT (volts)	COMPUTED PRESSURE (PSIA)	RESIDUAL (%FSR)
14.64	526966.0	2017.0	14.65	0.00
315.00	592681.0	2027.0	316.42	0.10
614.88	657713.0	2028.0	614.90	0.00
914.88	723098.0	2030.0	914.84	-0.00
1215.09	788553.0	2030.0	1214.94	-0.01
1464.88	843097.0	2030.0	1464.90	0.00
1214.92	788573.0	2030.0	1215.03	0.01
914.93	723127.0	2030.0	914.97	0.00
614.92	657719.0	2030.0	614.93	0.00
314.93	592349.0	2029.0	314.90	-0.00
14.64	526965.0	2031.0	14.65	0.00

THERMAL CORRECTION

TEMP (°C)	THERMISTOR OUTPUT (volts)	INSTRUMENT OUTPUT (counts)
32.50	2216	527012.20
29.00	2143	527016.40
24.00	2039	527023.80
18.50	1926	527038.60
15.00	1853	527046.10
4.50	1638	527080.50
1.00	1566	527090.40

TEMPERATURE (°C)	SPAN (mV)
-5.00	25.37
35.00	25.36

y = thermistor output (counts)

$t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$

$x = \text{instrument output} - PTCA0 - PTCA1 * t - PTCA2 * t^2$

$n = x * PTCB0 / (PTCB0 + PTCB1 * t + PTCB2 * t^2)$

$\text{pressure (PSIA)} = PA0 + PA1 * n + PA2 * n^2$

Residual (%FSR) = (computed pressure - true pressure) * 100 / Full Scale Range