

# RV Langseth Data Reduction Summary

MGL2105 Queen Charlotte Fault  
Leg 1

**Dr. Lindsay Worthington**

V1.0 2021-10-16  
Lamont-Doherty Earth Observatory, Columbia University

**16 July 2021**

Date	Day of Year	Time	Port
2021-07-16	196	08:30 UTC	Seattle, Washington
2021-08-23	235	17:30 UTC	Ketchikan, Alaska

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## Table of Contents

Table of Contents .....	4
I. Background and Scientific Objectives (excerpts from the Science Support Plan).....	6
Cruise Overview .....	6
III. Instrumentation Summary.....	12
IV. Seismic Summary .....	18
A. Acquisition Parameter Table.....	18
V. RV Langseth Gravity Tie Information.....	21
VII. Data Formats .....	23
Gravimeter data.....	23
CNAV GPS receiver data .....	23
\$GPVTG, xxx.x, T,, M, m.mm, N, n.nn, K*hh .....	23
\$GPGGA,hhmmss.ss, ddm. mmmmm, a, ddm. mmmmm, a, x, xx, x.x, xx.xx, M, xx.xx, M, x.x, xy*hh.....	24
CNAV 3050 GPS receiver data .....	25
\$GPVTG, xxx.x, T,, M, m.mm, N, n.nn, K*hh .....	25
\$GPGGA,hhmmss.ss, ddm. mmmmm, a, ddm. mmmmm, a, x, xx, x.x, xx.xx, M, xx.xx, M, x.x, xy*hh.....	26
EM122 Center Beam Depth.....	26
Furuno GC80 Gyroscope data .....	27
\$PTKM,HEALM,xxxx,x,xx*hh .....	27
\$HEHDT,xxx.x,T*hh.....	27
\$HEROT,-xxx.x,A*hh.....	27
Geometrics 882 Magnetometer Data .....	27
OBSIP Shotlog Format .....	29
Shot records are in the following format: .....	29
POS/MV Inertial Navigation System.....	30
\$INGGA, hhmmss.sss, lll.llll, a, yyyyy.yyyyy, b, t, nn, v.v, x.x, M,,c.c,rrrr*hh .....	30
\$INHDT, x.x, T*hh.....	31
\$INVTG, x.x, T,, M, n.n, N, k.k, K*hh .....	31
\$INGST, hhmmss,sss,,smjr.smjr,smnr.smnr, o.o, l.l, y.y, a.a *hh.....	32
\$PRDID, PPP.PP, RRR.RR, xxx.xx*hh .....	32
\$INZDA, hhmmss.ss, DD, MM, YYYY,, *hh .....	33
Seabird SBE-45 Thermosalinograph Data.....	33
SEAPATH 330 Inertial Navigation System .....	34
\$INGGA, hhmmss.sss, lll.llll, a, yyyyy.yyyyy, b, t, nn, v.v, x.x, M,,c.c,rrrr*hh .....	34
\$INHDT, x.x, T*hh.....	35
\$INVTG, x.x, T,, M, n.n, N, k.k, K*hh .....	35
\$INZDA, hhmmss.ss, DD, MM, YYYY,, *hh .....	35
DS 80 Speed log data.....	36
\$VHW,x.x,T,x.x,M,x.x,N,x.x,K*hh .....	36
\$VBW,x.x,x.x,A,x.x,x.x,A*hh .....	36

AML Oceanographic Micro-X XChange Sound Velocity Probe Data ..... 37

Seabird SBE38 Thermometer Probe Data ..... 37

Vaisala Ultrasonic Meteorological Station Data..... 37

VIII. Log file(s) Descriptive ..... 40

    BirdLogs ..... 40

    Daily\_Reports ..... 40

    GunLogs..... 40

    NavLogs..... 40

    Seismic\_Support\_Plan ..... 40

    Seal\_Report..... 40

    Standing\_orders ..... 40

    StreamerSheets..... 40

**I. Background and Scientific Objectives (excerpts from the Science Support Plan)**

**Cruise Overview**

The Queen Charlotte Fault Project will consist to two separate legs. The first leg, MGL21-05 is a two-ship operation with R/V Langseth conducting MCS operations with long-offset 2D streamer while the Canadian Coast Guard vessel, John P. Tully, deploys/retrieves short period Ocean Bottom Seismometers (OBS). Data acquisition will occur within ~52–56.5°N, ~-131–137°W. This leg will mobilize out of two locations with Langseth coming from Seattle, WA and the Tully mobilizing out of Port Angeles, WA. Both are due to depart on July 17<sup>th</sup> from respective ports. Leg 1 for the Langseth is ~38 at sea days with Tully schedule estimated at ~24 at sea days. Chief Scientist/PI for the Langseth will be Lindsay Worthington (Univ. of New Mexico) and Chief Scientist/PI’s for Tully will be Emily Roland (Univ. of Western Washington) and Maureen Walton (USGS).

The second leg of the QCF Project, MGL21-06, is an OBS Broadband deployment cruise from the R/V *Langseth*, in the SE Gulf of Alaska. The proposed 28 OBS deployments would occur within ~55-56°N, ~134.5–135.5°W

. This is a ~7-day cruise from Ketchikan, AK with return transit to Seattle, WA for demobilization. LDEO technicians will support this project and 5 OBS technicians will also sail from OBSIC in support of the OBS broadband deployment.

Other supporting equipment shall consist of a Kongsberg EM122 Multibeam echo sounder, Knudsen 3260 3.5 kHz Sub-Bottom Profiler, Bell Aerospace BGM-3 gravimeter, the RDI 75 kHz Acoustic Doppler Current Profiler (ADCP). LDEO will ensure that the equipment in use meets the manufacturer’s specifications, and also meets internal quality requirements. The technicians onboard are proficient in the operations of standard systems but are not experts.

**LEG #1**

<b>Cruise Date: July 17 to August 24, 2021</b>	<b>Total Days Departure to Arrival: 38</b>
<b>Departure Port (July 17): Seattle, WA</b>	<b>Arrival Port (Aug 24): Ketchikan</b>
<b>Seismic Source: 6600 cubic inches</b>	<b>Total Sail Kilometers of Source Data:</b>
<b>Seismic Streamer Length: (15km)</b>	<b>OBSs – From Tully- ~45 to deploy</b>
<b>Source Depth (12m) ; Shot spacing; (50 m)</b>	<b>Geometrics 882 Magnetometer (NA)</b>
<b>EM122 12kHz Multibeam</b>	<b>Bell Aerospace BGM3 Gravimeter</b>
<b>Knudsen 3.5 kHz SBP</b>	<b>RDI ADCP</b>

The QCF system is a ~1200-km-long onshore-offshore transform system connecting the Cascadia and Alaska-Aleutian subduction zones. The QCF is the ~900 km-long offshore component of the transform system, and the fault accommodates >50 mm/yr of dextral strike-slip motion between the Pacific and North American tectonic plates. This project would characterize ~450-km segment of the fault that encompasses systematic variations in key parameters in space and time: 1) changes in fault obliquity relative to Pacific-North American plate motion leading to increased convergence from north to south; 2) Pacific plate age and theoretical mechanical thickness decrease from north to south; and 3) a shift in Pacific plate motion at ~12-6 Ma that may have increased convergence along the entire length of the fault, possibly initiating underthrusting in the southern portion of the study area. Current understanding of how these variations are expressed through

seismicity, crustal-scale deformation, and lithospheric structure and dynamics is limited due to lack of instrumentation and modern seismic imaging.

The main goal of the seismic program proposed by University of New Mexico and Western Washington University is to characterize crustal and uppermost mantle velocity structure, fault zone architecture and rheology, and seismicity of the QCF. To achieve the project goals, the Principal Investigators (PI) Drs. L. Worthington (University of New Mexico) and E. Roland (Western Washington University) propose to utilize long-offset 2-D seismic reflection and wide-angle reflection-refraction capabilities of R/V *Langseth* and a combined U.S.-Canadian broadband OBS array.

### MGL2105 map of operations



## II. Personnel

### Shipboard Technical Staff

Participant	Group/Affiliation	Position
Todd Jensvold	LDEO	Chief Science Officer
Josh Kassinger	LDEO	Chief Source Mechanic
Cody Bahlau	LDEO	Technician
Giles Guerin	LDEO	Technician
Michael Coutal	Contractor	Mechanic
Alaskar Suleymanov	Contractor	Navigation
Mark Walker	Contractor	Compressor/Mechanic
Ray Hatton	Contractor	Mechanic
Klayton Curtis	Contractor	Navigation

### Ship's Crew

1	Wolford, David H.	Master
2	Bethlen, Christian A.	Chief Mate
3	Woronowicz, Jason J	2nd Mate
4	Bommer, Christian	3rd Mate
5	Cohan, Sean	3rd Mate
6	Cereno, George G.	Bosun
7	Robison, William J.	AB
8	White, Joselyn N.	AB
9	Hammond, Robert D.	Oiler
10	Woods, Shayna	OS
11	Tucke, Matthew S.	Chief Engr.
12	Romero, Michael A.	1st Asst. Engr.
13	Lear, Garret	2nd Asst. Engr.
14	Sebach, Stefan	3rd Asst. Engr.

15	Florendo, Rodolfo A.	Oiler
16	Davis Jr., Steven P.	Oiler
17	McLean-Fuller, Hervin	Steward
18	Martires, Leoncio R.	Cook

**PSO**

<b>Participant</b>	<b>Group/Affiliation</b>	<b>Position</b>
Cassandra Frey	RPS	Lead PSO
Eren Penfield	RPS	PSO
Evana Douglas	RPS	PSO
Lilia Perez	RPS	PSO
Jillian Daniel	RPS	PSO

**Science Party**

	<b>Participant</b>	<b>Group/Affiliation</b>	<b>Function</b>	<b>Gender</b>	<b>Email Address</b>
1	Lindsay Worthington	UNM	PI	F	lworthington@unm.edu
2	Gary Greene	USGS	Sr. Sc	M	<a href="mailto:greene@mlml.calstate.edu">greene@mlml.calstate.edu</a>
3	Ben Phrampus	US NRL	Sr. Sc	M	<a href="mailto:benjamin.phrampus@nrlssc.navy.mil">benjamin.phrampus@nrlssc.navy.mil</a>
4	Sarah Nolt-Caraway	UNM	Scientist	F	san264@unm.edu
5	Olumide Adedeji	UNM	Scientist	M	oadedeji@unm.edu
6	Pinar Gurun	Dalhousie U	Scientist	F	pn913293@dal.ca
7	Lazaro Garza	WWU	Scientist	M	lazarovgarza@ucsb.edu

### III. Instrumentation Summary

All science instruments aboard the Langseth are listed below with data formats in section VII. Summary notes on operation during this cruise are listed below. Seismic equipment is not listed here; refer to Part IV for the seismic summary.

#### Instrument Data Files

Instrument	Description	Data Set	Data Outputs	Files	Interval
EM122	Kongsberg EM122 Multibeam Sonar	Full	Center beam data	MGL-bath02.*	variable
KNUDSEN	Knudsen Engineering 3260 Sub-bottom Profiler	Full	KEA, KEB, SEG-Y	See below	variable
DS80	Furuno DS80 Doppler Speed log	Full	serial logs	MGL-slog01.*	1s
XBT/XCTD	Sippican MK21 XBT/XCTD Launcher	16 drops	raw output to file	See below	n/a
TSG	SeaBird SBE45 Thermosalinograph	Full	raw serial logs	MGL-tsgraw.*	1s
CNAV	C&C Tech. CNAV 2000 DGPS Receiver	Full	serial logs	MGL-cnav.*	1s
CNAV3050	C&C Tech. CNAV 3050 DGPS Receiver	Full	serial logs	MGL-cnav3050all.*	1s
MAG01	Geometrics 882 Magnetometer	On deploy	serial logs	MGL-mag01.*	1s
BGM	Bell Aerospace BGM-3 Gravimeter	Full	serial logs	MGL-vc01.*	1s
GYRO	Simrad GC80 Gyrocompass/AD100	Full	serial logs	MGL-gy01.*	1s
POSMV	POSMV Inertial Navigation System	Full	serial logs	MGL-posmv*	1s
SEAPATH	Seapath 330 Inertial Navigation System	Full	serial logs	MGL-seapath.*	1s
MICROSV	Applied Microsystems Sound Velocity USS Unit	Full	serial logs	MGL-svuss01.*	1s
ADCP	RDI OS 75 Current Profiler	Full	serial logs	MGL-adcp.*	variable
Vaisala1	Vaisala WXT-520 Ultrasonic Weather Station	Full	serial logs	MGL-vaisala1.*	1s
Vaisala2	Vaisala WXT-520 Ultrasonic Weather Station	Full	serial logs	MGL-vaisala2.*	1s

All timestamps in this report are presented using UTC time and day of year in order to avoid confusion with local time changes.

## Science Navigation Instrumentation

### EM-122 Multibeam

The EM122 multibeam sonar was operated throughout the cruise. The system is designed for deeper water, and does not track ground well in less than 50m of water.

EM122 swath data is saved to the cruise archive under MGL2105/raw/multibeam. Center beam depth is recorded separately to serial log. A daily built in self test (BIST) is done on the EM122 at which time logging of data is secured. Data gaps are approximately 8-12 minutes in duration, and every effort is made to schedule them during turns or areas where coverage already exists. See MGL2105/docs/elog for times and durations of tests.

**File id:** bath02

**Logging interval:** variable with water depth

bath02 data format:

bath02	2008:192:00:00:12.6663	\$KGDPT,2938.25,0.0,12000.0*4a
bath02	2008:192:00:00:30.3301	\$KGDPT,2954.08,0.0,12000.0*4f

### Knudsen Engineering 3260 Sub-bottom Profiler

The Knudsen 3260 is a chirp echosounder/sub-bottom profiler.

**File id:** n/a

**Logging interval:** Variable with water depth

The Knudsen 3260 is a chirp echosounder/sub-bottom profiler. It was in operation for the length of the cruise. Data written in proprietary KEB, KEA, and converted to SEG Y format (if requested). Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

### DS80 Speedlog

The Furuno DS-80 is a Doppler speed log. It was in operation for the duration of the cruise.

**File id:** slog01

**Logging interval:** 1 second

slog01 data format:

slog01	2008:231:00:00:00.0744	\$VDVHW,,T,,M,09.68,N,17.93,K*4C
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slog01	2008:231:00:00:00.1906	\$VDVBW,009.68,000.09,A,009.68,000.09,V*46
slog01	2008:231:00:00:00.1908	\$VDVLW,0005960.30,N,0005960.30,N*5F

**CNAV2000**

The C-NAV is a global satellite-based differential receiver. This was used as a secondary GPS system on the ship. This system was operational during the cruise. Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

**File id:** cnav**Logging interval:** 1 second

cnav data format:

cnav	2008:231:00:00:00.6936	\$GPGGA,000000.00,1434.94372,N,10444.85748,W,2,8,1.1,15.52,M,-20.60,M,9,0108*65
cnav	2008:231:00:00:00.7137	\$GPVTG,006.5,T,,M,9.64,N,17.85,K*53

**CNAV3050**

The C-NAV 3050 is a global satellite-based differential receiver. This is the best individual receiver currently on the ship. This system was operational during the cruise. Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

**File id:** cnav3050all**Logging interval:** 1 second

cnav3050 data format:

cnav3050	2011:132:00:00:00.0717	\$GNGGA,000000.00,0842.538264,N,08427.839561,W,2,16,0.9,28.395,M,0.0,M,9,0,0358*48
cnav3050	2011:132:00:00:00.0877	\$GNVTG,338.4,T,,M,5.78,N,10.71,K,D*27

**GC80 Gyrocompass**

The GC80 gyrocompass is installed on the bridge and used for ship and seismic navigation. Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

**File id:** gy01**Logging interval:** 1 second

gy01 data format:

gy01	2008:231:00:00:00.4110	\$PTKM,HEALM,0000,0,G1*09
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gy01	2008:231:00:00:00.6395	\$HEHDT,005.8,T*22
gy01	2008:231:00:00:00.6396	\$HEROT,-005.25,A*34
gy01	2008:231:00:00:01.6394	\$HEHDT,005.7,T*2D
gy01	2008:231:00:00:01.6395	\$HEROT,-004.53,A*34

### POSMV Inertial Navigation System

The POS/MV is a receiver that uses CNAV input in addition to its own antennae, an inertial sensor and optional RTG, WTC, or WAAS corrections and a Kalman filter to produce a smooth navigation output and very accurate heading. Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

**File id:** posmv

**Logging interval:** 1 second

posmv data format:

posmv	2008:231:00:00:00.0885	\$INGGA,235959.842,1434.95002,N,10444.85734,W,2,,1.1,12.71,M,,9.0,0108*2E
posmv	2008:231:00:00:00.0889	\$INHDT,15.0,T*11
posmv	2008:231:00:00:00.2047	\$INVTG,7.0,T,,M,9.7,N,17.9,K*46
posmv	2008:231:00:00:00.3208	\$INGST,235959.842,,0.9,0.9,0.0,0.9,0.9,2.5*51
posmv	2008:231:00:00:00.4411	\$PASHR,235959.842,15.05,T,-0.58,0.48,0.15,0.069,0.069,0.045,2,0*05
posmv	2008:231:00:00:00.4412	\$INZDA,235959.0000,17,08,2008,,*73

### SeaPath 330 Inertial Navigation System

The Kongsberg Seapath is an inertial navigation system. Operational for the duration of the cruise. Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

**File id:** seapath

**Logging interval:** 1 second

seapath data format:

seapath	2008:231:00:00:00.0504	\$INZDA,235959.99,17,08,2008,,*73
seapath	2008:231:00:00:00.1686	\$INGGA,235959.99,1434.953109,N,10444.859147,W,2,08,1.1,-16.30,M,,M,1.0,0291*70
seapath	2008:231:00:00:00.1687	\$INVTG,5.97,T,,M,9.7,N,,K,D*03
seapath	2008:231:00:00:00.1688	\$INHDT,5.82,T*1A

### Geometrics 882 Magnetometer

The Geometrics 882 magnetometer is towed behind the ship. Raw serial output is logged using LDS. Deployment is dependent upon seismic operations. Data collected only when Magnetometer is deployed. Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

**Logging interval:** 1 second

**File id:** mag01

mag01 data sample:

mag01	2015:329:00:00:01.2776	\$ 45499.940,0881,0691
mag01	2015:329:00:00:01.3735	\$ 45500.167,0879,0691
mag01	2015:329:00:00:01.4695	\$ 45499.940,0874,0691

### SBE-45 Thermosalinograph

The Seabird TSG output is logged by LDS to the “tsgraw” set. Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

**File id:** tsgraw

**Logging interval:** 1 second

tsgraw data sample:

tsgraw	2015:337:00:01:15.3000	t1= 18.9500, c1= 5.17155, s= 39.1095, sv=1522.706, t2= 18.7851
tsgraw	2015:337:00:01:25.3004	t1= 18.9526, c1= 5.17196, s= 39.1105, sv=1522.715, t2= 18.7878
tsgraw	2015:337:00:01:35.3018	t1= 18.9539, c1= 5.17219, s= 39.1113, sv=1522.720, t2= 18.7892

### BGM-3 Gravimeter

The Bell Aerospace BGM-3 Gravimeter operated normally during the length of this cruise. Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

**File id:** vc01

**Logging interval:** 1 second

vc01 data format:

vc01	2011:130:00:00:08.2866	01:024436 00
vc01	2011:130:00:00:09.2926	01:024548 00

### AML Oceanographic – Micro-X SV-Xchange sensor Unit

The AML Micro-X SV probe operated normally during the length of this cruise. Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

**File id:** svuss01

**Logging interval:** 1 second

svuss01 data format:

svuss01	2015:338:00:00:15.1382	1521.897
svuss01	2015:338:00:00:16.1282	1521.900

### Mk21 XBT System

**Files:** \*.RDF,\*.EDF

XBT drops were made during this cruise. The data set(s) are saved to the raw/XBT directory in the cruise archive. Refer to the MGL2105 Expendable Drops.xls spreadsheet in the docs/operations directory of the cruise archive for more information.

### Vaisala Meteorological Ultrasonic Integrated Weather

The weather station is used to log wind speed, direction, air temperature, relative humidity, precipitation, dew point, and barometric pressure. The unit was operational for the duration of the cruise. Reference MGL2105/docs/elog for information on any data gaps or degraded operation.

**File id:** vaisala1 and vaisala2

**Logging interval:** 1 second

vaisala data format:

vaisala	2015:346:00:00:00.0038	\$WIMWV,129,R,15.7,N,A*04
vaisala	2015:346:00:00:00.9930	\$WIXDR,A,125,D,0,A,129,D,1,A,134,D,2,S,15.3,N,0,S,15.7,N,1,S,16.5,N,2,C,14.2,C,0,C,14.4,C,1,H,52.9,P,0,P,1018.3,H,0,V,0.00,M,0,Z,0,s,0,R,0.0,M,0,V,0.0,M,1,Z,0,s,1,R,0.0,M,1,R,66.5,M,2,R,0.0,M,3*6D

## IV. Seismic Summary

### A. Acquisition Parameter Table

<b>Acquisition Parameter Table 1</b>	
<b>FieldActivityID</b>	MGL2105
<b>Acquisition_sequence(s)</b>	Seq 1-8
<b>ReceiverType</b>	OBS
<b>SourceType</b>	Airgun
<b>Acquisition System Name</b>	OBS
<b>Acquisition System Type</b>	OBS
<b>Seismic_Nav_System</b>	C-Nav 3050 primary
<b>Survey_datum</b>	WGS84
<b>Navigation Reference Point (primary GPS antenna)</b>	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 330 calculated center of gravity) waterline
<b>Antenna(NRP)_to_source</b>	230 m
<b>Source_to_Near_Channel</b>	N/A
<b>Number_of_channels_recorded</b>	N/A
<b>Number_of_cables</b>	N/A
<b>Number_of_channels_each_cable</b>	N/A
<b>Channel_length</b>	N/A
<b>Cable_length</b>	N/A
<b>Cable_spacing</b>	Applicable to multi-streamer MCS only
<b>Near_Channel_Number</b>	N/A
<b>Cable_depth</b>	N/A
<b>Number_sources</b>	1
<b>Sub-arrays_per_source</b>	2 – refer to logs for sub-arrays in use
<b>Flipflop_shooting (dual source alternating)</b>	False
<b>Source_separation</b>	Applicable to flipflop (dual source alternating) only
<b>Sub-array_separation</b>	6.0 m
<b>Source_volume</b>	6600 cubic inches
<b>Source_pressure</b>	2000 psi nominal
<b>Source_make,model</b>	Bolt 1500LL & 1900LL
<b>Source_element_number</b>	36 + 4 spare
<b>Source_depth</b>	12 m
<b>Shot_control</b>	Distance
<b>Shot_Interval</b>	150 m
<b>Sample_interval</b>	N/A
<b>Record_length</b>	N/A
<b>Compass_birds</b>	N/A
<b>Recording_delay</b>	False
<b>Active_tail_buoy</b>	False
<b>Multiple_ships</b>	False

<b>Acquisition Parameter Table 2</b>	
<b>FieldActivityID</b>	MGL2105
<b>Acquisition_sequence(s)</b>	Seq 9-19, 21, 22, 25-30, 33-59
<b>ReceiverType</b>	MCS/OBS
<b>SourceType</b>	Airgun
<b>Acquisition System Name</b>	Sercel Seal 408
<b>Acquisition System Type</b>	Multi-channel Seismic
<b>Seismic_Nav_System</b>	C-Nav 3050 primary
<b>Survey_datum</b>	WGS84
<b>Navigation Reference Point (primary GPS antenna)</b>	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 330 calculated center of gravity) waterline
<b>Antenna(NRP)_to_source</b>	230 m
<b>Source_to_Near_Channel</b>	219.7 m
<b>Number_of_channels_recorded</b>	1200
<b>Number_of_cables</b>	1
<b>Number_of_channels_each_cable</b>	1200
<b>Channel_length</b>	12.5 m
<b>Cable_length</b>	15k
<b>Cable_spacing</b>	Applicable to multi-streamer MCS only
<b>Near_Channel_Number</b>	1
<b>Cable_depth</b>	12 m
<b>Number_sources</b>	1
<b>Sub-arrays_per_source</b>	4
<b>Flipflop_shooting (dual source alternating)</b>	False
<b>Source_separation</b>	Applicable to flipflop (dual source alternating) only
<b>Sub-array_separation</b>	6.0 m
<b>Source_volume</b>	6600 cubic inches
<b>Source_pressure</b>	2000 psi nominal
<b>Source_make,model</b>	Bolt 1500LL & 1900LL
<b>Source_element_number</b>	36 + 4 spare
<b>Source_depth</b>	12 m
<b>Shot_control</b>	Distance
<b>Shot_Interval</b>	50 m
<b>Sample_interval</b>	2ms
<b>Record_length</b>	17s
<b>Compass_birds</b>	52
<b>Recording_delay</b>	False
<b>Active_tail_buoy</b>	False
<b>Multiple_ships</b>	False

<b>Acquisition Parameter Table 3</b>	
<b>FieldActivityID</b>	MGL2105
<b>Acquisition_sequence(s)</b>	Seq 20, 23, 24, 31, 32
<b>ReceiverType</b>	MCS/OBS
<b>SourceType</b>	Airgun
<b>Acquisition System Name</b>	Sercel Seal 408
<b>Acquisition System Type</b>	Multi-channel Seismic
<b>Seismic_Nav_System</b>	C-Nav 3050 primary
<b>Survey_datum</b>	WGS84
<b>Navigation Reference Point (primary GPS antenna)</b>	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 330 calculated center of gravity) waterline
<b>Antenna(NRP)_to_source</b>	230 m
<b>Source_to_Near_Channel</b>	219.7 m
<b>Number_of_channels_recorded</b>	1200
<b>Number_of_cables</b>	1
<b>Number_of_channels_each_cable</b>	1200
<b>Channel_length</b>	12.5 m
<b>Cable_length</b>	15k
<b>Cable_spacing</b>	Applicable to multi-streamer MCS only
<b>Near_Channel_Number</b>	1
<b>Cable_depth</b>	12 m
<b>Number_sources</b>	1
<b>Sub-arrays_per_source</b>	2, 3, & 4 – refer to MGL2105_SEAL408_line_configuration_by_sequence
<b>Flipflop_shooting (dual source alternating)</b>	False
<b>Source_separation</b>	Applicable to flipflop (dual source alternating) only
<b>Sub-array_separation</b>	6.0 m
<b>Source_volume</b>	3300, 4950 & 6600 in3 – refer to MGL2105_SEAL408_line_configuration_by_sequence
<b>Source_pressure</b>	2000 psi nominal
<b>Source_make,model</b>	Bolt 1500LL & 1900LL
<b>Source_element_number</b>	36 + 4 spare
<b>Source_depth</b>	12 m
<b>Shot_control</b>	Distance
<b>Shot_Interval</b>	150 m
<b>Sample_interval</b>	2ms
<b>Record_length</b>	17s
<b>Compass_birds</b>	52
<b>Recording_delay</b>	False
<b>Active_tail_buoy</b>	False
<b>Multiple_ships</b>	False

### **Physical Configuration**

The towing configuration for the air guns, streamers, antennas, and in-water offsets are detailed in the document titled *MGL2105\_Offsets\_Source\_Only.xls*, *MGL2105\_Offsets\_MCS\_9000m\_Streamer.xls*, and *MGL2105\_Offsets\_MCS\_6000m\_Streamer.xls*

### **Spectra**

Spectra was used for all timing and navigation during the cruise. Spectra generated UKOOA P294 and P190 files for the MCS line(s) acquired.

### **SeisPos**

SeisPos was used for post processing of Spectra UKOOA P294 files to produce UKOOA P190 files with improved positioning.

## **V. RV Langseth Gravity Tie Information**

Please refer to the documents located under MGL2105/docs/gravity\_tie for detailed records.

## VI. Archive Contents

MGL2105/docs	Cruise documents
MGL2105/docs/elog	Cruise elog
MGL2105/docs/gravity_tie	Gravity Tie information
MGL2105/docs/map	Cruise maps, track map
MGL2105/docs/offsets	Vessel/sensor offsets
MGL2105/docs/operations/	Operations documents
MGL2105/docs/operations/Daily_Reports	Cruise Daily Reports
MGL2105/docs/operations/NavLogs	Spectra Nav logs
MGL2105/docs/operations/ObsLogs	MCS/Source logs
MGL2105/docs/MGL2105_B15_line_log_multi_channel_seismics	Master line log table
MGL2105/docs/MGL2105_SEAL408_line_configuration_by_sequence	Seismic configuration log
MGL2105/docs/MGL2105_Expendable_Drops_Complete	XBT log
MGL2105/docs/tapelogs	Seal 408 line logs
MGL2105/docs/permits	Associated permitting
MGL2105/docs/waypoints	Waypoint files
MGL2105/docs/personnel	Rosters, org charts etc.
MGL2105/docs/reports	Associated reports
MGL2105/docs/reports/MGL2105_DataReport_v1.0.doc	This file
MGL2105/docs/offsets/MGL2105_Offsets_MCS.xls	Vessel/sensor offsets
MGL2105/docs/screencaps	Screen captures
MGL2105/processed	Processed data
MGL2105/processed/knudsen	Knudsen segy
MGL2105/processed/reflex	Spectra reflex files
MGL2105/processed/obsip	OBS Shot log files
MGL2105/processed/sprint	Sprint UKOOA P190s
MGL2105/processed/svp	Sound velocity profiles
MGL2105/raw	Raw data
MGL2105/raw/adcp	Raw ADCP data
MGL2105/raw/knudsen	Raw Knudsen data
MGL2105/raw/MarkeyWinch	DESH-5 winch data
MGL2105/raw/multibeam	Raw EM122 data
MGL2105/raw/serial	Underway serial data
MGL2105/raw/spectra/P1	Spectra underway p190
MGL2105/raw/spectra/P2	Spectra UKOOA p294
MGL2105/raw/XBT	Raw XBT data

## VII. Data Formats

### Gravimeter data

The gravimeter serial data is output in the following format:

01:025610 01

01:xxxxxx ff

Item	Definition	Units
01	output frequency	Hz
xxxxxx	raw counts	n/a
ff	sensor status	n/a

### CNAV GPS receiver data

CNAV outputs data in NMEA 0183 compatible format. Currently\* the following sentence types are enabled:

- \$GPVTG-GPS Velocity, Track made good and Ground speed data (computed by the CNAV GPS receiver).
- \$GPGGA-Global Positioning System Fix data (computed by the CNAV GPS receiver).

\*Note: there are other sentence types available from CNAV. Please consult the software manual for more options.

### **\$GPVTG, xxx.x, T,, M, m.mm, N, n.nn, K\*hh**

\$GPVTG Sentence Fields

Item	Definition	Units
xxx.x	Course over ground (COG)	Degrees from True North
T	Indicates course relative to True North	n/a
M	COG	Degrees from Magnetic North
m.mm	Speed over ground (SOG)	Nautical miles per hour (knots)
N	Indicates that the speed over ground is in knots	n/a
n.nn	SOG	km/h
K	Indicates that the SOG is in km/h	n/a /td>
*hh	Checksum (hexadecimal representation)	n/a

**\$GPGGA,hhmmss.ss, ddm. mmmmm, a, ddm. mmmmm, a, x, xx, x.x, xx.xx, M, xx.xx, M, x.x, xyy\*hh**

\$GPGGA Sentence Fields

Item	Definition	Units
hhmmss.ss	UTC time of position	Hours/Minutes/Seconds.decimal.
ddm. mmmmm	Latitude	Degrees/Minutes.decimal.
a	Direction of Latitude N = North S = South	n/a
ddm. mmmmm	Longitude	Degrees/Minutes.decimal
a	Direction of Longitude E = East W = West	n/a
x	GPS Quality indicator 0 = fix not valid 1 = GPS Autonomous fix 2 = GcGPS Corrected Fix	n/a
xx	Number of GPS satellites used in solution fix	n/a
x.x	Horizontal Dilution of Precision (HDOP)	n/a
xx.xx	C-NAV GPS receiver antenna altitude reference to Mean Sea Level (MSL)	n/a
M	Altitude units--M indicates meters	n/a
xx.xx	WGS-84 Geoidal separation distance from MSL based on the NIMA/NASA EGM96 15-minute (Earth Gravity Model)	Meters
M	Geosoidal separation units--M indicates meters	n/a
x.x	Age of GcGPS corrections used in solution fix	n/a
xyy	C-NAV GPS receiver reference identification	x is downlink satellite communication beam in use yy is the GPS correction signal mode/type being used
*hh	Checksum (hexadecimal representation) followed by CRLF terminator pair	n/a

### **CNAV 3050 GPS receiver data**

CNAV 3050 outputs data in NMEA 0183 compatible format. Currently\* the following sentence types are enabled:

- \$GPVTG-GPS Velocity, Track made good and Ground speed data (computed by the CNAV GPS receiver).
- \$GPGGA-Global Positioning System Fix data (computed by the CNAV GPS receiver).

\*Note: there are other sentence types available from CNAV. Please consult the software manual for more options.

### **\$GPVTG, xxx.x, T,, M, m.mm, N, n.nn, K\*hh**

\$GPVTG Sentence Fields

<b>Item</b>	<b>Definition</b>	<b>Units</b>
xxx.x	Course over ground (COG)	Degrees from True North
T	Indicates course relative to True North	n/a
M	COG	Degrees from Magnetic North
m.mm	Speed over ground (SOG)	Nautical miles per hour (knots)
N	Indicates that the speed over ground is in knots	n/a
n.nn	SOG	km/h
K	Indicates that the SOG is in km/h	n/a
*hh	Checksum (hexadecimal representation)	n/a

**\$GPGGA,hhmmss.ss, dddm.mmmmm, a, dddm.mmmmm, a, x, xx, x.x, xx.xx, M, xx.xx, M, x.x, xyy\*hh**

\$GPGGA Sentence Fields

Item	Definition	Units
hhmmss.ss	UTC time of position	Hours/Minutes/Seconds.decimal.
ddmm.mmmmm	Latitude	Degrees/Minutes.decimal.
a	Direction of Latitude N = North S = South	n/a
ddmm.mmmmm	Longitude	Degrees/Minutes.decimal
a	Direction of Longitude E = East W = West	n/a
x	GPS Quality indicator 0 = fix not valid 1 = GPS Autonomous fix 2 = GcGPS Corrected Fix	n/a
xx	Number of GPS satellites used in solution fix	n/a
x.x	Horizontal Dilution of Precision (HDOP)	n/a
xx.xx	C-NAV GPS receiver antenna altitude reference to Mean Sea Level (MSL)	n/a
M	Altitude units--M indicates meters	n/a
xx.xx	WGS-84 Geoidal separation distance from MSL based on the NIMA/NASA EGM96 15-minute (Earth Gravity Model)	Meters
M	Geosoidal separation units--M indicates meters	n/a
x.x	Age of GcGPS corrections used in solution fix	n/a
xyy	C-NAV GPS receiver reference identification	x is downlink satellite communication beam in use yy is the GPS correction signal mode/type being used
*hh	Checksum (hexadecimal representation) followed by CRLF terminator pair	n/a

### **EM122 Center Beam Depth**

This page describes the EM122 centerbeam depth serial output, used for real-time depth display. For full multibeam data, please see the [multibeam](#) page.

The EM122 outputs serial data in the following formats:

- KIDPT - Depth below transducer

**\$KIDPT,x.x,x.x,hh.h\*hh**

SDDPT sentence format

Item	Definition	Units
x.x	Water depth	meters
x.x	Offset from transducer; positive means distance from transducer to water line, negative means distance from transducer to keel	meters
hh.h* hh	Checksum	n/a

**Furuno GC80 Gyroscope data**

The gyroscope serial data is output in the following sentence formats:

- PTKM,HEALM -- Unspecified
- HEHDT -- Heading - True
- HEROT -- Rate Of Turn

**\$PTKM,HEALM,xxxx,x,xx\*hh**

ALM sentence format

Item	Definition	Units
xxxx	unspecified	n/a
x	unspecified	n/a
*hh	unspecified	n/a

**\$HEHDT,xxx.x,T\*hh**

HDT sentence format

Item	Definition	Units
xxx.x	Heading true	degrees
T	T = true	n/a
*hh	Checksum	n/a

**\$HEROT,-xxx.x,A\*hh**

HEROT sentence format

Item	Definition	Units
xxxx.x	Rate of turn	Degrees per minute, Note: "-" means bow turns to port
A	A = data valid	n/a
*hh	Checksum	n/a

**Geometrics 882 Magnetometer Data**

The magnetometer serial data is output in the following format:

\$ 53863.927,0652

\$ xxxxx.xxx,vvvv

Item	Definition	Units
------	------------	-------

xxxxx.xxx	Magnetic field intensity	nT
vvvv	Reserved for future use	n/a

**OBSIP Shotlog Format**

Each OBSIP shotlog contains a header followed by shot records:

```
#obsipshotfile v1.0
#shotnumber date time sourceLat sourceLon shipLat shipLon waterDepth sciTag
0001280 2009-08-27 05:08:49.807873 48.495334 -129.201444 48.494097 -129.203017 2530.6 MGL0910_05
0001279 2009-08-27 05:12:33.961869 48.491860 -129.204474 48.490060 -129.205425 2526.4 MGL0910_05
0001278 2009-08-27 05:16:36.302883 48.488608 -129.206115 48.486807 -129.206944 2530.3 MGL0910_05
0001277 2009-08-27 05:19:51.053880 48.485157 -129.209212 48.483406 -129.209755 2526.1 MGL0910_05
0001276 2009-08-27 05:24:01.863875 48.480813 -129.212118 48.479293 -129.213152 2516.1 MGL0910_05
```

**Shot records are in the following format:**

```
0001276 2009-08-27 05:24:01.863875 48.480813 -129.212118 48.479293 -129.213152 2516.1 MGL0910_05
sssssss yyyy-mm-dd hh:mm:ss.ssssss xx.xxxxxx yyy.yyyyyy vv.vvvvvv www.wwwwww dddd.d llllllllllllll
```

OBSIP record format

Item	Definition	Units
sssssss	shot number	n/a
yyyy-mm-dd	date	ISO8601 format
hh:mm:ss.ssssss	time	ISO8601 format
xx.xxxxxx	source lat	degrees, WGS84
yy.yyyyyy	source lon	degrees, WGS84
vv.vvvvvv	vessel lat	degrees, WGS84
ww.wwwwww	vessel lon	degrees, WGS84
ddd.d	depth	meters
llllllllllllll	linename	n/a

**POS/MV Inertial Navigation System**

POS/MV outputs data using the NMEA 0183 format at rates of up to fifty sentences per second. The following seven different sentence formats are available.

- 1. \$INGGA-Global System Position Fix Data
- 2. \$INHDT-Heading - True data
- 3. \$INVTG-Course over ground and Ground speed data
- 4. \$INGST-GPS pseudorange noise statistics
- 6. \$PRDID-Attitude data
- 7. \$INZDA-Time and date

**\$INGGA, hhhmss.sss, lll.llll, a, yyyy.yyyy, b, t, nn, v.v, x.x, M,,c.c,rrrr\*hh**

\$INGGA-Global System Position Fix Data

Item	Definition	Value	Units
\$INGGA	Header	\$INGGA	
hhmmss.sss	UTC time of position	n/a	Hours/Minutes/Seconds.decimal. Two fixed digits of hours. Two fixed digits of minutes. Two fixed digits of seconds. Three digits for decimal fractions of a second.
lll.llll	Latitude	-90 to +90	Degrees/Minutes.decimal. Two fixed digits of degrees Two fixed digits of minutes Five digits for decimal minutes.
a	N (north) or S (south)	N or S	
yyyyy.yyyyy	Longitude	-180 to +180	Degrees/Minutes.decimal. Three fixed digits of degrees. Two fixed digits of minutes. Five digits for decimal minutes.
b	E (east) or W (west)	E or W	
t	GPS Quality Indicator	0 = Fix not available or invalid 1 = CIA standard GPS; fix valid. 2 = DGS mode; fix valid. 3 = PPP mode; fix valid. 4 = RTK fixed 5 = RTK float 6 = free inertial	
nn	Number of satellites used in fix	0 to 32	

v.v	Horizontal dilution of precision		
x.x	Altitude of the IMU above or below the mean sea level. A negative value indicates below sea level.	n/a	Metres
M	Units of measure = metres	M	
Null	Null		
Null	Null		
c.c	Age of differential corrections in records since last RTCM-104 message.	0 to 99.9	Seconds
rrr	DGPS reference station identity	0000 to 1023	
*hh	Checksum	00 - FF	
/CR/LF	Carriage return and line feed	/CR/LF	

Note that, in the case of the HDOP, IMU altitude and age of differential connections, POS/MV adds leading digits as required (i.e. if the value exceeds 9.9). Also, note that commas separate all items, including null fields. The information is valid at the location of the vessel frame.

### **\$INHDT, x.x, T\*hh**

#### \$INHDT-Heading - True data

Item	Definition	Value	Units
\$INHDT	Header	\$INHDT	
x.x	True vessel heading in the vessel frame	0 to 359.99	degrees
*hh	Checksum	n/a	
/CR/LF	Carriage return and line feed	/CR/LF	

### **\$INVTG, x.x, T, M, n.n, N, k.k, K\*hh**

#### \$INVTG-Course over ground and Ground speed data

Item	Definition	Value	Units
%INVTG	Header	\$INVTG	
x.x	True vessel track in the vessel frame	0 to 359.99	degrees
T	True	T	
null	Not supported	null	
M		M	
n.n	Speed in the vessel frame	n/a	Knots
N	Knots	N	
k.k	Kilometres	K	
*hh	Checksum	n/a	
/CR/LF	Carriage return and line feed	/CR/LF	

Note that, in the case of the track and the speed fields, POS/MV adds the leading digits as required (i.e. if the value exceeds 9.9). Also, note that commas separate all items in the including null fields.

**\$INGST, hhmmss,sss,,smjr.smjr,smnr.smnr, o.o, l.l, y.y, a.a \*hh**

\$INGST-GPS pseudorange noise statistics

Item	Definition	Value	Units
\$INGST	Header	\$INGST	
hhmmss.sss	UTC time of position	n/a	Hours/Minutes/Seconds.decimal. 2 fixed digits of hours. 2 fixed digits of minutes. 2 fixed digits of seconds. Three digits for decimal fractions of a second.
null	Not supported	null	
smjr.smjr	Standard Deviation of semi-major axis of error ellipse	n/a	Metres
smnr.smnr	Standard deviation of semi-minor axis of error ellipse	n/a	Metres
o.o	Orientaion of semi-major axis ellipse	0 to 359.9	Degrees from true north
l.l	Standard deviation of latitude	n/a	Metres
y.y	Standard deviation of longitude	n/a	Metres
a.a	Standard deviation of Altitude	n/a	Metres
*hh	Checksum	n/a	
/CR/LF	Carriage return and line feed	/CR/LF	

Note that, in the case of all fields POS/MV adds leading digits as required (i.e. if the value exceeds 9.9). Also, note that commas separate all items, including null fields. The information is valid at the location of the vessel frame.

Note that commas separate all items

Two attitude data strings are available. The strings are identical except for the definition of roll and pitch angles. One string uses Tate-Bryant angles and the

other uses TSS angles. Use the POS/MV Controller program to set the required angle convention.

**\$PRDID, PPP.PP, RRR.RR, xxx.xx\*hh**

\$PRDID-Attitude data

Item	Definition	Value	Units
\$PRDID	Header	\$PRDID	
PPP.PP	Pitch	-90.00 to +90.00	Degrees
RRR.RR	Roll	-90.00 to +90.00	Degrees
xxx.xx	Sensor heading	0 to 359.99	Degrees
*hh	Checksum	n/a	
/CR/LF	Carriage return and line feed	/CR/LF	

Note that commas separate all items

Two attitude data strings are available. The strings are identical except for the definition of roll and pitch angles. One string uses Tate-Bryant angles and the other uses TSS angles. Use the POS/MV Controller program to set the required angle convention.

**\$INZDA, hhmmss.ss, DD, MM, YYYY,, \*hh**

\$INZDA-Time and date

Item	Definition	Value	Units
\$INZDA	Header	\$INZDA	
hhmmss.sss	UTC time	n/a	Hours/Minutes/Seconds.decimal. 2 fixed digits of hours 2 fixed digits of minutes 2 fixed digits of seconds Three digits for decimal fractions of a second
DD	Day of month	01 to 31	
MM	Month of year	01 to 12	
YYYY	Year		
Null	Null		
Null	Null		
*hh	Checksum	n/a	/CR/LF

**Seabird SBE-45 Thermosalinograph Data**

Data from the SBE-45 TSG is output in the following format:

2012:050:06:02:01.0294 27.2958, 5.51684, 34.7768

yyyy:ddd:hh:mm:ss.ssss tttt, cccc, xxxx

Item	Definition	Units
yyyy	year	n/a
ddd	day of year	n/a
hh	hours	n/a
mm	minutes	n/a
ss.ssss	seconds	n/a
tttt	Raw internal temperature sensor data	n/a
cccc	Raw conductivity sensor data	n/a
xxxx	Raw salinity sensor data	n/a

### SEAPATH 330 Inertial Navigation System

SEAPATH outputs data in NMEA format using the following sentence formats:

- 1. \$INGGA-Global System Position Fix Data
- 2. \$INHDT-Heading - True data
- 3. \$INVTG-Course over ground and Ground speed data
- 4. \$INZDA-Time and date

### **\$INGGA, hmmmss.sss, llll.llll, a, yyyyy.yyyyy, b, t, nn, v.v, x.x, M,,c.c,rrrr\*hh**

\$INGGA-Global System Position Fix Data

Item	Definition	Value	Units
\$INGGA	Header	\$INGGA	
hmmmss.sss	UTC time of position	n/a	Hours/Minutes/Seconds.decimal. Two fixed digits of hours. Two fixed digits of minutes. Two fixed digits of seconds. Three digits for decimal fractions of a second.
llll.llll	Latitude	-90 to +90	Degrees Minutes.decimal. Two fixed digits of degrees Two fixed digits of minutes Five digits for decimal minutes.
a	N (north) or S (south)	N or S	
yyyyy.yyyyy	Longitude	-180 to +180	Degrees/Minutes.decimal. Three fixed digits of degrees. Two fixed digits of minutes. Five digits for decimal minutes.
b	E (east) or W (west)	E or W	
t	GPS Quality Indicator	0 = Fix not available or invalid 1 = CIA standard GPS; fix valid. 2 = DGS mode; fix valid. 3 = PPP mode; fix valid. 4 = RTK fixed 5 = RTK float 6 = free inertial	
nn	Number of satellites used in fix	0 to 32	
v.v	Horizontal dilution of precision		
x.x	Altitude of the IMU above or below the mean sea level. A negative value indicates below sea level.	n/a	Metres
M	Units of measure = metres	M	
Null	Null		
Null	Null		

c.c	Age of differential corrections in records since last RTCM-104 message.	0 to 99.9	Seconds
rrr	DGPS reference station identity	0000 to 1023	
*hh	Checksum		
/CR/LF	Carriage return and line feed	/CR/LF	

### \$INHDT, x.x, T\*hh

#### \$INHDT-Heading - True data

Item	Definition	Value	Units
\$INHDT	Header	\$INHDT	
x.x	True vessel heading in the vessel frame	0 to 359.99	degrees
*hh	Checksum	n/a	
/CR/LF	Carriage return and line feed	/CR/LF	

### \$INVTG, x.x, T, M, n.n, N, k.k, K\*hh

#### \$INVTG-Course over ground and Ground speed data

Item	Definition	Value	Units
\$INVTG	Header	\$INVTG	
x.x	True vessel track in the vessel frame	0 to 359.99	degrees
T	True	T	
null	Not supported	null	
M		M	
n.n	Speed in the vessel frame	n/a	Knots
N	Knots	N	
k.k	Kilometres	K	
*hh	Checksum	n/a	
/CR/LF	Carriage return and line feed	/CR/LF	

### \$INZDA, hhmmss.ss, DD, MM, YYYY,, \*hh

#### \$INZDA-Time and date

Item	Definition	Value	Units
\$INZDA	Header	\$INZDA	
hhmmss.sss	UTC time	n/a	Hours/Minutes/Seconds.decimal. 2 fixed digits of hours 2 fixed digits of minutes 2 fixed digits of seconds Three digits for decimal fractions of a second
DD	Day of month	01 to 31	
MM	Month of year	01 to 12	
YYYY	Year		

Null	Null	
Null	Null	
*hh	Checksum	n/a
/CR/LF	Carriage return and line feed	/CR/LF

### **DS 80 Speed log data**

Speed log data is formatted in the following sentences:

- VHW - Water speed and heading
- VBW - Dual Ground/Water Speed

### **\$VHW,x.x,T,x.x,M,x.x,N,x.x,K\*hh**

VHW sentence fields

<b>Item</b>	<b>definition</b>	<b>units</b>
x.x	degrees true	?
T	T=true	n/a
x.x	degrees Magnetic	?
M	M = Magnetic	n/a
x.x	Speed of vessel relative to water	Knots/hour
N	N = Nots	n/a
x.x	Speed of vessel relative to water	Km/hour
K	K = Kilometers	n/a
*hh	Checksum	n/a

### **\$VBW,x.x,x.x,A,x.x,x.x,A\*hh**

VBW sentence fields

<b>Item</b>	<b>Definition</b>	<b>Units</b>
x.x	Longitudinal water speed, "-" means astern	?
x.x	Transverse water speed, "-" means port	?
A	A = Data Valid	n/a
x.x	Longitudinal ground speed, "-" means astern	?
x.x	Transverse ground speed, "-" means port	?
A	A = data valid, V = data invalid	n/a
*hh	Checksum	n/a

### AML Oceanographic Micro-X XChange Sound Velocity Probe Data

The sound velocity probe serial data is output in the following format:

1479.35

xxxx.xx

Item	Definition	Units
xxxx.xx	Sound Velocity	m/s

### Seabird SBE38 Thermometer Probe Data

The sound velocity probe serial data is output in the following format:

8.2221

xx.xxxx

Item	Definition	Units
xx.xxxx	Temperature	Celcius

### Vaisala Ultrasonic Meteorological Station Data

The meteorological data from the Vaisala integrated ultrasonic weather station is output in the following sentence format:

*\$WIMWV,105,R,3.8,N,A\*32*

*\$WIMWV,x.x,R,y.y,N,A\*32*

Item	Definition	Units
x.x	Wind direction value: Wind direction is given in relation to the devices north-south axis.	Degrees
R	Wind direction unit (R = relative)	n/a
y.y	Wind speed value	Knots
N	Wind speed unit (knots)	n/a
A	Data status: A = valid, V = Invalid	n/a

*\$WIXDR,A,105,D,0,A,105,D,1,A,105,D,2,S,3.7,N,0,S,3.8,N,1,S,3.9,N,2,C,27.2,C,0,C,28.4,C,1,H,70.5,P,0,P,1013.5,H,0,V,0.00,M,0,Z,0,s,0,R,0.0,M,0,V,0.0,M,1,Z,0,s,1,R,0.0,M,1,R,1.7,M,2,R,0.0,M,3\*6D*

*\$WIXDR,A,xxx,D,0,A,xxx,D,1,A,xxx,D,2,S,x.x,N,0,S,x.x,N,1,S,x.x,N,2,C,xx.x,C,0,C,xx.x,C,1,H,xx.x,P,0,P,xxxx.x,H,0,V,x.xx,M,0,Z,0,s,0,R,x.x,M,0,V,x.x,M,1,Z,0,s,1,R,x.x,M,1,R,x.x,M,2,R,x.x,M,3\*6D*

Item	Definition	Units
A	Transducer id 0 type (Wind Direction)	n/a
xxx	Transducer id 0 data (min wind direction)	Degrees
D	Transducer id 0 units (degrees, min wind direction)	n/a
0	Transducer id for min wind direction	n/a

A	Transducer id 1 type (wind direction)	n/a
xxx	Transducer id 1 data (average wind direction)	Degrees
D	Transducer id 1 units (degrees, average wind direction)	n/a
1	Transducer id for average wind direction	n/a
A	Transducer id 2 type (wind direction)	n/a
xxx	Transducer id 2 data (max wind direction)	Degrees
D	Transducer id 2 units (degrees, max wind direction)	n/a
2	Transducer id for max wind direction	n/a
<b>S</b>	<b>Transducer id 0 type (wind speed)</b>	<b>n/a</b>
x.x	Transducer id 0 data (min wind speed)	Knots
N	Transducer id 0 units (Knots, min wind speed)	n/a
0	Transducer id for min wind speed	n/a
S	Transducer id 1 type (wind speed)	n/a
x.x	Transducer id 1 data (average wind speed)	Knots
N	Transducer id 1 units (Knots, average wind speed)	n/a
1	Transducer id for average wind speed	n/a
S	Transducer id 2 type (wind speed)	n/a
x.x	Transducer id 2 data (max wind speed)	Knots
N	Transducer id 2 units (Knots, max wind)	n/a
2	Transducer id for max wind speed	n/a

<b>C</b>	<b>Transducer id 0 type (Temperature)</b>	<b>n/a</b>
xx.x	Transducer id 0 data (Temperature)	Celcius
C	Transducer id 0 units (C, Temperature)	n/a
0	Transducer id for Temperature	n/a
<b>C</b>	<b>Transducer id 1 type (temperature)</b>	<b>n/a</b>
xx.x	Transducer id 1 data (Tp internal temperature)	Celcius
C	Transducer id 1 units (C, Tp internal temperature)	n/a
1	Transducer id for Tp internal temperature	n/a
<b>H</b>	<b>Transducer id 0 type (Humidity)</b>	<b>n/a</b>
xx.x	Transducer id 0 data (Humidity)	% Reletive Humidity
<b>P</b>	<b>Transducer id 0 units (% , Humidity)</b>	<b>n/a</b>
0	Transducer id for Humidity	n/a
<b>P</b>	<b>Transducer id 0 type (Pressure)</b>	<b>n/a</b>
xxxx.x	Transducer id 0 data (Pressure)	hPA

H	Transducer id 0 units (hPa, Pressure)	n/a
0	Transducer id for Pressure	n/a

<b>V</b>	<b>Transducer id 0 type (Accumulated rainfall)</b>	<b>n/a</b>
x.xx	Transducer id 0 data (Accumulated rainfall)	millimeters
I	Transducer id 0 units (mm, Accumulated rainfall)	n/a
0	Transducer id for Accumulated rainfall	n/a
<b>Z</b>	<b>Transducer id 0 type (Rain duration)</b>	<b>n/a</b>
xx	Transducer id 0 data (Rain duration)	seconds
s	Transducer id 0 units (s, Rain duration)	n/a
0	Transducer id for Rain duration	n/a
<b>R</b>	<b>Transducer id 0 type (Rain intensity)</b>	<b>n/a</b>
x.x	Transducer id 0 data (Rain intensity)	mm/hr
M	Transducer id 0 units (mm/h, Rain intensity)	n/a
0	Transducer id for Rain intensity	n/a
<b>V</b>	<b>Transducer id 1 type (Hail accumulation)</b>	<b>n/a</b>
x.x	Transducer id 1 data (Hail accumulation)	hits/cm2
M	Transducer id 1 units (hits/cm2, Hail accumulation)	n/a
1	Transducer id for Hail accumulation	n/a
<b>Z</b>	<b>Transducer id 1 type (Hail duration)</b>	<b>n/a</b>
x	Transducer id 1 data (Hail duration)	seconds
s	Transducer id 1 units (s, Hail duration)	n/a
1	Transducer id for Hail duration	n/a
<b>R</b>	<b>Transducer id 1 type (Hail intensity)</b>	<b>n/a</b>
x.x	Transducer id 1 data (Hail intensity)	hits/cm2h
M	Transducer id 1 units (hits/cm2h, Hail intensity)	n/a
1	Transducer id for Hail intensity	n/a
<b>R</b>	<b>Transducer id 1 type (Rain peak intensity)</b>	<b>n/a</b>
x.x	Transducer id 1 data (Rain peak intensity)	mm/h
M	Transducer id 1 units (mm/h, Rain peak intensity)	n/a
2	Transducer id for Rain peak intensity	n/a
<b>R</b>	<b>Transducer id 1 type (Hail peak intensity)</b>	<b>n/a</b>
x.x	Transducer id 1 data (Hail peak intensity)	hits/cm2
M	Transducer id 1 units (hits/cm2, Hail peak intensity)	n/a

## **VIII. Log file(s) Descriptive**

### **BirdLogs**

The directory /docs/operations/BirdLogs/ contains meta-data (when logged) for the Digicourse compass/cable levelers (birds). Attributes (when logged) are “fin angle”, “depth”, and “battery”.

### **Daily Reports**

The directory /docs/operations/Daily\_Reports/ contains the daily production report compiled by the CSO.

### **GunLogs**

The directory /docs/operations/GunLogs/ contains source errors/changes in “source only” operations.

### **NavLogs**

The directory /docs/operations/NavLogs/ contains line logs for the Spectra Integrated Navigation System on a sequence by sequence basis.

### **Seismic Support Plan**

The directory /docs/operations/Seismic\_Support\_Plan/ contains all of the revisions of the plan which details the intended survey activity.

### **Seal Report**

The directory /docs/operations/Seal\_report/ contains sequence by sequence logs for the Seal408 MCS system detailing critical attributes ie: file number, shotpoint, source volume, etc.

### **Standing orders**

The directory /docs/operations/Standing\_orders/ contains watch-stander duties and responsibilities documents and log syntax documentation.

### **StreamerSheets**

The directory /docs/operations/StreamerSheets/ contains serial number and configuration documentation for each streamer deployed during the cruise.