RV Langseth
Data Reduction Summary

MGL1216

Astoria, OR – Astoria, OR

FINAL

V1.1, 2012-10-19

Lamont-Doherty Earth Observatory, Columbia University

Monday, August 27 2012 08:00:00L

Date	Julian Date	Time	Port
2012-08-16	2012-229	1900 UTC	Departed Astoria, OR
2012-08-22	2012-235	1809 UTC	Picked up the pilot for repairs alongside
2012-08-23	2012-236	0248 UTC	Departed Astoria, OR
2012-08-26	2012-239	1800 UTC	Arrived Astoria, OR

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I. Background and Scientific Objectives

(Pulled from foreign clearance application information submitted by the PI)

Background

This research cruise is a continuation of work on the long-term observatory at Axial Seamount. The project began in 1998 and has involved submersible operations in nearly every year since then. Monitoring instruments including geophysical sensors (hydrophones, bottom pressure and tilt recorders), temperature sensors, and chemical sampling instruments have been deployed and maintained over many years. Significant seafloor eruptions occurred in 1998 and 2011. We are interested in the long-term cycles and ecology of this volcanic/hydrothermal ecosystem.

2012 Objectives

Following the 2011 eruption, our goals are to:

- collect time-series samples for chemistry and microbiology
- document vent sites with video and still photography
- recover a time-series water sampler (RAS) mooring
- re-deploy time-series water sampler mooring
- recover and re-deploy temperature recorders from several vents
- collect biological materials (bacterial mats and vent fauna) for natural products research
- conduct shipboard microbiological culture experiments
- conduct shipboard chemical analysis of fluids
- CTD casts at multiple locations for plume time series

Collaborating scientists include Bill Chadwick (PMEL/Oregon State, volcanology), Bob Dziak (PMEL/Oregon State, acoustics), Marv Lilley (U. Washington, gas chemistry), Jim Holden (U. Mass Amherst, microbiology), Julie Huber (MBL, microbiology), Kerry McPhail (Oregon State, pharmacology).

We intend to have 3 Jason dives, equipped with the Hydrothermal Fluid and Particle Sampler, one or two titanium major samplers, gas-tight samplers, small syringe samplers for microbial mats, and small bio-box for vent fauna, rock, or sulfide mineral collection. A RAS water sampler mooring will be recovered using Jason to release by pull-pin. A second RAS mooring will be deployed by near-sea surface drop and moved into position by Jason. CTD casts will be performed between dives.

To the extent possible, we will integrate our operations with Mark Zumberge's Self-Calibrating Pressure Recorder.

Objectives of the NeMO Project at Axial Seamount

This cruise is a combination of several programs and multiple PIs funded by NSF, NOAA, and the Gordon and Betty Moore Foundation. David Butterfield of the University of Washington and NOAA Pacific Marine Environmental Lab is in charge of the chemistry and microbiology work at Axial Seamount, with dives funded by NOAA to support the NeMO long-term observatory at Axial Seamount. Axial Seamount erupted in 1998 and 2011. The project began in 1998 and has involved submersible operations in nearly every year since then. Monitoring instruments including geophysical sensors (hydrophones, bottom pressure and tilt recorders), temperature sensors, and chemical sampling instruments have been deployed and maintained over many years. NeMO and associated projects are collecting data to understand how hydrothermal ecosystems on undersea volcanoes evolve with

volcanic eruption cycles. Along with Butterfield, microbiologist Jim Holden, of U. Mass. Amherst, is onboard with funding from the Gordon and Betty Moore Foundation (GBMF). Julie Huber, of the Marine Biological Lab, is the lead scientist on this multi-investigator GBMF Marine Microbiology Initiative project. Geophysicist Glenn Sasagawa of UCSD is funded by NSF to develop, test and deploy a self-calibrating, high-precision pressure sensor, capable of measuring tsunamis or small vertical ground motions over longperiods.

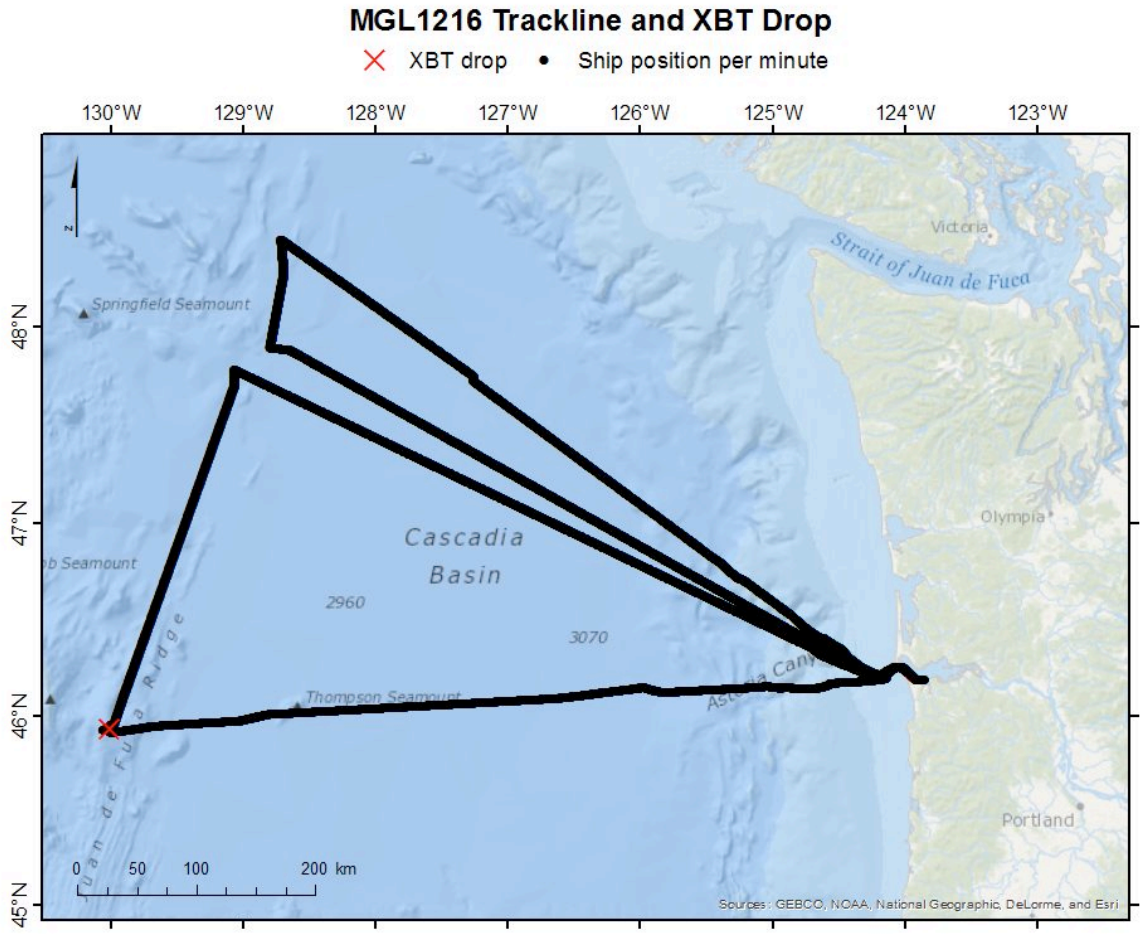
Overall Objectives CORK project

The overall goal of the 2012 CORK Optical Telemetry System (OTS) field program is to deploy and install two seafloor optical communication instruments at CORK instrumented borehole well-heads in the northeast Pacific. The first site to be instrumented will be CORK Hole 857D (48deg 26.571247'N 128deg 42.65207'W). At this site, after installation of the seafloor unit using ROV Jason, we will download pressure data from the CORK. Following recovery of Jason we plan to carry out a series of communication tests between the seafloor optical comms device and a ship-based lowered CTD instrument (using SDSL comms over CTD wire). If testing goes well, we will leave this optical-comms unit in place for a year and plan to revisit and recover it in the following year, 2013. The second seafloor optical communication unit will be installed at seafloor CORK Hole 1025C (47deg 53.2470'N 128deg 38.9190'W). We will install a new CORK data logger along with the seafloor optical unit. Again, following recovery of Jason, we plan to carry out a ship-based CTD comms operation to test the installed unit. This second CORK will also remain installed for a year.
We are collaborating with Dr. Earl Davis of Pacific Geoscience Center, Sidney, BC on the CORK communication interface along with Keir Becker of RSMAS, Miami.

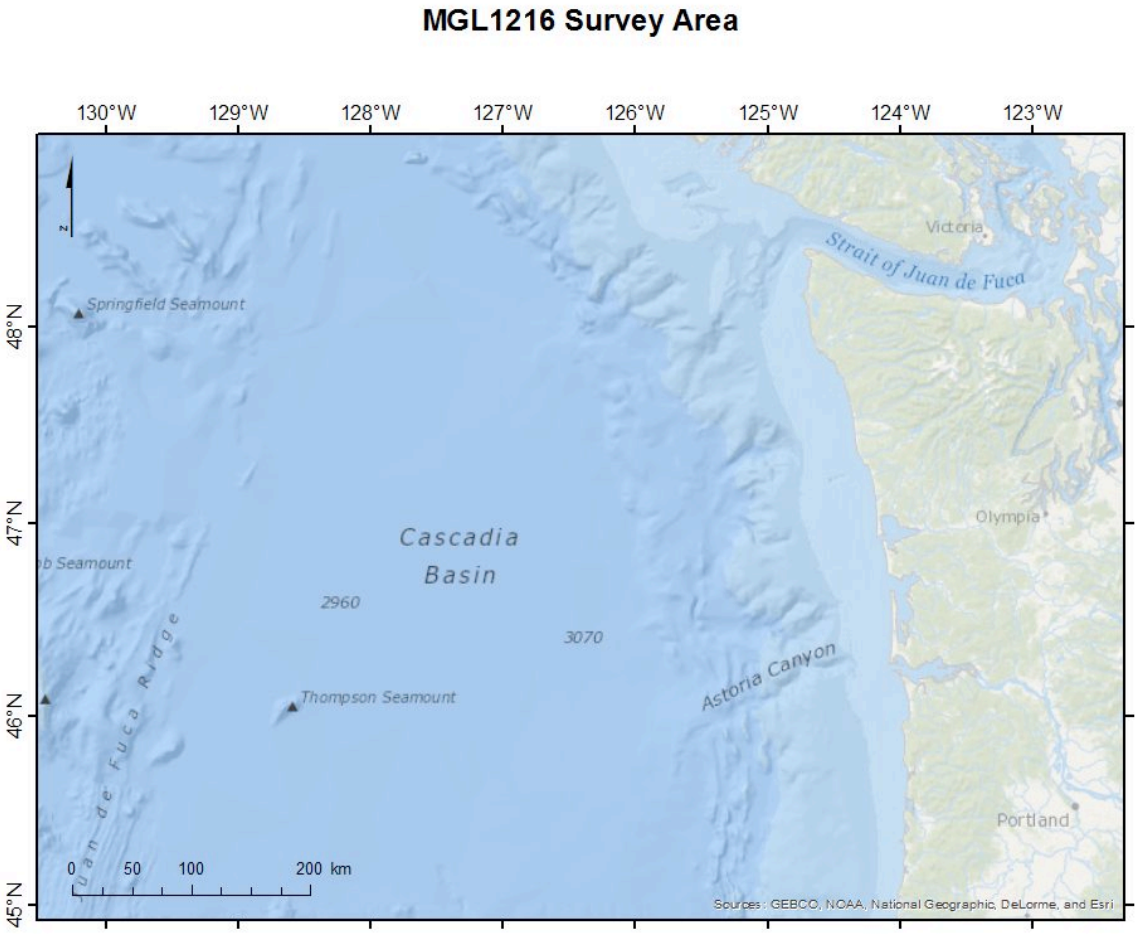
On transit to/from Axial Seamount to these CORK operations we will deploy 6 surface oceanographic drifters on the western side of the Endeavour Ridge segment. They will not be recovered unless the situation presents itself as a possibility.

Norm Farr and Jon Ware also have a Jason dive to test their High Speed Optical communications by transmitting live realtime video between Jason and Medea (i.e. tetherless communications). This test will either be accommodated at Axial Seamount or at one of the CORK sites.

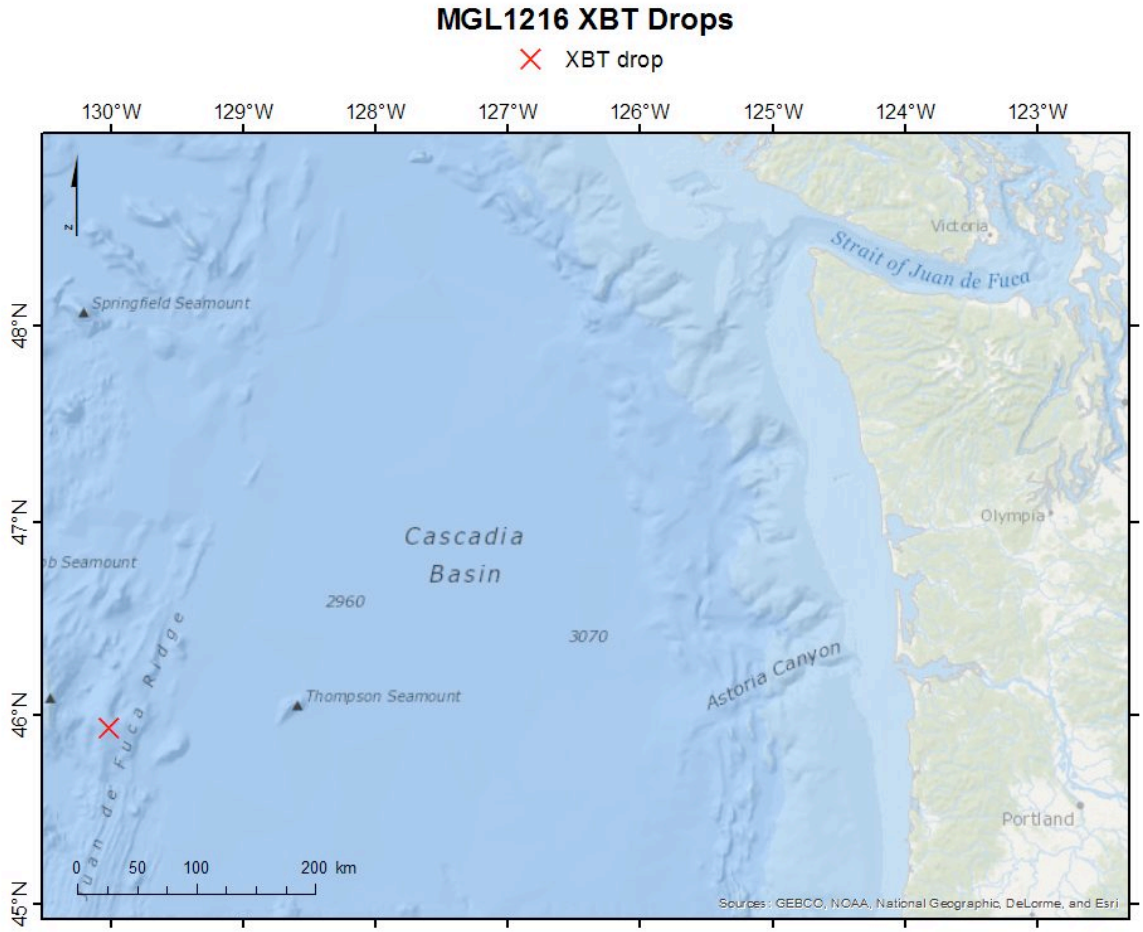
Cruise Track and XBT Drops –



Bathymetry –


MGL1216 Survey Area
130°W
129°W
128°W
127°W
126°W
125°W
124°W
123°W
48°N
47°N
46°N
45°N
N
Springfield Seamount
Victoria
Strait of Juan de Fuca
Olympia
Cascadia
Basin
2960
3070
Thompson Seamount
Astoria Canyon
Portland
0 50 100 200 km
Sources: GEBCO, NOAA, National Geographic, DeLorme, and Esri

XBT Drops –


MGL1216 XBT Drops
XBT drop
130°W
129°W
128°W
127°W
126°W
125°W
124°W
123°W
48°N
47°N
46°N
45°N
N
Victoria
Strait of Juan de Fuca
Springfield Seamount
Olympia
Cascadia
Basin
2960
3070
Thompson Seamount
Astoria Canyon
Portland
0
50
100
200 km
Sources: GEBCO, NOAA, National Geographic, DeLorme, and Esri

II. Personnel

Ship's Crew

1	James O'Loughlin	Master
2	Stanley Zeigler	Chief Mate
3	David Wolford	2nd Mate
4	Rueben Ganser	3rd Mate
5	Ricardo Redito	Bosun
6	Peter Piscitello	AB
7	George Cereno	AB
8	Inocencio Rimando	AB
9	Jeromiel Webster	OS
10	Joselyn White	OS
11	Stephen Pica	Chief Engr.
12	Ryan Vetting	2nd Engr.
13	Nathan Gardner	2nd Engr.
14	Mark Bancroft	3rd Engr.
15	Philip Neis	Electrician
16	Jerald Chase	Oiler
17	William Buchanan	Oiler
18	Guillermo Uribe	Oiler
19	Hervin McLean-Fuller	Steward
20	Leoncio Martires	Cook

Shipboard Technical Staff

1	Tom Spoto	Chief Science Officer
2	Bernard McKiernan	Acquisition

Science Party

1	Andrew S. Billings	Engineer (WHOI)
2	Clifford T. Pontbriand	Tech (WHOI)
3	Coquille O. Rex	Tech (UW)
4	Dara Evan S. Scott	Pilot (WHOI)
5	David A. Butterfield	Chief Scient. (UW)
6	David V. Price	Tech (UCSD)

7	Edward A. Mitchel	Post Doc (OSU)
8	Emily Reddington	Post Doc (MBL)
9	Glen S. Sasagawa	PI (UCSD)
10	James F. Holden	PI (U. Mass)
11	James H. Varnum	Pilot (WHOI)
12	Jonathan D. Ware	PI (WHOI)
13	Kevin K. Roe	Tech (UW)
14	Korey D. Verhein	Tech (WHOI)
15	Leigh J. Evan	Tech (OSU)
16	Leo-Paul A. Pelletier	Tech (WHOI)
17	Lorenzo McCoy	Tech (UCSD)
18	Lucy C. Stewart	Grad Student (U. Mass)
19	Mario A. Fernandez Jr.	Tech (WHOI)
20	Marvin Lilley	PI (UW)
21	Masako Tominaga	PI (Mich. St. U)
22	Maurice A. Tivey	Chief Scient. (WHOI)
23	Nile A. Kevis-Stirling	Pilot (WHOI)
24	Norman E. Farr	PI (WHOI)
25	Oliver B. Vining	Post Doc (OSU)
26	Robert L. Elder	Tech (WHOI)
27	Ron Greene	Tech (OSU)
28	Scott A. Hansen	Pilot (WHOI)
29	Scott J. McCue	Data Manager (WHOI)
30	Seth E. Shuler	Tech (UW)
31	William J. Davis	Engineer (UCSD)
32	Lorenzo McCoy *only 9/22-26	Tech (UCSD)

The sailing science participants, August 22-26, the other departed:
Maurice A. Tivey, Scott J. McCue, Andrew S. Billings, Norman E. Farr, Masako Tominaga, Jonathan D. Ware, Scott A. Hansen, Nile A. Kevis-Stirling, Dara Evan Scott, James H. Varnum, Robert L. Elder, Leigh J. Evan, Mario A. Fernandez Jr., Leo-Paul A. Pelletier, Clifford T. Pontbriand, Korey D. Verhein, Steven Jalickee and Lorenzo McCoy (UCSD, Tech).

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. Other instruments not listed were not in operation.

Instrument Data Files

Instrument	Description	Data Set	Data Outputs	Files	Interval
FE700	Furuno FE700 Echosounder	N/A	serial logs	MGL-bath01.*	1s
EM122	Kongsberg EM122 Multibeam Sonar	Partial	raw output to file	See below	variable
			centerbeam serial logs	MGL-bath02.*	variable
KNUDSEN	Knudsen Engineering 3260 Sub-bottom Profiler	Full	KEA, KEB, SEG-Y	See below	variable
DS50	Furuno DS50 Doppler Speedlog	Full	serial logs	MGL-slog01.*	1s
XBT/XCTD	Sippican MK21 XBT/XCTD Launcher	N/A	raw output to file	See below	n/a
			converted output to file	See below	n/a
WX1	RM Young 5103 Weather Bird and Translator	Full	serial logs	MGL-wx01.*	1s
			mwv conversion	MGL-mwv01.*	1s
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	raw serial logs	MGL-cnav3050all.*	1s
			converted data	MGL-cnav3050.*	1s
GYRO	Simrad GC80 Gyrocompass/AD100	Full	serial logs	MGL-gy01.*	1s
SEAPATH	Konsberg SeaPath Integrated Nav System	Full	serial logs	MGL-seapath.*	1s
MICROSV	Applied Microsystems Sound Velocity Pod Unit #1	Full	serial logs	MGL-svpod01.*	1s
MICROSV	Applied Microsystems Sound Velocity Pod Unit #2	Full	serial logs	MGL-svpod02.*	1s
SBE38	SeaBird SBE38 Pod Thermometer Pod Unit #1	Full	serial logs	MGL-temppod01.*	1s
SBE38	SeaBird SBE38 Pod Thermometer Pod Unit #2	Full	serial logs	MGL-temppod02.*	1s
PCO2	LDEO PCO2 System	Full	serial logs	MGL-pco2.*	~180s

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

FE700 - Not in use on MGL1216

The FE700 only operated up to 800m depth. The echosounder is normally switched off before the unit goes out of depth.

Logging interval: 1 second
File id: bath01

bath01 data sample:

```
bath01      2008:220:13:45:42.0681  $SDDBT,,,,,,
bath01      2008:220:13:45:42.0690  $SDDBS,,,,,,
bath01      2008:220:13:45:42.0691  $SDDPT,,0006.6*49
bath01      2008:220:13:45:42.1482  $PFEC,Alarm,0,0*6F
bath01      2008:220:13:45:42.1483  $PFEC,xdr,FORE,050*79
```

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 MGL1216/raw/multibeam. Center beam depth is recorded separately to serial log. The MicroSV (svpod01) probe in the pod supplied sound velocity to the EM122. A daily built in self test (BIST) is done on the EM122 at which time logging of data is secured (see table below for date and time of data gaps)

File id: bath02
Logging interval: variable with water depth

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:229:20:39:36.9084		start of data set	Logging Started
2012:229:20:41:22.5930	2012:229:21:30:56.1010	gap	
2012:232:18:38:39.9692	2012:232:21:21:01.6764	gap	
2012:235:18:17:20.0352	2012:236:04:25:18.7734	gap	
2012:239:15:05:40.2072		end of data set	Logging Ended

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 - Not in use on MGL1216

The Knudsen 3260 is a chirp echosounder/sub-bottom profiler. It was not in operation for the length of the cruise.

File id: n/a
Logging interval: Variable with water depth

DS50 Speedlog

The Furuno DS-50 is a Doppler speed log. It was in operation for the length of the cruise.

File id: slog01
Logging interval: 1 second

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:227:17:41:01.7986		start of data set	Before cruise
2012:228:15:58:49.7472	2012:228:16:22:35.3350	gap	Before cruise
2012:239:21:37:02.1958	2012:240:14:53:55.5638	gap	Start of Cruise
2012:228:15:58:49.7472	2012:228:17:02:12.8304	gap	
2012:239:21:37:02.1958	2012:240:14:59:24.0324	gap	End of cruise
2012:240:23:59:59.8650		end of data set	

slog01 data format:

```
slog01      2008:231:00:00:00.0744  $VDVHW,,T,,M,09.68,N,17.93,K*4C
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
```

RMYoung Integrated Weather

The weather station is used to log wind speed, direction, air temperature, and barometric pressure. The unit was functioning during the cruise.

File id: wx01
Logging interval: 1 second

Interruptions greater than ten seconds are displayed in the following table.

Log Date		Event	Comment
2012:225:00:00:01.0404		start of data set	Before cruise
2012:225:22:19:34.4770	2012:227:00:15:59.2702	gap	Before cruise
2012:228:15:58:50.6534	2012:228:16:20:40.2782	gap	Before cruise
2012:239:21:37:02.2458	2012:240:14:53:28.5154	gap	
2012:241:00:00:00.9850		end of data set	

wx01 data format:

```
wx01  2011:130:00:00:00.3553   19.0  18.6  19.3  22.5 328 328   2  16.6  17.1   3.7
21.1 355 355   0  28.2  31.1  28.0  31.2  96  85  97 1006

wx01  2011:130:00:00:01.2983   18.8  18.6  19.3  22.5 331 328   2  16.2  17.1   3.7
21.1 355 355   0  28.2  31.1  28.0  31.2  96  85  97 1006
```

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.

File id: cnav
Logging interval: 1 second

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:225:00:00:00.0764		start of data set	Before cruise
2012:225:22:19:35.2072	2012:227:00:14:42.5294		Before cruise
2012:228:15:58:51.7894	2012:228:16:19:36.1784		Before cruise
2012:239:21:37:01.0836	2012:240:14:51:59.2114		End of cruise
2012:241:00:00:00.9190		end of data set	

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.

File id: cnav3050
Logging interval: 1 second

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:225:00:00:01.4484		start of data set	before cruise
2012:225:22:19:35.2072	2012:227:00:17:32.3604		before cruise
2012:228:15:58:51.7894	2012:228:16:23:39.3246		before cruise
2012:239:21:37:01.9256	2012:240:14:55:46.2856		end of cruise
2012:241:00:00:00.7590		end of data set	

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,9.0,035
8*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.

File id: gy01
Logging interval: 1 second

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:225:00:00:01.2864		start of data set	Before cruise
2012:225:22:19:35.0590	2012:227:00:14:17.7112	gap	Before cruise
2012:228:15:58:51.0152	2012:228:16:19:19.3320	gap	Before cruise
2012:239:21:37:01.3956	2012:240:14:51:32.7670	gap	End of cruise
2012:241:00:00:00.8470		end of data set	

gy01 data format:

```
gy01  2008:231:00:00:00.4110  $PTKM,HEALM,0000,0,G1*09
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 Integrated Nav - Not in use on MGL1216.

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. System was not in operation for MGL1216. It has been decommissioned and is awaiting upgrade.

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 Integrated Nav

The Kongsberg Seapath is an inertial navigation system. Operational for the duration of the cruise.

File id: seapath
Logging interval: 1 second

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:225:00:00:00.9864		start of data set	before cruise
2012:225:22:19:35.1972	2012:227:00:15:04.4112		before cruise
2012:228:15:58:50.8432	2012:228:16:20:08.8632		before cruise
2012:239:21:37:02.1898	2012:240:14:54:16.0276		end of cruise
2012:240:23:59:59.8408		end of data set	

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
```

Sercel Streamer Tension Unit - Not in use on MGL1216.

The Sercel Streamer Tension Unit measures streamer tension in pounds. Not in use on MGL1216.

File id: stu1
Logging interval: 15 seconds

stu1 data format:

```
stu1  2011:130:00:02:12.8968  111 129  22  0 49   1  0     3360     3472     -179
33  1  1     3643     3643     -157       31  1  2     3964     3994     -157
34  1  3     3487     3584     -157       32

stu1  2011:130:00:02:27.8994  111 129  22  1  4   1  0     3375     3487     -164
33  1  1     3643     3793     -157       31  1  2     3950     4002     -164
34  1  3     3509     3606     -179       32
```

Geometrics 882 Magnetometer - Not in use on MGL1216.

The Geometrics 882 magnetometer is towed behind the ship. Raw serial output is logged using LDS. Deployment is dependent upon seismic operations. See the deployment/retrieval data gaps in the table below. For further information, see the elog files in docs/elog. Not in use on MGL1216.

SBE-45 Thermosalinograph

The Seabird TSG output is logged by LDS to the "tsg" set.

File id: tsgraw
Logging interval: 1 second

Data intermittent interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:229:21:24:42.8694		start of data set	
2012:235:19:19:44.5064	2012:236:09:04:14.6434		back in Astoria
2012:239:15:36:04.9424		end of data set	

tsgraw data sample:

```
tsgraw      2012:050:05:59:11.0312   27.3455,  5.52201,  34.7764

tsgraw      2012:050:05:59:21.0406   27.3435,  5.52175,  34.7760

tsgraw      2012:050:05:59:31.0341   27.3304,  5.52027,  34.7753
```

BGM-3 Gravimeter - Not in use on MGL1216.

The Bell Aerospace BGM-3 Gravimeter - Not in use on MGL1216.

Applied Microsystems MicroSV Pod Unit #1

The Applied Microsystems MicroSV probe #1 in the pod was functional and logging during the length of the cruise.

File id: svpod01
Logging interval: 1 second

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:225:00:00:00.3384		start of data set	before cruise
2012:225:22:19:34.8210	2012:227:00:21:06.5372		before cruise
2012:228:15:58:50.5732	2012:228:17:00:34.1344		before cruise
2012:239:21:37:01.0236	2012:240:14:56:53.6054		end of cruise
2012:240:23:59:59.1028		end of data set	

svpod01 data format:

```
svpod01     2011:130:00:00:08.6626   1540.52

svpod01     2011:130:00:00:09.6527   1540.53
```

Applied Microsystems MicroSV Pod Unit #2

The Applied Microsystems MicroSV probe #2 in the pod was functional and logging during the length of the cruise.

File id: svpod02
Logging interval: 1 second

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:225:00:00:01.5264		start of data set	before cruise
2012:225:22:19:34.5090	2012:229:14:21:33.9290		before cruise
2012:239:21:37:01.5118		end of data set	end of cruise

svpod02 data format:

```
svpod02     2011:130:00:00:08.0686   1541.87

svpod02     2011:130:00:00:09.0746   1541.88
```

Seabird SBE38 Temperature Probe Pod Unit #1

The Seabird SBE38 temperature probe #1 in the pod was functional and logging during the length of the cruise.

File id: temppod01
Logging interval: 1 second

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:225:00:00:01.0408		start of data set	before cruise
2012:225:22:19:35.0450	2012:227:00:18:40.7778		before cruise
2012:228:15:58:50.5332	2012:228:16:31:45.8692		before cruise
2012:239:21:37:01.9118	2012:240:14:56:11.9738		end of cruise
2012:240:23:59:59.3528		end of data set	

temppod01 data format:

```
temppod01   2011:130:00:00:07.0855  29.4851

temppod01   2011:130:00:00:07.9476  29.4850
```

Seabird SBE38 Temperature Probe Pod Unit #2

The Seabird SBE38 temperature probe #2 in the pod was functional and logging during the length of the cruise.

File id: temppod02
Logging interval: 1 second

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:225:00:00:01.1044		start of data set	before cruise
2012:225:22:19:35.6772	2012:227:00:18:55.3970		before cruise
2012:228:15:58:50.3672	2012:229:21:28:25.9036		before cruise
2012:239:21:37:01.8416	2012:240:14:56:26.5912		end of cruise
2012:240:23:59:59.4108		end of data set	

temppod02 data format:

```
temppod02   2011:130:00:00:07.2015  29.4884

temppod02   2011:130:00:00:08.0786  29.4883
```

LDEO PCO2 System

The LDEO PCO2 system output is logged by LDS to the "pco2" set.

File id: pco2
Logging interval: ~180 seconds

Interruptions greater than one hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2012:229:22:21:26.6604		start of data set	start of cruise
2012:235:19:23:49.5118	2012:236:09:03:41.5044		
2012:236:11:47:16.9698	2012:236:12:07:49.7024		
2012:235:19:23:49.5118	2012:236:09:03:41.5044		
2012:236:11:47:16.9698	2012:236:12:07:49.7024		
2012:239:15:32:13.2606		end of data set	end of cruise

pco2 data format:

```
pco2  2011:130:00:27:11.9162  2011130.02002        2370.39      37.54     1007.07
          404.51      28.42       386.9   5000.00         19           0
Equil

pco2  2011:130:00:30:00.5374  2011130.02198        2370.02      37.53     1007.14
          404.42      28.46       386.8   5000.00         19           0
Equil
```

Mk21 XBT System

Files: *.RDF,*.EDF

One (1) XBT drop was made during this cruise. The type breakdown is as follows: 1 – T5. The data set is saved to the raw/XBT directory in the cruise archive. Refer to the MGL1216_Expendable_Drops.xls spreadsheet in the docs/operations directory of the cruise archive for more information.

IV. Seismic Summary - Not in use on MGL1216.

A. Seismic Overview - Not in use on MGL1216.

Physical Configuration
The towing configuration for the air guns and streamers is detailed in the document titled

Offsets
All antenna and in-water offset drawings are in the file

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

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

V. RV Langseth Gravity Tie Information

A gravity tie was done before and after the cruise in Astoria, Oregon. Please refer to the documents located under MGL1216/docs/gravity_tie for detailed records.

VI. Archive Contents

Key files are bolded.

MGL1216/docs	Cruise documents and logs
MGL1216/docs/config	Configuration archive
MGL1216/docs/elog	Cruise elog
MGL1216/docs/gravity_tie	Gravity Tie information
MGL1216/docs/map	Cruise maps, track map
Not in use on MGL1216	Vessel/sensor offsets
MGL1216/docs/operations/	Operations documents
MGL1216/docs/operations/Daily_Reports	Cruise Daily Reports from Chief Science Officer
Not in use on MGL1216	Seismic navigation logs (spectra)
Not in use on MGL1216	Seismic acquisition logs (gun controller)
Not in use on MGL1216	**Master line log table**
MGL1216/docs/permits	Clearance Documents
MGL1216/docs/waypoints	Waypoint files
MGL1216/docs/personnel	Personnel rosters, org chart, bunk and phone lists
MGL1216/docs/reports	Cruise Report and supplemental docs
MGL1216/docs/reports/MGL1216_DataReport_v1.0.doc	**This file**
Not in use on MGL1216	**Vessel/sensor offsets**
MGL1216/docs/screencaps	Screen captures
MGL1216/processed	Processed data
Not in use on MGL1216	Spectra reflex files
Not in use on MGL1216	Shot log files
Not in use on MGL1216	Sprint files
MGL1216/processed/svp	Sound velocity profiles
MGL1216/raw	Raw data
MGL1216/raw/adcp	Raw ADCP data
Not in use on MGL1216	Raw Knudsen sub-bottom profiler data
MGL1216/raw/multibeam	Raw EM122 data
MGL1216/raw/serial	Underway serial data: gps, tsg, weather, etc.
Not in use on MGL1216	Spectra p190
Not in use on MGL1216	Spectra p294
MGL1216/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-Gobal 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, ddmm.mmmmm, a, ddmm.mmmmm, a, x, xx, x.x, xx.xx, M, xx.xx, M, x.x, xyy*hh

$GPGGA Sentence Fields

Item	Definition	Units
hhmms.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

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-Gobal 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, ddmm.mmmmm, a, ddmm.mmmmm, a, x, xx, x.x, xx.xx, M, xx.xx, M, x.x, xyy*hh

$GPGGA Sentence Fields

Item	Definition	Units
hhmms.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 fulll multibeam data, please see the multibeam page.

The EM122 outputs serial data in the following formats:

- KIDPT - Depth below transducer

$KIDBT,x.x,x.x,x.x,*hh

SDDBT sentence format

Item	Definition	Units
x.x	Water depth	feet
x.x	Water depth	meters
x.x	Water depth	fathoms
*hh	Checksum	n/a

FE700 Navigational Echosounder data

The FE700 Navigational Echosounder outputs data in the following formats

- $PFEC - unspecified
- $SDDBT - Depth Below Transducer
- $SDDBS - Depth Below Surface

$PFEC ,aaaa,x,x*hF

PFEC sentence format

Item	Definition	Units
aaaa	unspecified	unspecified
x	unspecified	unspecified
x	unspecified	unspecified
*hF	unspecified	unspecified

$DBT,x.x,f,x.x,M,x.x,F*hh

SDDBT sentence format

Item	Definition	Units
x.x	Water depth	feet
f	f = feet	n/a
x.x	Water depth	meters
M	M = meters	n/a
x.x	Water depth	fathoms
F	F = fathoms	n/a
*hh	Checksum	n/a

$DBS,x.x,f,x.x,M,x.x,F*hh

SDDBS sentence format

Item	Definition	Units
x.x	Water depth	feet
f	f = feet	n/a
x.x	Water depth	meters
M	M = meters	n/a
x.x	Water depth	fathoms
F	F = fathoms	n/a
*hh	Checksum	n/a

Gyroscope data

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

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

$PCICM,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

RM Young Meteorological Station Data

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

```
 12.6  13.2  12.6  16.9   1 335   2   0.0   0.0   0.0   0.0 355 355   0 -11.9 -23.8
*****   7.3  8  4  9 1006.9
aaa.a bbb.b ccc.c  dd.d eee fff ggg hhh.h iii.i jjj.j kkk.k lll mmm nnn -oo.o -pp.p
-qq.q -rr.r ss tt uu vvvv.v
```

Langseth WX station sentence format

Item	Definition	Units
aaa.a	bird 1 speed, instantaneous	knots
bbb.b	bird 1 speed, 60 second average	knots
ccc.c	bird 1 speed, 60 minute average	knots
ddd.d	bird 1 speed, 60 second peak	knots
eee	bird 1 direction, instantaneous	knots
fff	bird 1 direction, 60 second average	knots
ggg	bird 1 direction, 60 minute average	knots
hhh.h	bird 2 speed, instantaneous	knots
iii.i	bird 2 speed, 60 second average	knots
jjj.j	bird 2 speed, 60 minute average	knots
kkk.k	bird 2 speed, 60 second peak	knots
lll	bird 2 direction, instantaneous	knots
mmm	bird 2 direction, 60 second average	knots
nnn	bird 2 direction, 60 minute average	knots
ooo.o	temperature, instantaneous	Degrees C
ppp.p	temperature, 60 minute average	Degrees C
qqq.q	temperature, 60 minute low	Degrees C
rrr.r	temperature, 60 minute high	Degrees C
ss	relative humidity, instantaneous	%
tt	relative humidity, 60 minute low	%
uu	relative humidity, 60 minute high	%
vvvv.v	Baromoeter, instantaneous	knots

OBSIP Shotlog Format (not used on MGL1216)

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
lllllllllllllll
```

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
dddd.d	depth	meters
lllllllllllllll	linename	n/a

LDEO PCO2 System

PCO2 outputs data in the following sentence format:

yyyyjjj.jjj aaaa.aa bb.bb cccc.cc ddd.dd e.ee fff.f gggg.gg hh i k

PCO2 Data

Item	Definition	Value	Units
yyyyjjj.jjj	pco2 Computer Date/Time	n/a	Year/Julian Day.decimal Four fixed digits of year. Three fixed digits of julian day. Five fixed digits for decimal fractions of a julian day.
aaaa.aa	CO2 Raw Signal	n/a	mVolts
bb.bb	CO2 Analyzer Cell Temperature	n/a	Celcius
cccc.cc	PCO2 Barometer	n/a	mbar
ddd.dd	VCO2	n/a	ppm
e.ee	Equilibrator Water Temp	n/a	Celcius
fff.f	pCO2	n/a	uatm
gggg.gg	Flow Controller	n/a	mVolts
hh	Flow Meter	n/a	cc/min
i	Sample ID #	0 to 16	integer
k	Sample ID	Equil, Atmos, Nitrogen, CC18798, CA07163, CC15551, or CC63668	alphanumeric

LDEO PCO2 + CNav + TSG + WX01 + SBE38 Systems

PCO2 merge is a combination of outputs of various serial data in the following sentence format:

yyyyjjj.jjj aaaa.aa bb.bb cccc.cc ddd.dd e.ee fff.f gggg.gg hh i k, llll.llllllm, nnnnn.nnnnnno, pppp.pp, q.qq, r .rr , s.ss, tt.tt, uu.u, vvv w .w , xxx.x, yyyzzz.z, @@.@@@@

PCO2 Data

Item	Definition	Value	Units
yyyyjjj.jjj	pco2 Computer Date/Time	n/a	Year/Julian Day.decimal Four fixed digits of year. Three fixed digits of julian day. Five fixed digits for decimal fractions of a julian day.
aaaa.aa	CO2 Raw Signal	n/a	mVolts
bb.bb	CO2 Analyzer Cell Temperature	n/a	Celcius
cccc.cc	PCO2 Barometer	n/a	mbar
ddd.dd	VCO2	n/a	ppm
e.ee	Equilibrator Water Temp	n/a	Celcius
fff.f	pCO2	n/a	uatm
gggg.gg	Flow Controller	n/a	mVolts
hh	Flow Meter	n/a	cc/min
i	Sample ID #	0 to 16	integer
k	Sample ID	Equil, Atmos, Nitrogen,CC18798, CA07163, C15551, or CC63668	alphanumeric
llll.llllllm	CNav Latitude	0 to 90, N/S	degrees/minutes.decimal/direction
nnnnn.nnnnnno	CNav Longitude	0 to 180, E/W	degrees/minutes.decimal/direction
pppp.pp	TSG Speed of Sound	n/a	m/s
q.qq	TSG Internal Temperature	n/a	Celcius
r.rr	TSG External Temperature	n/a	Celcius
s.ss	TSG Conductivity	n/a	S/m
tt.tt	TSG Salinity	25 to 40	ppm
uu.u	WX01 Bird 1 Wind Speed 60 sec avg	n/a	knots
vvv	WX01 Bird 1 Wind Direction 60 sec avg	0 to 360	degrees
w.w	WX01 Temperature Instantaneous	n/a	Celcius
xxx.x	WX01 Ship Barometer Instantaneous	n/a	mbar
y.yy	CNav Speed Over Ground / Speed Made Good	0 to 15	knots
zzz.z	CNav Course Made Good	0 to 360	degrees
@@.@@@@	SBE38 Temperature Probe	n/a	Celcius

POS/MV Position and Orientation System for Marine Vessels

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, hhmmss.sss, llll.lllll, a, yyyyy.yyyyyb, 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.
llll.lllll	Latitude	-90 to +90	DegreeslMinutes.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	n/a	Metres

	mean sea level. A negative value indicates below sea level.		
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	o 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

RM Young Rain Gauge & Eppley PSP data

RM Young Rain Gauge & Eppley PSP data is formatted in the following sentences:

x.xxxxxx,yy

Sentence field

Instrument	Item	definition	units
Eppley PSP	x.xxxxxx	voltage	mV
RM Young Rain Gauge	y.y	amount of rain	mm

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 200 Intertial 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, hhmmss.sss, llll.lllll, 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	
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.
llll.lllll	Latitude	-90 to +90	DegreeslMinutes.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	o 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

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

Item	definition	units
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

Item	Definition	Units
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

Streamer Tension Unit Data (not used on MGL1216)
STU outputs data in the following sentence format:

aaa bbb cc dd ee f g hhhh iiii jjjj kkkk l m nnnn oooo pppp qqqq r s tttt uuuu vvvv wwww x y zzzz !!!! @@@@

STU Data

Item	Definition	Value	Units
aaa	na	n/a	n/a
bbb	Julian Day	1 to 366	day
cc	Hour	0 to 24	integer
dd	Minutes	0 to 60	integer
ee	Seconds	0 to 60	integer
f	# 1 ID	1	integer
g	# 1 Channel #	0	integer
hhhh	# 1 Peak Tension	n/a	lbs
iiii	# 1 Average Tension	n/a	lbs
jjjj	# 1 Delta Tension	n/a	n/a
kkkk	# 1 Temperature	n/a	Celcius
l	# 2 ID	1	integer
m	# 2 Channel #	1	integer
nnnn	# 2 Peak Tension	n/a	lbs
oooo	# 2 Average Tension	n/a	lbs
pppp	# 2 Delta Tension	n/a	n/a
qqqq	# 2 Temperature	n/a	Celcius
r	# 3 ID	1	integer
s	# 3 Channel #	2	integer
tttt	# 3 Peak Tension	n/a	lbs
uuuu	# 3 Average Tension	n/a	lbs
vvvv	# 3 Delta Tension	n/a	n/a
wwww	# 3 Temperature	n/a	Celcius
x	# 4 ID	1	integer
y	# 4 Channel #	3	integer
zzzz	# 4 Peak Tension	n/a	lbs
!!!!	# 4 Average Tension	n/a	lbs
@@@@	# 4 Delta Tension	n/a	n/a
####	# 4 Temperature	n/a	Celcius

Applied Microsystems 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

RM Young Meteorological Station Data

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

```
 12.6  13.2  12.6  16.9   1 335   2   0.0   0.0   0.0   0.0 355 355   0 -11.9 -23.8
*****   7.3  8  4  9 1006.9
aaa.a bbb.b ccc.c  dd.d eee fff ggg hhh.h iii.i jjj.j kkk.k lll mmm nnn -oo.o -pp.p -
qq.q -rr.r ss tt uu vvvv.v
```

Langseth WX station sentence format

Item	Definition	Units
aaa.a	bird 1 speed, instantaneous	knots
bbb.b	bird 1 speed, 60 second average	knots
ccc.c	bird 1 speed, 60 minute average	knots
ddd.d	bird 1 speed, 60 second peak	knots
eee	bird 1 direction, instantaneous	knots
fff	bird 1 direction, 60 second average	knots
ggg	bird 1 direction, 60 minute average	knots
hhh.h	bird 2 speed, instantaneous	knots
iii.i	bird 2 speed, 60 second average	knots
jjj.j	bird 2 speed, 60 minute average	knots
kkk.k	bird 2 speed, 60 second peak	knots
lll	bird 2 direction, instantaneous	knots
mmm	bird 2 direction, 60 second average	knots
nnn	bird 2 direction, 60 minute average	knots
ooo.o	temperature, instantaneous	Degrees C
ppp.p	temperature, 60 minute average	Degrees C
qqq.q	temperature, 60 minute low	Degrees C
rrr.r	temperature, 60 minute high	Degrees C
ss	relative humidity, instantaneous	%
tt	relative humidity, 60 minute low	%
uu	relative humidity, 60 minute high	%
vvvv.v	Baromoeter, instantaneous	knots