RV Langseth
Data Reduction Summary

MGL1305

St. George's, Bermuda to Ponta Delgada, Azores

FINAL

V1.2, 2013-08-20

Lamont-Doherty Earth Observatory, Columbia University

Aug 14 2013 08:00:00L

Date	Julian Date	Time	Port
2013-04-09	2013-99	1200 UTC, 0800L	St. George, Bermuda
2013-05-19	2013-139	0800 UTC, 0800L	Ponta Delgada, Azores

Prepared by:
David Martinson
Science Officer
dmartins@ldeo.columbia.edu

Lisa Hawkins
lhawkins@ldeo.columbia.edu

Table of Contents

I. Background and Scientific Objectives

MGL1305 is a Seismic Investigation of the Rainbow Hydrothermal Field and its Tectono/Magmatic Setting at the Mid-Atlantic Ridge 36° 14'N. Other supporting equipment shall consist of a Kongsberg EM122 Multibeam echo sounder, the Knudsen 3260 3.5 kHz Sub-bottom Profiler, the RDI 75 kHz acoustic Doppler current profiler (ADCP), the Bell BGM-3 Gravimeter, and the Geometrics 882 magnetometers.

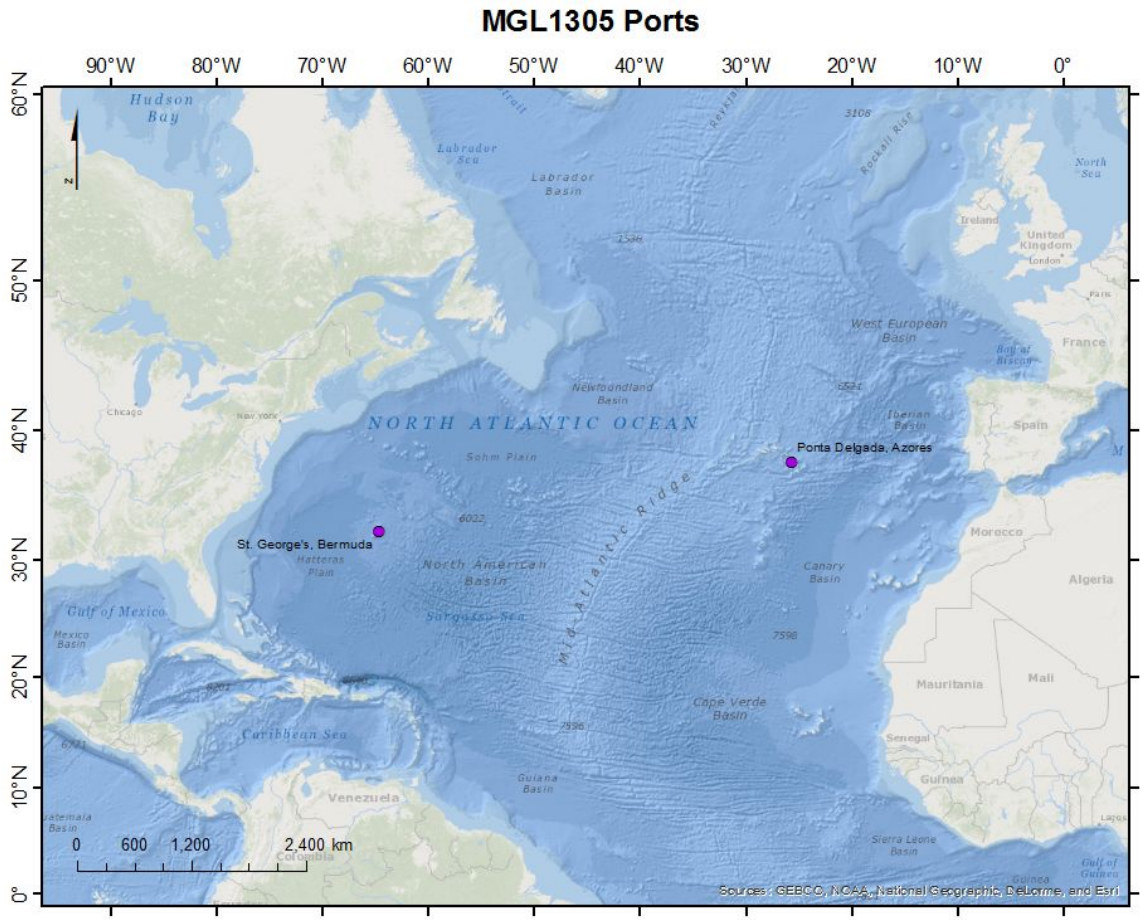
(Pulled from IHA application information submitted by the PI)

This project proposes to conduct a multi-scale seismic investigation of the tectono/magmatic setting of the Rainbow hydrothermal field, located within a non- transform discontinuity of the Mid-Atlantic Ridge (36°14'N). The main goals are (1) to determine the nature, geometry, and location of the heat source driving high- temperature circulation at Rainbow; (2) to determine the structure and origin of the ultramafic massif that hosts the hydrothermal field; and (3) to image large (detachment) and small-scale faults and investigate how they link to the heat source and control hydrothermal fluid focusing and discharge. To achieve these goals we propose (1) to conduct a 3D active-source seismic tomography experiment using 46 short-period OBSs (one single deployment); (2) to acquire 2D single-8km-streamer seismic reflection profiles; and (3) to monitor passive microseismicity in the area for a period of 6 months using 15 shot-period OBSs. As platform for active source OBS deployment/recover, passive OBS deployment, MCS profiling, and airgun shooting we propose to use the R/V Marcus G. Langseth.

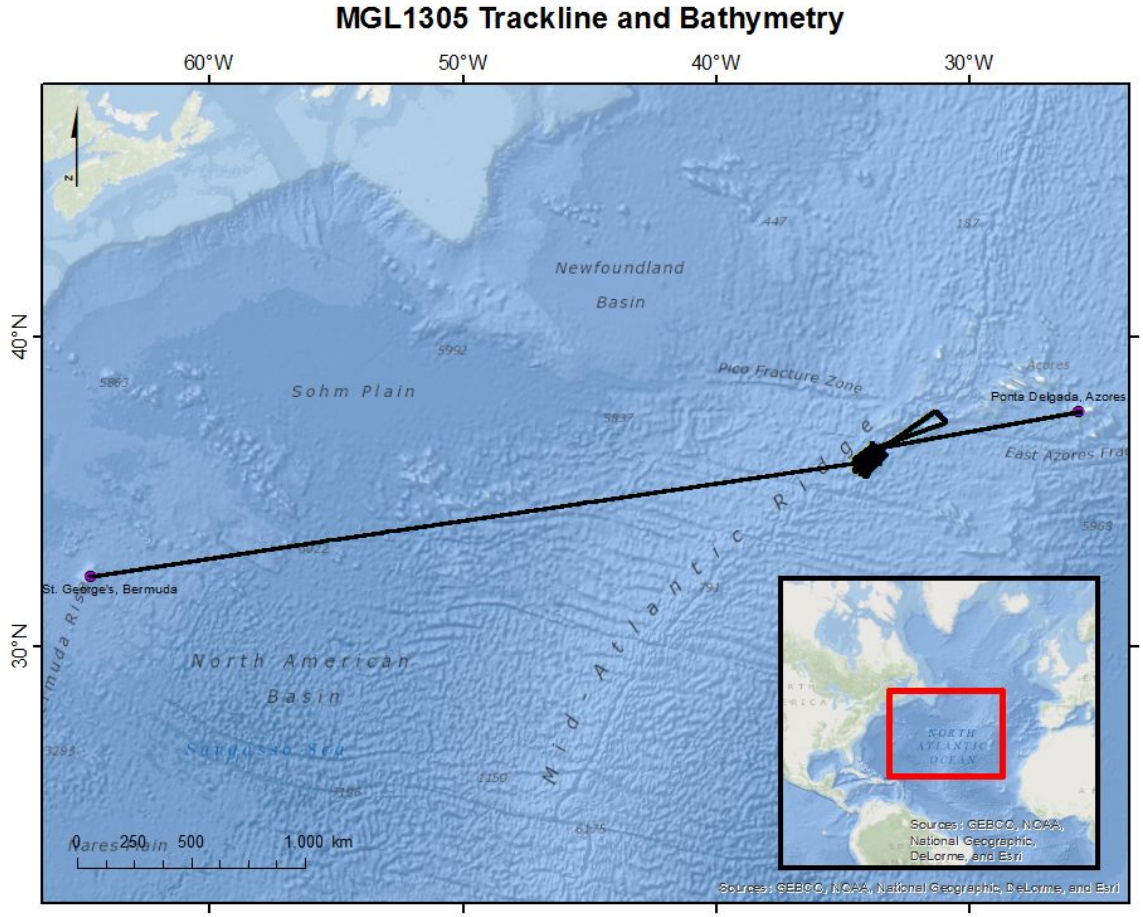
Port –

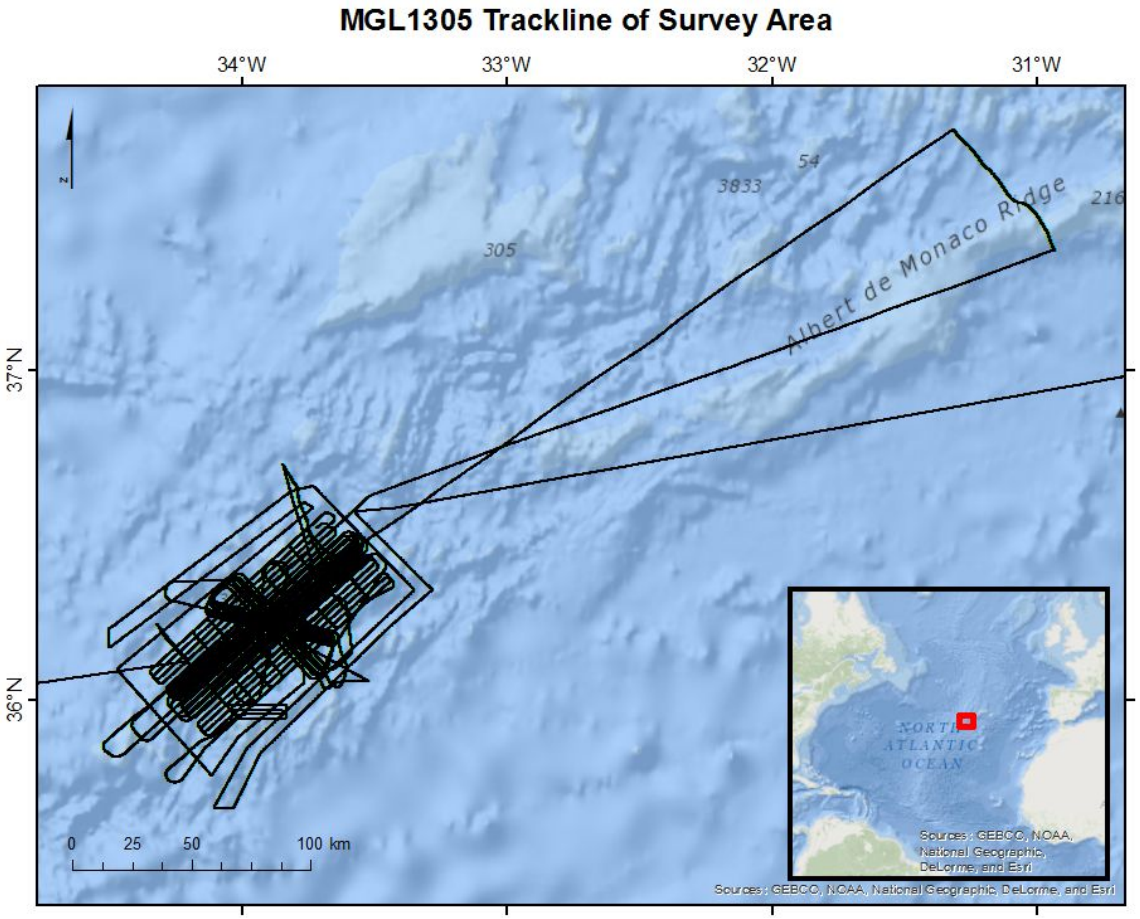
St. George's Bermuda 32° 22' 54" N, 064° 40' 41" W

Ponta Delgada, Azores 37.7333° N, 025.6667° W

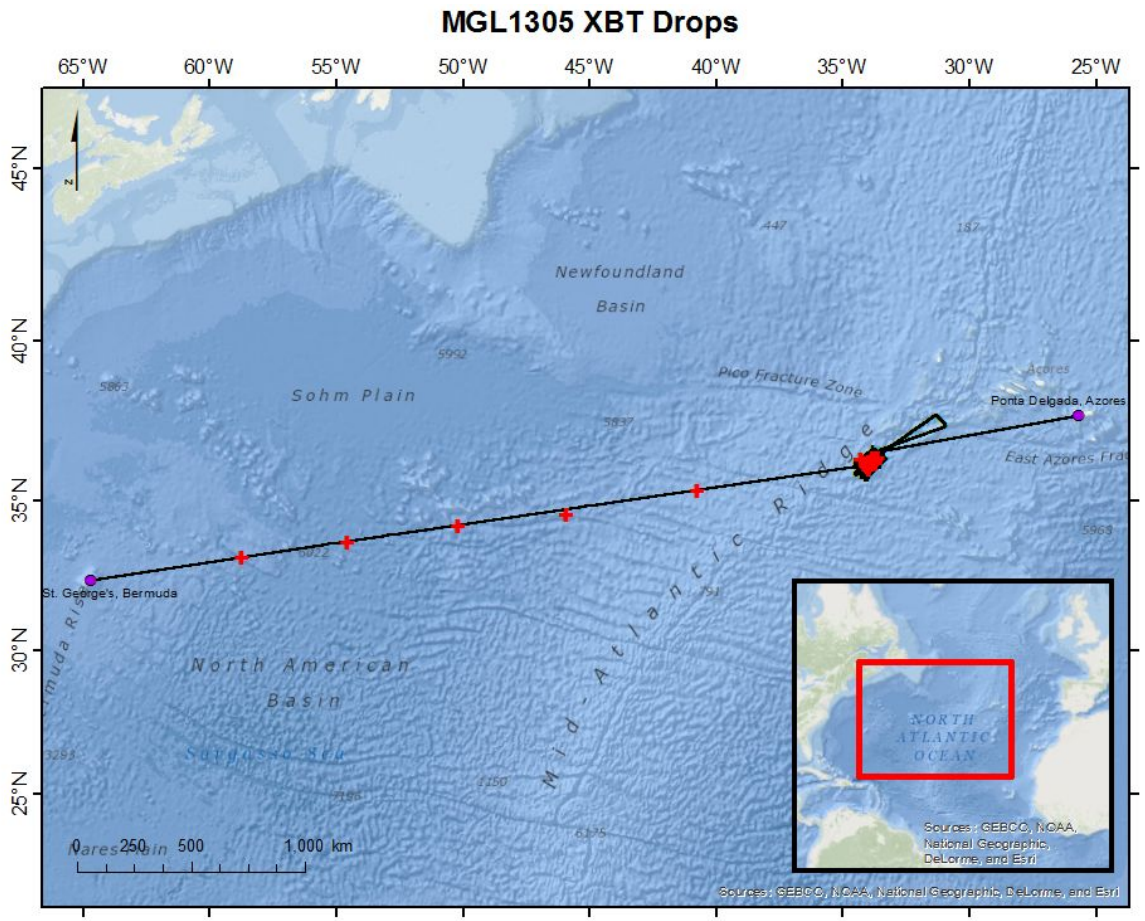


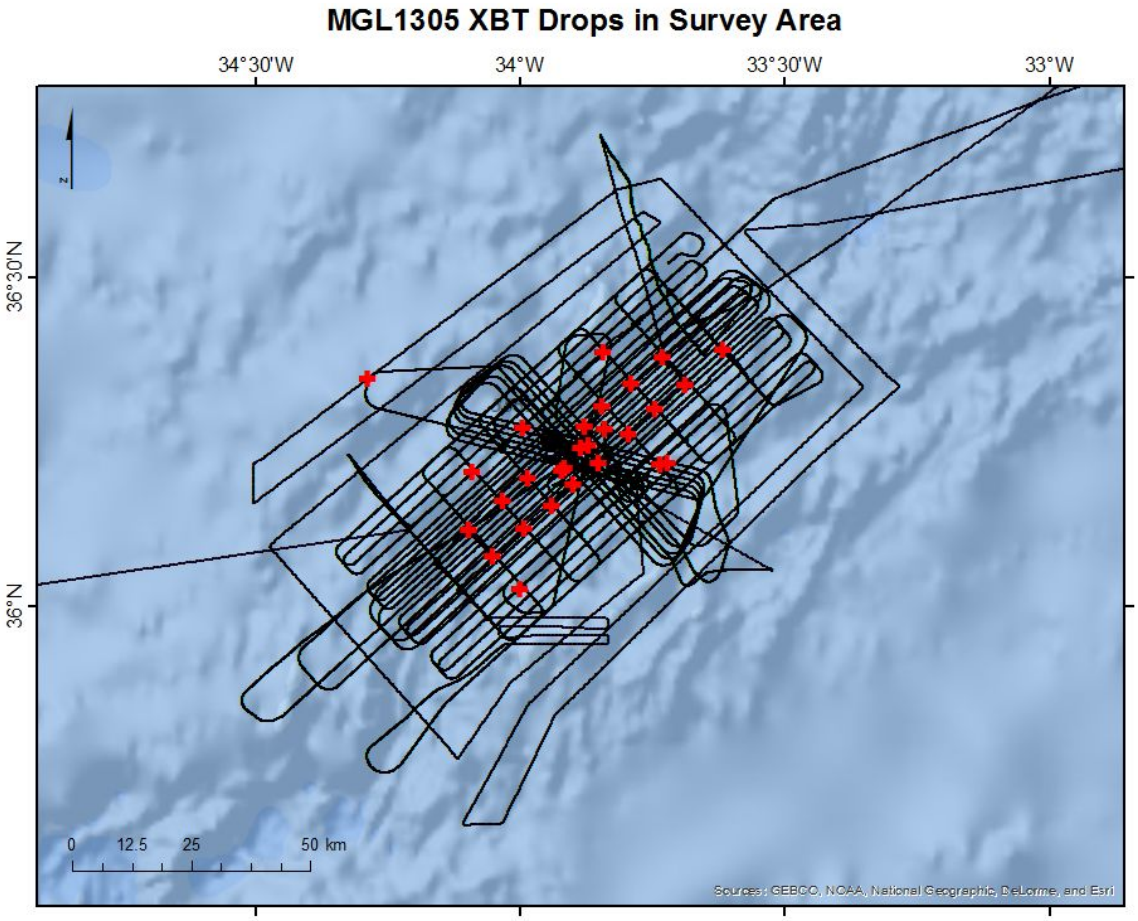
Trackline and Bathymetry –




MGL1305 Trackline of Survey Area
34°W
33°W
32°W
31°W
37°N
36°N
N
3833
54
305
216
Albert de Monaco Ridge
0
25
50
100 km
NORTH ATLANTIC OCEAN
Sources: GEBCO, NOAA, National Geographic, DeLorme, and Esri
Sources: GEBCO, NOAA, National Geographic, DeLorme, and Esri

XBT Drops –


MGL1305 XBT Drops
65°W
60°W
55°W
50°W
45°W
40°W
35°W
30°W
25°W
45°N
40°N
35°N
30°N
25°N
Newfoundland
Basin
Sohm Plain
Pico Fracture Zone
Azores
Ponta Delgada, Azores
East Azores Fra
St. George's, Bermuda
North American
Basin
Mid-Atlantic Ridge
0 250 500 1,000 km
NORTH ATLANTIC OCEAN
Sources: GEBCO, NOAA, National Geographic, DeLorme, and Esri
Sources: GEBCO, NOAA, National Geographic, DeLorme, and Esri


MGL1305 XBT Drops in Survey Area
34°30'W
34°W
33°30'W
33°W
36°30'N
36°N
N
0
12.5
25
50 km
Sources: GEBCO, NOAA, National Geographic, DeLorme, and Esri

II. Personnel

Shipboard Technical Staff

1	David Martinson	Chief Science Officer
2	Michael Martello	Navigation
3	Nigel Crane	Navigation
4	Bern Mckiernan	Acquisition
5	Klayton Curtis	Acquisition
6	Tom Spoto	Chief Sound Source Mechanic
7	Robbie Gunn	Sound Source Mechanic
8	Carlos Gutierrez	Sound Source Mechanic
9	Josh Kasinger	Sound Source Mechanic

Ship's Crew

1	Mark Landow	Captain
2	David Wolford	Chief Mate
3	Lee Dortzbach	2nd Mate
4	West Wilson	3rd Mate
5	Jason Woronowitcz	Bosun
6	Peter Pistacello	AB
7	George Cereno	AB
8	Inocencio Rimando	AB
9	Jeromiel Webster	OS
10	Jocelyn White	Utility
11	Albert Karlyn	Chief Engineer
12	Matthew Tucke	1st Asst. Engineer
13	Michael Romero	2nd Asst. Engineer
14	Apolonario Scalacal	3rd Asst. Engineer
15	Jack Schwartz	Electrician
16	Guillermo Uribe	Oiler
17	Jack Billings	Oiler
18	Cheryl Gutkowski	Oiler
19	Michael McCoy	Steward
20	Ricardo Rios	Cook

MMO

1	Stephanie Milne	PSO
2	Meghan Piercy	PSO
3	Dara Cameron	PSO
4	Leslie Curran	PSO
5	Katelyn Morrel	PSO

Science Party

1	Juan Pablo Canales	Chief Scientist	WHOI
2	Robert Dunn	Co-chief Scientist	U of Hawaii
3	Stephen Swift	Co-chief Scientist	WHOI
4	Ryuta Arai	Post Doc Researcher	U of Hawaii
5	Michele Paulatto	Post Doc Researcher	Oxford, UK
6	Greg Horning	Graduate Student	WHOI
7	Florent Szitkar	Graduate Student	IPG Paris, FR
8	Maja Fabeta	Graduate Student	National University Galway, IR
9	Omar Benazzouz	Graduate Student	University of Aveiro, Portugal
10	Eva Kakone	Undergrad Student	U of Hawaii
11	Hannes Griesche	Undergrad Student	University of Munster, Germany
12	Chris McHugh	MATE Intern	Coastel Carolina University

OBS

1	Ernie Aaron	OBS	SIO
2	Mark Gibaud	OBS	SIO
3	Phil Thai	OBS	SIO

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	Full	Center beam data	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	18 drops	raw output to file	See below	n/a
			converted output to file	See below	n/a
WX1	RM Young 5103 Weather Bird and	Full	serial logs	MGL-wx01.*	1s
			mwv conversion	MGL-mwv01.*	1s
TSG	SeaBird SBE45 Thermosalinograph	Full	raw serial logs	MGL-	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
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 Integrated Nav	Full	serial logs	MGL-posmv*	ls
SEAPATH	Konsberg SeaPath Integrated Nav System	Full	serial logs	MGL-seapath.*	1s
STU	Sercel Streamer Tension	Full	Serial logs	MGL-stu1*	15s

MICROSV	Applied Microsystems Sound Velocity Pod Unit #1	N/A	serial logs	MGL-svpod01.*	1s
MICROSV	Applied Microsystems Sound Velocity Pod Unit #2	Full	serial logs	MGL-svpod02.*	1s
MICROSV	Applied Microsystems Sound Velocity USS Unit	N/A	serial logs	MGL-svuss01.*	1s
SBE38	SeaBird SBE38 Pod Thermometer Pod Unit #1	Full	serial logs	MGL-temppod01.*	1s
SBE38	SeaBird SBE38 Pod Thermometer Pod Unit #2	N/A	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.

Notes:

EM122 MBES and Knudsen 3260 SBP were secured (not logging) during OBS operations, usually about an hour at a time mostly concentrated during the first half of the cruise.

Science Navigation Instrumentation

FE700 - Not in use on MGL1305

The FE700 was not in use on MGL1305.

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 MGL1305/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), usually about 8-15 minutes.

File id: bath02
Logging interval: variable with water depth

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

Log Date		Event	Comment
2013:101:22:05:05.7358		start of data set	
2013:101:22:05:15.9710	2013:101:22:26:03.9092	gap	21 min
2013:101:22:29:36.0536	2013:101:22:36:47.9562	gap	7 min
2013:102:15:38:38.6580	2013:102:15:51:29.8994	gap	13 min
2013:103:12:26:21.4840	2013:103:18:54:01.1052	gap	6 hrs 28 min
2013:104:18:11:04.7612	2013:104:18:17:37.3288	gap	6 min
2013:104:22:16:40.6100	2013:104:22:23:04.3166	gap	7 min
2013:105:16:13:41.7774	2013:105:16:47:18.6250	gap	34 min
2013:107:20:53:43.7528	2013:107:21:02:25.8314	gap	9 min
2013:108:15:37:17.6296	2013:108:15:44:36.5768	gap	7 min
2013:111:12:17:33.0806	2013:111:12:27:06.8636	gap	10 min
2013:114:10:06:40.3788	2013:114:10:31:59.2046	gap	25 min
2013:118:11:37:46.1850	2013:118:11:57:24.6482	gap	20 min
2013:121:22:06:04.5040	2013:121:23:20:54.2626	gap	1 hrs 14 min
2013:121:23:44:36.0288	2013:122:01:13:34.6464	gap	1 days 22 hrs 31 min
2013:122:01:38:59.6716	2013:122:02:38:46.4644	gap	1 hrs 0 min
2013:122:03:07:53.6324	2013:122:04:22:37.5918	gap	1 hrs 15 min
2013:122:05:01:22.5018	2013:122:05:51:41.7934	gap	50 min
2013:122:06:16:25.1448	2013:122:07:15:30.6458	gap	59 min

2013:122:07:32:26.7690	2013:122:08:26:44.3940	gap	54 min
2013:122:08:57:29.8606	2013:122:10:03:06.0006	gap	1 hrs 6 min
2013:122:10:42:05.1548	2013:122:11:37:58.7584	gap	55 min
2013:122:12:17:24.4774	2013:122:13:11:45.3332	gap	54 min
2013:122:13:51:01.1954	2013:122:15:21:41.0346	gap	1 hrs 30 min
2013:122:15:59:21.1770	2013:122:16:57:23.1698	gap	58 min
2013:122:17:34:02.5348	2013:122:18:27:23.1276	gap	53 min
2013:122:19:08:12.3022	2013:122:20:16:44.0616	gap	1 hrs 8 min
2013:122:20:52:38.3784	2013:122:21:55:52.9066	gap	1 hrs 3 min
2013:122:22:34:38.7944	2013:122:23:35:36.1608	gap	1 hrs 1 min
2013:123:00:05:58.8494	2013:123:01:05:11.1666	gap	1 hrs 0 min
2013:123:01:25:29.4912	2013:123:01:52:53.6042	gap	27 min
2013:123:01:53:25.9230	2013:123:03:31:25.1900	gap	1 hrs 38 min
2013:123:03:31:49.6360	2013:123:03:48:04.6600	gap	17 min
2013:123:04:01:46.3244	2013:123:04:59:58.4160	gap	58 min
2013:123:05:16:01.2570	2013:123:06:29:16.7060	gap	1 hrs 13 min
2013:123:06:55:55.8938	2013:123:07:53:11.4064	gap	58 min
2013:123:08:22:46.4188	2013:123:09:24:17.7858	gap	1 hrs 2 min
2013:123:09:57:27.0386	2013:123:11:02:10.5250	gap	1 hrs 5 min
2013:123:11:35:27.3576	2013:123:12:45:58.7306	gap	1 hrs 10 min
2013:123:13:18:25.3602	2013:123:14:17:56.6492	gap	59 min
2013:123:14:46:47.4742	2013:123:15:38:40.4776	gap	52 min
2013:125:11:12:24.3220	2013:125:11:23:01.5528	gap	11 min
2013:128:11:10:44.6504	2013:128:11:18:24.2376	gap	8 min
2013:133:08:37:20.4544	2013:133:09:39:56.4236	gap	1 hrs 2 min
2013:133:10:00:13.6634	2013:133:11:13:06.2362	gap	1 hrs 13 min
2013:133:11:32:45.3266	2013:133:12:54:33.5556	gap	1 hrs 22 min
2013:133:13:23:46.3812	2013:133:14:36:38.5296	gap	1 hrs 13 min
2013:133:15:07:19.9592	2013:133:16:43:10.7118	gap	1 hrs 36 min
2013:133:17:06:07.9514	2013:133:18:22:38.6206	gap	1 hrs 16 min
2013:133:18:48:55.5656	2013:133:20:09:09.7052	gap	1 hrs 21 min
2013:133:20:37:05.5384	2013:133:22:02:15.6154	gap	1 hrs 25 min
2013:133:22:20:47.4638	2013:133:23:54:59.7960	gap	1 hrs 34 min
2013:134:00:22:10.3138	2013:134:01:30:14.2114	gap	1 hrs 8 min
2013:134:01:39:40.0244	2013:134:02:53:55.3254	gap	1 hrs 14 min
2013:134:03:12:21.4574	2013:134:04:22:08.9448	gap	1 hrs 10 min
2013:134:04:34:37.6566	2013:134:06:05:37.6388	gap	1 hrs 31 min
2013:134:06:22:13.7268	2013:134:07:43:34.9270	gap	1 hrs 21 min
2013:134:08:00:54.5792	2013:134:09:08:33.0768	gap	1 hrs 8 min

2013:134:09:30:43.5858	2013:134:10:42:25.9606	gap	1 hrs 12 min
2013:134:11:08:38.8470	2013:134:12:27:27.3628	gap	1 hrs 19 min
2013:134:12:53:15.8330	2013:134:14:41:08.4220	gap	1 hrs 48 min
2013:134:14:48:05.4224	2013:134:16:07:22.1602	gap	1 hrs 19 min
2013:134:16:31:08.7500	2013:134:17:40:41.9932	gap	1 hrs 9 min
2013:134:19:10:23.7808	2013:135:01:50:12.6388	gap	1 days 17 hrs 20 min
2013:135:02:29:19.1730	2013:135:04:56:41.5920	gap	2 hrs 27 min
2013:135:06:39:07.5604	2013:135:16:27:24.1136	gap	9 hrs 48 min
2013:135:16:54:06.7410	2013:135:19:41:47.2256	gap	2 hrs 47 min
2013:139:05:16:38.9736		end of data set	

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 and KEA format, later converted to segy rev 1.

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 three hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2013:099:00:00:01.4702		start of data set	
2013:099:18:22:15.9398	2013:101:21:06:23.0616	gap	2 hrs 47 min
2013:142:00:00:00.7592		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. See also mwv01 below.

File id: wx01
Logging interval: 1 second

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

Log Date		Event	Comment
2013:099:00:00:00.9244		start of data set	
2013:141:23:59:59.9570		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
```

File id: mwv01
Logging interval: 1 second

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

Log Date		Event	Comment
2013:099:00:00:00.9244		start of data set	
2013:141:23:59:59.9570		end of data set	

The weather station is used to log wind speed, direction, air temperature, and barometric pressure. The wx01 strings are converted in real-time to produce mwv strings for the DP. The mwv output is strictly a derivative of the w01 output. See also the wx01 description above.

mwv01 data sample:

```
mwv01 2008:231:00:00:00.5173  6.1   6.6   6.6   8.8 354 321   5   0.0   0.0   0.0
0.0 355 355   0 ***** ***** ***** *****  8  8  8 1009.7
```

```
mwv01 2008:231:00:00:01.5172  5.9   6.6   6.6   8.8 353 321   5   0.0   0.0   0.0
0.0 355 355   0 ***** ***** ***** *****  8  8  8 1009.6
mwv01 2008:231:00:00:02.5190  6.3   6.6   6.6   8.8 354 321   5   0.0   0.0   0.0
0.0 355 355   0 ***** ***** ***** *****  8  8  8 1009.8
```

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 three hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2013:099:00:00:00.1482		start of data set	
2013:142:00:00:00.9010		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 three hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2013:099:00:00:01.5204		start of data set	
2013:142:00:00:00.1150		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 three hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2013:099:00:00:00.3144		start of data set	
2013:142:00:00:00.9070		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

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.

File id: posmv
Logging interval: 1 second

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

Log Date		Event	Comment
2013:099:00:00:00.4964		start of data set	
2013:107:10:15:09.7740	2013:107:10:20:49.8128	gap	5 min
2013:110:16:55:46.6640	2013:110:17:58:03.0868	gap	1 hrs 3 min
2013:111:04:57:46.8484	2013:111:07:44:17.1706	gap	2 hrs 47 min
2013:111:07:56:06.4572	2013:111:08:04:14.0010	gap	8 min
2013:111:08:22:31.7490	2013:111:08:49:22.4348	gap	27 min
2013:111:08:54:26.2728	2013:111:09:20:00.1060	gap	26 min
2013:111:09:20:24.3220	2013:111:09:40:50.3028	gap	20 min

2013:111:09:41:16.5730	2013:111:09:46:38.4846	gap	5 min
2013:111:09:56:57.7974	2013:111:10:04:38.5470	gap	8 min
2013:142:00:00:00.9630		end of data set	

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 three hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2013:099:00:00:00.6344		start of data set	
2013:142:00:00:00.3890		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

The Sercel Streamer Tension Unit measures streamer tension in pounds.

Logging interval: 15 seconds

File id: stu1

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

Log Date		Event	Comment
2013:099:12:32:11.5124		start of data set	
2013:099:12:32:21.5012	2013:123:22:42:43.5766	gap	10 hrs 10 min
2013:133:03:13:29.4946		end of data set	

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

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. See the deployment/retrieval data gaps in the table below. For further information, see the elog files in docs/elog.

Magnetometer deployment/retrieval data gaps

Log Date		Event	Comment
2013:109:12:11:57.1854		start of data set	
2013:114:03:34:16.5388	2013:117:19:22:43.4842	gap	3 days 15 hrs 48 min
2013:117:19:34:35.7972	2013:118:08:21:17.5300	gap	12 hrs 47 min

2013:121:20:14:52.3104	2013:124:11:58:14.9984	gap	2 days 15 hrs 44 min
2013:131:04:16:39.3558	2013:135:20:51:33.9372	gap	4 days 16 hrs 35 min
2013:137:16:34:38.8694		end of data set	

Logging interval: 1 second

File id: mag01
mag01 data sample:

```
mag01 2008:185:09:45:58.1820  $107714.673,0042,0024,0110,3533,1143
mag01 2008:185:09:46:01.0333  $ 63703.933,0042,0024,0110,3533,1143
mag01 2008:185:09:46:04.0330  $ 44031.029,0042,0027,0110,3533,1143
```

SBE-45 Thermosalinograph

The Seabird TSG output is logged by LDS to the "tsg" set. Output is also converted in real-time and recorded to the "tsgconv" data set.

File id: tsgraw
Logging interval: 1 second

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

Log Date		Event	Comment
2013:101:23:00:45.7950		start of data set	
2013:139:05:11:28.9590		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

The Bell Aerospace BGM-3 Gravimeter operated normally during the length of this cruise.

File id: vc01
Logging interval: 1 second

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

Log Date		Event	Comment
2013:099:00:00:00.0622		start of data set	
2013:141:23:59:59.7270		end of data set	

vc01 data format:

```
vc01  2011:130:00:00:08.2866  01:024436 00

vc01  2011:130:00:00:09.2926  01:024548 00
```

Applied Microsystems MicroSV Pod Unit #1 – Not in use on MGL1305

The Applied Microsystems MicroSV probe #1 in the pod was NOT functional during the length of the cruise.

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 three hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2013:099:00:00:00.0622		start of data set	
2013:136:10:43:31.0382	2013:136:12:26:00.4480	gap	1 hrs 43 min
2013:136:12:58:46.1202	2013:136:13:08:08.8746	gap	10 min
2013:136:13:21:07.7830		end of data set	

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 three hundred and one seconds are displayed in the following table.

Log Date		Event	Comment
2013:099:00:00:00.2382		start of data set	
2013:136:11:01:31.8430	2013:136:11:08:09.8148	gap	7 min
2013:136:11:08:15.9196	2013:136:11:14:50.1366	gap	6 min
2013:136:11:15:17.8170	2013:136:12:17:19.4554	gap	1 hrs 2 min
2013:142:00:00:00.4770		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 – Not in use on MGL1305

The Seabird SBE38 temperature probe #2 in the pod was NOT functional during the length of the cruise.

LDEO PCO2 System

The LDEO PCO2 system output is logged by LDS to the "pco2" set. See below for more information.

File id: pco2
Logging interval: ~180 seconds

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

Log Date		Event	Comment
2013:101:21:01:00.9502		start of data set	
2013:104:16:12:19.9044	2013:104:16:20:46.3776	gap	8 min
2013:104:16:20:46.3776	2013:104:16:33:09.1428	gap	13 min
2013:107:12:54:16.2100	2013:107:13:02:43.2572	gap	8 min

2013:109:15:58:54.4638	2013:109:16:04:32.9128	gap	6 min
2013:110:09:04:57.1386	2013:110:09:10:34.2538	gap	6 min
2013:110:09:16:12.4648	2013:110:09:30:16.8768	gap	14 min
2013:112:06:17:02.5164	2013:112:06:37:43.7008	gap	20 min
2013:104:16:12:19.9044	2013:104:16:20:46.3776	gap	8 min
2013:104:16:20:46.3776	2013:104:16:33:09.1428	gap	13 min
2013:107:12:54:16.2100	2013:107:13:02:43.2572	gap	8 min
2013:109:15:58:54.4638	2013:109:16:04:32.9128	gap	6 min
2013:110:09:04:57.1386	2013:110:09:10:34.2538	gap	6 min
2013:110:09:16:12.4648	2013:110:09:30:16.8768	gap	14 min
2013:112:06:17:02.5164	2013:112:06:37:43.7008	gap	20 min
2013:139:05:09:39.7138		end of data set	

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

33 XBT drops were made during this cruise. Map of drops above. The data set(s) are saved to the raw/XBT directory in the cruise archive. Refer to the MGL1305_Expendable_Drops.xls spreadsheet in the docs/operations directory of the cruise archive for more information.

IV. Seismic Summary

A. Acquisition Parameter Table

Acquisition Parameter Table	
AcquisitionParameterID	MGL1305_ACQ01
FieldActivityID	MGL1305
ReceiverType	Ocean Bottom Seismometer
SourceType	Airgun
Acquisition System Name	OBS
Acquisition System Type	OBS
Seismic_Nav_System	C-Nav 3050 primary
Survey_datum	WGS84
Navigation Reference Point	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 200 calculated center of gravity) waterline
NRP to source	214 m
Source_to_Near_Channel	N/A
Number _of_channels_recorded	N/A
Number _of_cables	0
Number_of_channels_each_cable	N/A
Channel_length	N/A
Cable_length	N/A
Cable_spacing	N/A
Near_Channel_Number	N/A
Cable_depth	N/A
Number_sources	1
Sub-arrays_per_source	4
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	6.0 m
Source_volume	6600 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_number	36 + 4 spare
Source_depth	12.0 m
Shot_control	Distance
Shot_Interval	450 m
Sample_interval	N/A
Record_length	N/A
Compass_birds	N/A
Recording_delay	N/A

Acquisition Parameter Table	
AcquisitionParameterID	MGL1305_ACQ02
FieldActivityID	MGL1305
ReceiverType	Ocean-Bottom Seismometer/Sentry Solid Streamer
SourceType	Airgun
Acquisition System Name	SIO OBS/Sercel Syntrak 960
Acquisition System Type	OBS/MCS
Seismic_Nav_System	C-Nav 3050 primary
Survey_datum	WGS84
Navigation Reference Point	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 200 calculated center of gravity) waterline
NRP to source	214 m
Source_to_Near_Channel	210 m (reference for MCS only)
Number _of_channels_recorded	636
Number _of_cables	1
Number_of_channels_each_cable	636
Channel_length	12.5 m
Cable_length	8 km
Cable_spacing	N/A
Near_Channel_Number	N/A
Cable_depth	12.0 m
Number_sources	1
Sub-arrays_per_source	4
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	6.0 m
Source_volume	6600 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_number	36 + 4 spare
Source_depth	12.0 m
Shot_control	Distance
Shot_Interval	37.5 m
Sample_interval	2ms
Record_length	12s
Compass_birds	30 Digicourse 5011
Recording_delay	N/A

Physical Configuration

The towing configuration for the air guns and streamers is detailed in the document titled ***MGL1305_Offsets.xls***.

Offsets

All antenna and in-water offset drawings are in the file ***MGL1305_Offsets.xls***.

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

Date / Time	Ship Location	Reference Location	Mistie
2013-04-09T17:32	St. George, Bermuda	Panno's Wharf	St. George, Bermuda
2013-05-19T18:04	Ponta Delgada, Azores	North Wharf	Ponta Delgada, Azores

Please refer to the documents located under MGL1305/docs/gravity_tie for detailed records.

VI. Archive Contents

Key files are bolded.

MGL1305/docs	Cruise documents and logs
MGL1305/docs/config	Configuration archive
MGL1305/docs/elog	Cruise elog
MGL1305/docs/gravity_tie	Gravity Tie information
MGL1305/docs/map	Cruise maps, track map
MGL1305/docs/offsets	Vessel/sensor offsets
MGL1305/docs/operations/	Operations documents
MGL1305/docs/operations/Daily_Reports	Cruise Daily Reports from Chief Science Officer
MGL1305/docs/operations/NavLogs	Seismic navigation logs (spectra)
MGL1305/docs/operations/ObsLogs	Seismic acquisition logs (gun controller)
MGL1305/docs/operations/MGL1305_B15_line_log_multi_channel_seismics .xls	**Master line log table**
MGL1305/docs/permits	Clearance Documents
MGL1305/docs/waypoints	Waypoint files
MGL1305/docs/personnel	Personnel rosters, org chart, bunk and phone lists
MGL1305/docs/reports	Cruise Report and supplemental docs
MGL1305/docs/reports/MGL1305_DataReport_v1.0.doc	**This file**
MGL1305/docs/offsets/MGL1305_Offsets.xls	**Vessel/sensor offsets**
MGL1305/docs/screencaps	Screen captures
MGL1305/processed	Processed data
MGL1305/processed/reflex (3D data-sets only, not applicable to OBS and 2D)	Spectra reflex files
MGL1305/processed/obsip	sho log files
MGL1305/processed/sprint	Sprint UKOOA P190s
MGL1305/processed/svp	Sound velocity profiles
MGL1305/raw	Raw data
MGL1305/raw/adcp	Raw ADCP data
MGL1305/raw/knudsen	Raw Knudsen sub-bottom profiler data
MGL1305/raw/multibeam	Raw EM122 data
MGL1305/raw/serial	Underway serial data: gps, tsg, weather, etc.
MGL1305/raw/sonobuoy	Raw sonobuoy data
MGL1305/raw/spectra/P1	Spectra underway p190
MGL1305/raw/spectra/P2	Raw seismic navigation, p294
MGL1305/raw/XBT	Raw XBT data

This page is blank.

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

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, vvy 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

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