# RV Langseth
# Data Reduction Summary

# MGL1307

Galicia 3D
Vigo, Spain - Vigo, Spain

REV. 1.5 - Final

2014-07-14
Lamont-Doherty Earth Observatory, Columbia University

**MGL1307 Cruise Period:**

| Date | Julian Date | Time | Port |
|---|---|---|---|
| 2013-06-01 | 2013-152 | 0600 UTC, 0600L | Vigo, Spain |
| 2013-08-02 | 2013-214 | 0630 UTC, 0630L | Vigo, Spain |

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Please refer to the Langseth Data Report Supplement for information regarding data formats.

## I. Background and Scientific Objectives

MGL13-07 is a 3D seismic reflection survey in the Atlantic Ocean offshore Galicia, Spain. The proposed survey area is shown in Figure 1.4. The principal investigators (PIs) and science party objectives will drive this program on the *R/V Langseth* with the coordination and advisement of the technical staff headed by the Office of Marine Operations (OMO) at Lamont Doherty Earth Observatory (LDEO). The proposed 3D acquisition survey requests dual source arrays, four 6 km streamers deployed at 200 m spacing and run in a 64 km by 22.4 km box, a 2D line extending to the West, and an array of 78 OBS's. The *R/V Poseidon* will be deploying and recovering the OBS's. The survey program will be dynamic and varying dependent on the seabed conditions, weather conditions, and maximizing the science objectives.

(Pulled from IHA application information submitted by the PI)
L-DEO plans to conduct a seismic survey in the northeast Atlantic Ocean west of Spain at between ~41.5–42.5°N and ~11.5–17.5°W (Fig. 1). Water depths in the survey area range from ~3500 m to >5000 m. The seismic survey would be conducted International Waters and within the EEZ of Spain, and would be scheduled to occur for ~39 days during 1 June–15 July 2013. Some minor deviation from these dates would be possible, depending on logistics and weather.

L-DEO plans to use conventional seismic methodology in the Deep Galicia Basin of the northeast Atlantic Ocean west of Spain. The goal of the proposed research is to collect data necessary to study the rifted continental to oceanic crust transition in the Deep Galicia Basin west of Spain. This margin and its conjugate are among the best studied magma-poor, rifted margins in the world, and the focus of studies has been the faulting mechanics and modification of the upper mantle associated with such margins.

Over the years, a combination of 2-D seismic reflection profiling, general marine geophysics, and ocean drilling have identified a number of interesting features of the margin. Among these are the S reflector, which has been interpreted to be a detachment fault overlain with fault bounded, rotated, continental crustal blocks and underlain by serpentinized peridotite, and the Peridotite Ridge, composed of serpentinized peridotite and thought to be upper mantle exhumed to the seafloor during rifting.

To achieve the project's goals, the Principal Investigators (PIs), Drs. D.S. Sawyer (Rice University), J.K. Morgan (Rice University), and D.J. Shillington (L-DEO) propose to use a 3-D seismic reflection survey, 2-D survey, and a long-offset seismic program extending through the crust and S detachment into the upper mantle to characterize the last stage of continental breakup and the initiation of seafloor spreading, relate post-rifting subsidence to syn-rifting lithosphere deformation, and inform the nature of detachment faults. Ocean Bottom Seismometers (OBSs) and Ocean Bottom Hydrophones (OBHs) would also be deployed during the program. It is a cooperative program with scientists from the U.K., Germany, Spain, and Portugal.

The survey would involve one source vessel, the R/V Marcus G. Langseth. The Langseth would deploy an array of 18 airguns as an energy source with a total volume of ~3300 in3. The receiving system would consist of four 6000-m hydrophone streamers at 200-m spacing and up to 78 OBH/S instruments. The OBH/Ss would be deployed and retrieved by a second vessel, the R/V Poseidon, provided by the German Science Foundation. As the airgun array is towed along the survey lines, the hydrophone streamer would receive the returning acoustic signals and transfer the data to the on-board processing system. The OBH/Ss record the returning acoustic signals internally for later analysis.

A total of ~5834 km of survey lines, including turns, would be shot in a grid pattern with a single line extending to the west (Fig. 1). There would be additional seismic operations in the survey area associated with airgun testing and repeat coverage of any areas where initial data quality is sub-standard. In our calculations (see § VII), 25% has been added for those additional operations.

In addition to the operations of the airgun array, a multibeam echosounder (MBES) and a subbottom profiler (SBP) will also be operated from the Langseth continuously throughout the survey. All planned geophysical data acquisition activities would be conducted by L-DEO with on-board assistance by the scientists who have proposed the study. The vessel would be self-contained, and the crew would live aboard the vessel for the entire cruise.

**Figure 1 – Cruise Track**

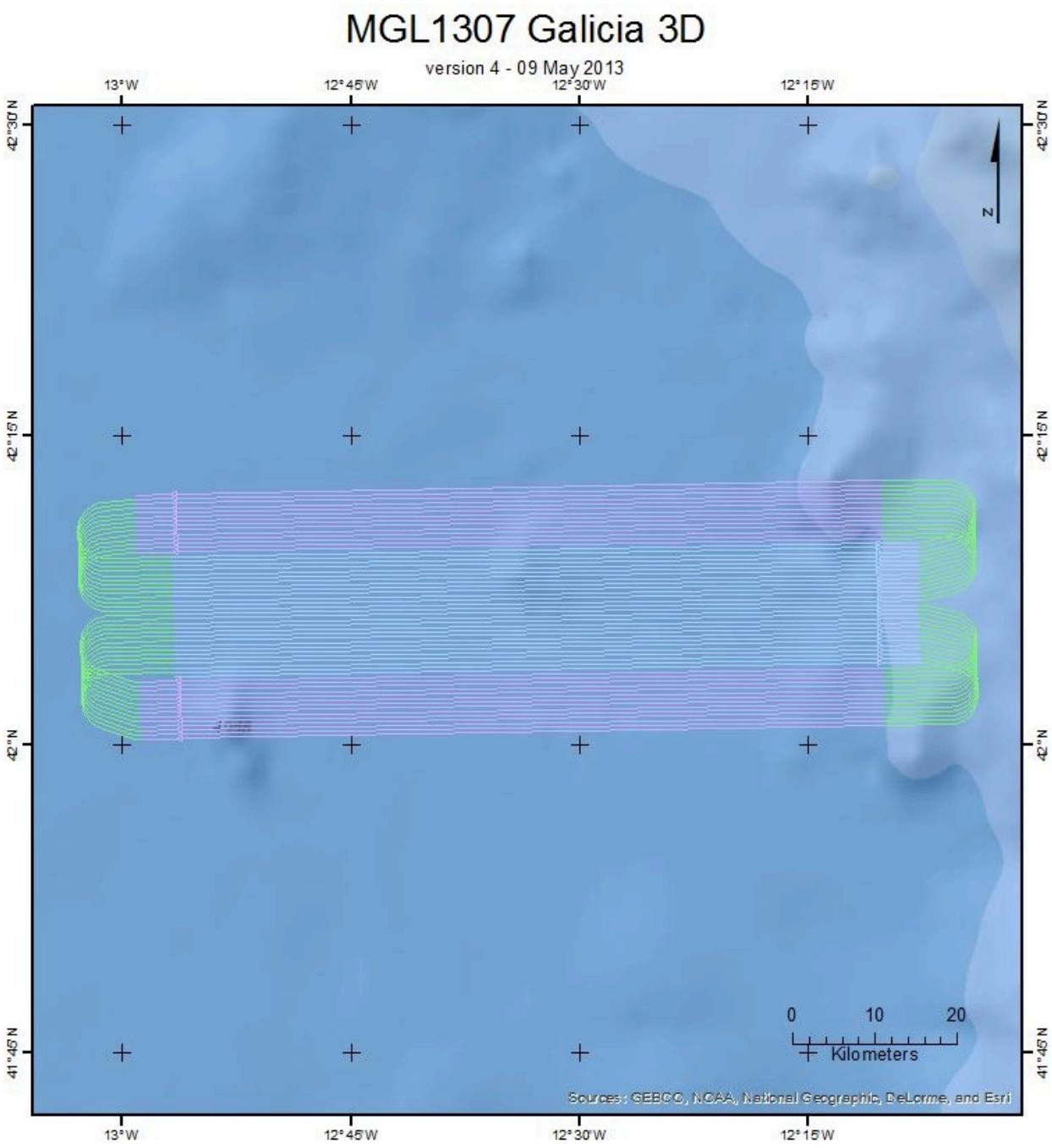


**Figure 2 – Cruise Track relative to the Spanish and Portuguese Coast**

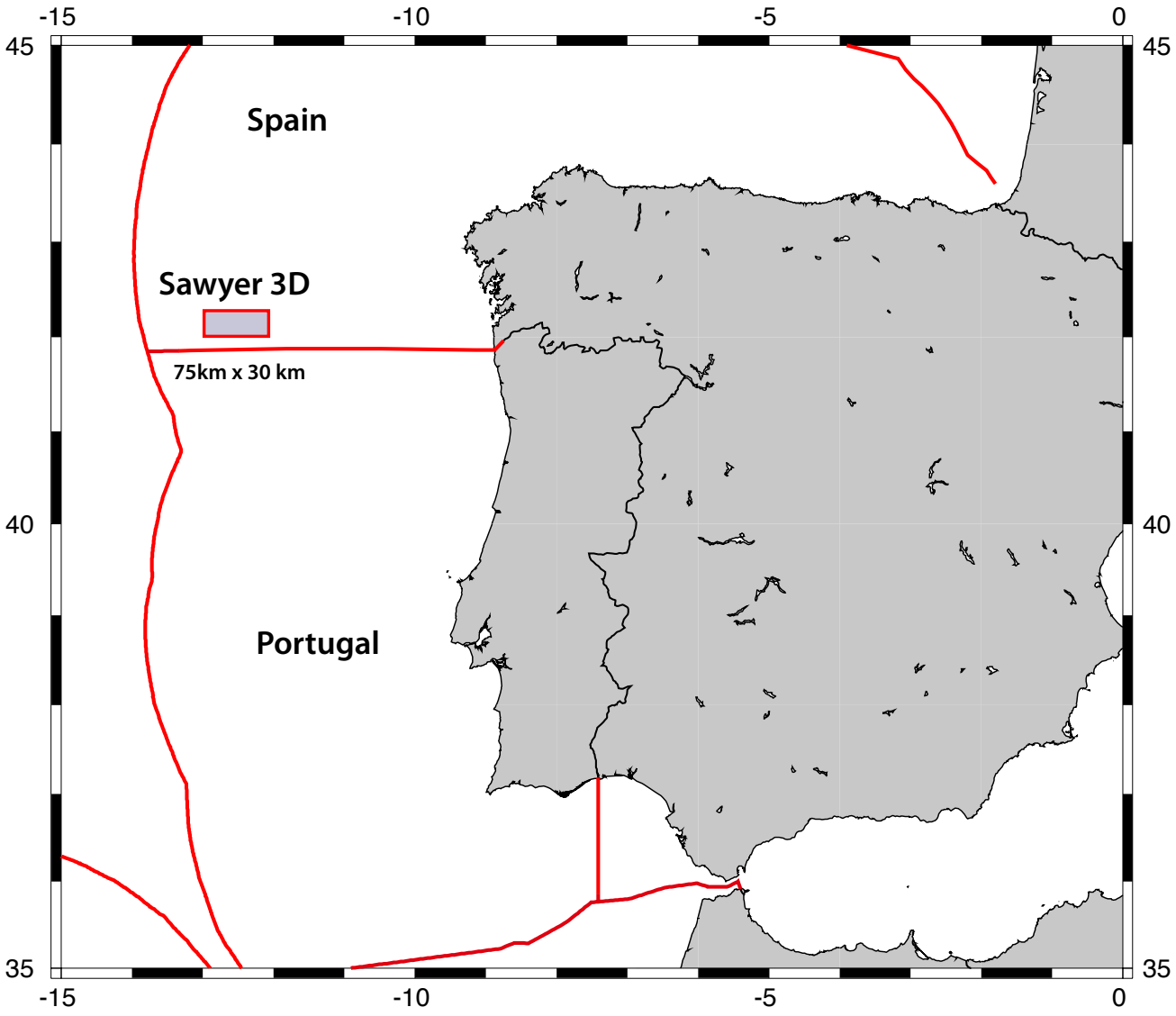
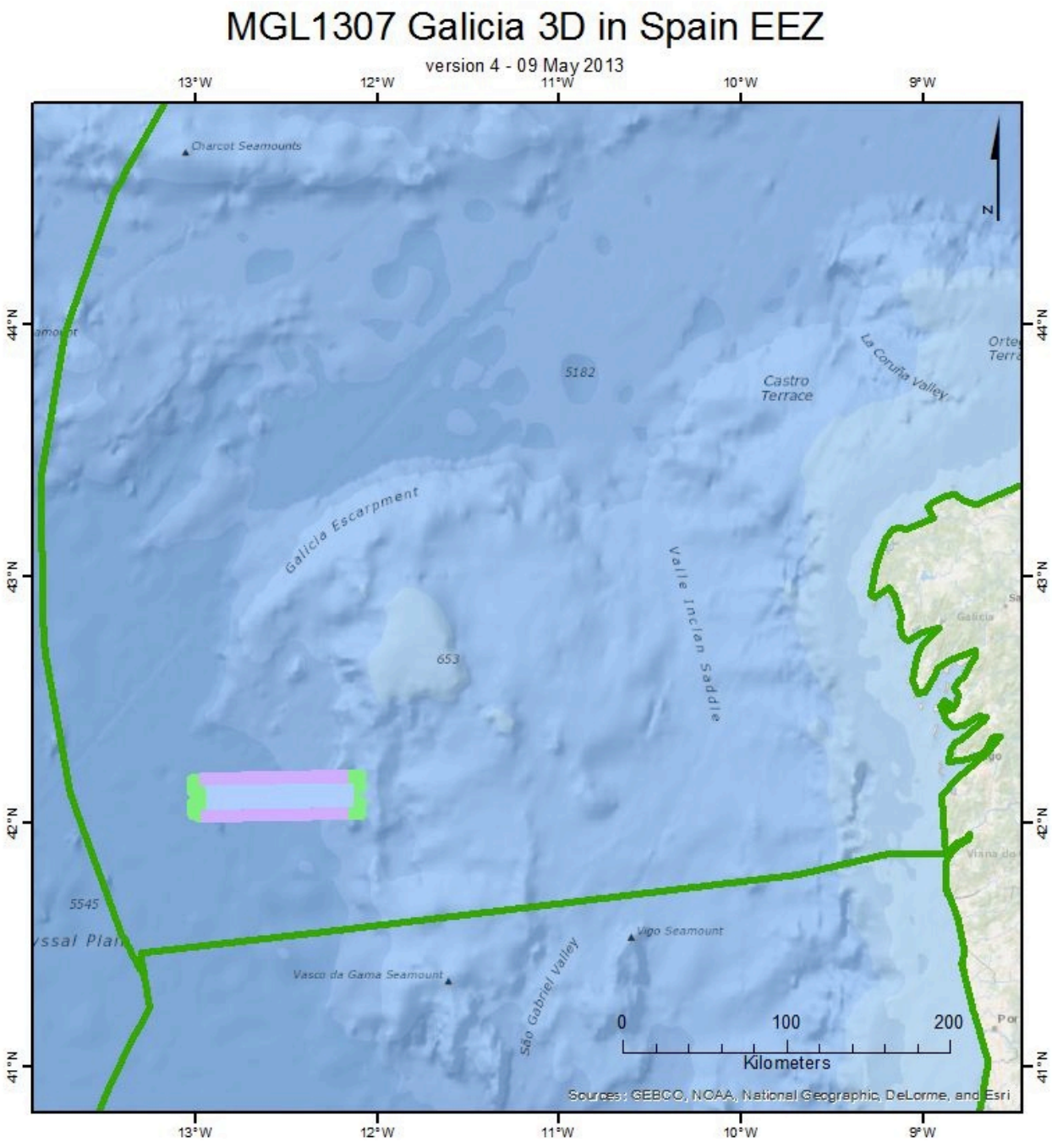


**Figure 3 – Coast of Spain Topography & Bathymetry**



# II. Personnel

**Shipboard Technical Staff**

| | | |
|---|---|---|
| 1 | Robert Steinhaus | Chief Science Officer |
| 2 | Jay Johnstone | Science Officer – ACQ/IT |
| 3 | Matt Grey | Chief NAV (Contractor) |
| 4 | Tom Spoto | Chief Sound Source Mechanic (LDEO) |
| 5 | Bern McKiernan | ACQ (LDEO) |
| 6 | Klayton Curtis | ACQ (Contractor) |
| 7 | Mike Tatro | Sound Source Mechanic (Contractor) |
| 8 | Mike Martello | NAV (Contractor) |
| 9 | Weston Groves | Sound Source Mechanic (Contractor) |
| 10 | Robert Koprowski | Marine Science Technician (LDEO) |
| 11 | Alan Thompson | NAV Processor (Contractor) |
| 12 | Carlos Guitierrez | Sound Source Mechanic (LDEO) |
| 13 | Robbie Gunn | Sound Source Mechanic (Contractor) |
| 14 | Josh Kasinger | Sound Source Mechanic (Contractor) |
| 15 | Tyler Poppenwimer | MATE Intern |

**Ship's Crew**

| | | |
|---|---|---|
| 1 | James O'Loughlin | Captain |
| 2 | Stanley Zeigler | Chief Mate |
| 3 | Breckenridge Crum | 2nd Mate |
| 4 | Kyle Grant | 3rd Mate |
| 5 | Jason Woronowicz | Bosun |
| 6 | Marcus Nadler | AB |
| 7 | George Cereno | AB |
| 8 | Petronio Paragas | AB |
| 9 | Joshua Schaffner | OS |
| 10 | Brian Dibbern | OS |
| 11 | Stephen Pica | Chief Engineer |
| 12 | Ryan Vetting | 1st Asst. Engineer |
| 13 | Clayton Busenga | 2nd Asst. Engineer |
| 14 | Steven Truelove | 3rd Asst. Engineer |
| 15 | Cheryl Gutkowski | Oiler |

| | | |
|---|---|---|
| 16 | Rodolfo Florendo | Oiler |
| 17 | Jeffrey McCuthcen | Oiler |
| 18 | Hervin McLean Fuller | Steward |
| 19 | Leoncio Matires | Cook |
| 20 | John Schwartz | Electrician |

**MMO**

| | | |
|---|---|---|
| 1 | Heidi Ingram | Lead PSO |
| 2 | Dara Cameron | PAM Operator / PSO |
| 3 | Emily Ellis | PSO |
| 4 | Meghan Piercy | PSO |
| 5 | Rebecca Lago | PSO, Foreign Observer |
| 6 | Vanesa Costas | PSO (2nd Leg) |

**Science Party**

| | | | |
|---|---|---|---|
| 1 | Dale Sawyer | Chief Scientist | Rice University |
| 2 | Donna Shillington | Co-Chief Scientist | LDEO |
| 3 | Tim Reston | Co-Chief Scientist | University of Birmingham, UK |
| 4 | Cesar Renero | Co-Chief Scientist | Barcelona, Spain |
| 5 | Steve Danbom | Seismologist | Rice University |
| 6 | Marianne Karplus | Post Doc | University of Southampton, UK |
| 7 | James Gibson | Grad Student | LDEO |
| 8 | Brian Jordan | Grad Student | Rice University |
| 9 | Mari Tesi Sanjurjo | Grad Student | Rice University |
| 10 | Sarah Dean | Grad Student | Rice University |
| 11 | Miguel Andres Martinez | Grad Student | Royal Holloway, U. of London, UK |
| 12 | Tobias Merry | Grad Student | University of Birmingham, UK |
| 13 | Luke Holroyd | Grad Student | University of Birmingham, UK |
| 14 | Khemraj Shukla | Grad Student | Oklahoma State University, USA |
| 15 | Boualem Pereira | Grad Student | Universidade de Aveiro, Portugal |
| 16 | Milena Marjanovic | Scientist (2nd Leg) | LDEO |
| 17 | Katherine Coates | Scientist (2nd Leg) | University of Southampton, UK |
| 18 | Joao Tauscheck Zielinski | Scientist (2nd Leg) | Universidad Complutense Madrid |
| 19 | Tessa Gregory | Scientist (2nd Leg) | University of Southampton, UK |
| 20 | Gaye Bayrakci | Scientist (2nd Leg) | University of Southampton, UK |
| 21 | Natalie Accardo | Scientist (2nd Leg) | LDEO |

## 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 |
|---|---|---|---|---|---|
| EM122 | Kongsberg EM120 Multibeam Sonar | Full | 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 | Full | raw output to file | See below | n/a |
| WX1 | RM Young 5103 Weather Bird and Translator | Full | serial logs | MGL-wx01.* | 1s |
| TSG | SeaBird SBE23 Thermosalinograph | Full | raw serial logs | MGL-tsgraw.* | 1s |
| CNAV | C&C Tech. CNAV 2000 DGPS Receiver | Full | serial logs | MGL-cnav.* | 1s |
| CNAV 3050 | 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 | Applanix POSMV Integrated Nav System | Full | serial logs | MGL-posmv.* | 1s |
| 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 USS Unit | Full | 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 | 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 Instrumentation

### EM-122 Multibeam

The EM-122 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.

EM-122 swath data is saved to the cruise archive under MGL1307/raw/multibeam. Center beam depth is recorded separately to serial log. The MicroSV (svpod01) probe in the pod supplied sound velocity to the EM-122.

**Logging interval**: variable with water depth

**File id**: bath02

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

| Log Date | Event | Comment |
|---|---|---|
| 2013:152:08:20:22.7603 | Start | Logging officially started |
| 2013:152:09:07:23 | Logging | operational and logging |
| 2013:153:11:25:13 | Crash | SIS Crashed |
| 2013:153:11:26:16 | Running | SIS back online - New Survey MGL1307A |
| 2013:154:13:16:38 | Diagnostics | Start bist |
| 2013:156:14:07:28 | Diagnostics | Start Bist |
| 2013:156:15:14:04 | Parameter Change | EM122 Max Ange |
| 2013:156:15:38:01 | Parameter Change | Ping Mode |
| 2013:156:16:05:33 | Parameter Change | EM122 ping mode changed from medium to deep |
| 2013:156:16:33:24 | Parameter Change | Em122 FM mode disabled |
| 2013:156:16:59:48 | Parameter Change | EM122 FM mode enabled |
| 2013:156:18:22:35 | Parameter Change | Speed of sound in EM122 is 'SENSOR' not 'PROFILE' |
| 2013:157:15:30:01 | Parameter Change | EM122 settings |
| 2013:157:15:34:19 | Parameter Change | EM122 settings |
| 2013:157:16:28:05 | Parameter Change | EM122 Settings |
| 2013:157:22:05:30 | Restart | EM122 off line |
| 2013:159:11:35:12 | Diagnostics | Start BIST |
| 2013:160:17:34:43 | Parameter Change | EM122 max coverage changed from 20000 to 2250 Port and Starboard |
| 2013:160:18:36:29 | Diagnostics | Start of BIST |
| 2013:161:03:57:12 | Diagnostics | Start BIST SP: 6353 |
| 2013:161:04:09:18 | Multibeam | BIST passed SP: 6379 |
| 2013:163:18:31:42 | Diagnostics | Start bist |

| | | |
|---|---|---|
| 2013:164:21:40:43 | Parameter Change | EM122 Port and Starboard Max Coverage changed from 2250m to 20000m |
| 2013:165:08:28:05 | Parameter Change | EM122 Port and Starboard Max Coverage changed from 20000m to 2250m |
| 2013:165:12:49:44 | Diagnostics | Start of BIST |
| 2013:165:12:50:34 | Diagnostics | Passed BIST - now operational |
| 2013:166:16:23:59 | Diagnostics | Start of BIST |
| 2013:166:16:25:28 | Logging | Failed Test #9/ Operational |
| 2013:168:08:47:40 | Parameter Change | EM122 port and starboard max coverage changed from 2250m to 20000m |
| 2013:168:22:06:02 | Diagnostics | Started bist test |
| 2013:168:22:06:53 | Diagnostics | Failed bist #7 and started logging. |
| 2013:170:01:42:06 | Parameter Change | changed settings to constrain multibeam width back to 4500m port and starboard |
| 2013:170:02:57:31 | Parameter Change | changed settings to constrain multibeam width to 2250m port and starboard |
| 2013:170:10:15:20 | Multibeam | Start of BIST SP 6369 |
| 2013:170:10:15:54 | Diagnostics | BIST complete and operating |
| 2013:172:18:43:15 | Diagnostics | Start Bist |
| 2013:173:11:30:44 | Diagnostics | Start of BIST SP turn |
| 2013:173:11:59:03 | Multibeam | BIST complete and operating |
| 2013:174:03:38:33 | Multibeam | EM122 Max Coverage changed port and starboard from 2250m to 20000m |
| 2013:174:17:46:24 | Parameter Change | EM122 Ping mode changed to Auto from Deep |
| 2013:175:04:37:20 | Multibeam | EM122 online and logging disk surge did not work sending support email |
| 2013:175:04:38:27 | Crash | EM122 offline trying different disk |
| 2013:175:04:39:27 | Multibeam | New disk complete formating pinging and logging |
| 2013:175:17:45:21 | Diagnostics | Start of Bist |
| 2013:176:01:25:51 | Multibeam | Observed that multibeam was not outputting depth data |
| 2013:176:01:26:33 | Multibeam | Multibeam rebooted pinging and logging |
| 2013:176:05:53:41 | Secured - Temporary Shutdown | Multibeam Secured |
| 2013:183:14:29:09 | Diagnostics | Start Bist |
| 2013:192:06:43:30 | Diagnostics | Start Bist |
| 2013:192:10:38:15 | Diagnostics | Start Bist |
| 2013:193:06:59:44 | Diagnostics | Start Bist |
| 2013:194:06:03:33 | Diagnostics | Start Bist |

| | | |
|---|---|---|
| 2013:196:05:36:59 | Multibeam | EM122 Online Logging |
| 2013:197:13:00:33 | Multibeam | Passed Bist and operating |
| 2013:197:13:30:17 | Multibeam | Start new survey 1307F |
| 2013:198:04:02:44 | Parameter Change | EM122 Max Coverage Changed from 20,000 m port and starboard to 2250 |
| 2013:199:08:48:19 | Diagnostics | BIST Test EM122 |
| 2013:199:08:48:44 | Logging | EM122 Back Online and Logging |
| 2013:199:17:13:13 | Diagnostics | start BIST |
| 2013:200:14:28:34 | Diagnostics | start BIST |
| 2013:202:06:06:35 | Diagnostics | Start BIST |
| 2013:202:06:07:09 | Diagnostics | Passed Bist and operating |
| 2013:203:11:28:50 | Diagnostics | Start BIST |
| 2013:203:11:34:37 | Diagnostics | Passed Bist and operating |
| 2013:205:02:58:55 | Diagnostics | Start BIST |
| 2013:205:02:59:54 | Diagnostics | Passed BIST - now operating |
| 2013:206:09:16:18 | Diagnostics | Start BIST |
| 2013:206:09:22:21 | Diagnostics | Passed BIST - now operating |
| 2013:208:16:57:39 | Diagnostics | Start BIST |
| 2013:210:09:08:43 | Diagnostics | BIST Test |
| 2013:210:09:15:39 | Diagnostics | BIST Passed |
| 2013:211:16:27:40 | Multibeam | EM122 Max Coverage changed from 2250m port and starboard to 20000m |
| 2013:212:06:55:56 | Diagnostics | Passed BIST |
| 2013:212:23:48:13.7717 | End | Logging officially 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
bath02      2008:192:00:00:46.5831  $KGDPT,2958.32,0.0,12000.0*4a
bath02      2008:192:00:01:03.0606  $KGDPT,2954.18,0.0,12000.0*4e
```

**Knudsen Engineering 3260 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.

| Log Date | Event | Comment |
|---|---|---|
| 2013:152:09:08:07 | Start | operational and logging |
| 2013:156:18:26:49 | Shut down | Knudsen disabled-have not had good returns for several days |
| 2013:158:12:07:05 | Diagnostics | Trouble Shooting Knudsen - Changed 3.5kHz Transmit |
| 2013:196:05:41:03 | Startup | Knudsen Online and Logging |
| 2013:197:10:12:47 | Errors | Secured - no data |
| 2013:203:08:07:29 | Start / Stop | Knudsen operational and logging |

**DS50 Speedlog**

**File id**: slog01
**Logging interval**: 1 second

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

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

| **Log Date** | **Event** | **Comment** |
|---|---|---|
| 2013:149:00:00:01.6443 | Start | Logging officially started |
| 2013:214:08:10:27.3770 | End | Logging officially ended |

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**

**File id**: wx01
**Logging interval**: 1 second

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.

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

| **Log Date** | **Event** | **Comment** |
|---|---|---|
| 2013:149:00:00:00.2842 | Start | Logging officially started |
| 2013:214:08:10:28.5430 | End | Logging officially ended |

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
```

**CNAV**

**File id: cnav**

**Logging interval**: 1 second

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.

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

| Log Date | Event | Comment |
|---|---|---|
| 2013:149:00:00:00.0723 | Start | Logging officially started |
| 2013:214:08:10:27.6390 | End | Logging officially ended |

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
```

**CNAV 3050 – Primary Navigation System**

**File id: cnav3050**

**Logging interval**: 1 second

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.

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

| Log Date | Event | Comment |
|---|---|---|
| 2013:149:00:00:00.0723 | Start | Logging officially started |
| 2013:214:08:10:27.6390 | End | Logging officially ended |

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 ten seconds are displayed in the following table.*

| Log Date | Event | Comment |
|---|---|---|
| 2013:149:00:00:00.1203 | Start | Logging officially started |
| 2013:214:08:10:28.2292 | End | Logging officially ended |

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 Inertial GPS System**

The POS/MV is a receiver that uses CNAV input in addition to its own antennae, an inertial sensor and optional RTG, WTC, or WAAS corrections and a Kalman filter to produce a smooth navigation output and very accurate heading.

The PosMV operated normally during the cruise.

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

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

| Log Date | Event | Comment |
|---|---|---|
| 2013:149:00:00:00.0392 | Start | Logging officially started |
| 2013:207:23:30:06 | Testing | POS MV is secured for testing of the ADCP |
| 2013:214:08:10:28.2050 | End | Logging officially ended |

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 200 Integrated Inertial GPS System**

The Kongsberg Seapath is an integrated inertial navigation system. It was in operation for the length of the cruise.

**Logging interval**: 1 second

**File id**: seapath

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

| Log Date | Event | Comment |
|---|---|---|
| 2013:149:00:00:00.4122 | Start | Logging officially started |
| 2013:214:08:10:28.1560 | End | Logging officially ended |

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. It was in operation while streamers were deployed.

**Logging interval**: 15 seconds

**File id**: stu1

*Data intermittent interruptions greater than thirty seconds are displayed in the following table.*

| Log Date | Event | Comment |
|---|---|---|
| 2013:153:15:08:11.3943 | Start | Logging officially started |
| 2013:212:23:55:12.5907 | End | Logging officially ended |

*Streamer deployment gaps greater than thirty seconds are displayed in the following table.*

| Time | Event |
|---|---|
| | Streamer deployment |
| | Streamer deployment |

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. See the deployment notes below.

*Magnetometer Deployment Notes*

| Time | Event |
|---|---|
| 2013:157:07:35:10 | Magnetometer deploy |
| 2013:159:22:57:08 | Maggie redeployed at SP 6691 |
| 2013:160:04:52:43 | Maggie picked up |
| 2013:160:05:04:42 | Maggie on board |
| 2013:160:18:40:03 | Deployment of Maggie |
| 2013:162:09:12:39 | Maggie deploying with new cable |
| 2013:163:00:43:20 | Maggie redeployed at SP 6596 |
| 2013:163:00:51:23 | Maggie recovered |
| 2013:198:00:54:44 | Maggie deployed |
| 2013:198:01:08:07 | Maggie fully deployed 210 mts |
| 2013:198:18:53:17 | start recovering Maggie |
| 2013:198:18:59:24 | Maggie on board |
| 2013:204:06:15:32 | Maggie onboard |

| | |
|---|---|
| 2013:205:11:01:13 | Corrupt data - start recovery |
| 2013:210:10:23:29 | Start deploying Maggie |

**Logging interval**: 1 second

**File id**: mag01

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

| **Log Date** | **Event** | **Comment** |
|---|---|---|
| 2013:157:07:20:16.1269 | Start | Logging officially started |
| 2013:159:14:45:16 | Missing Data | Lost Magnetometer |
| 2013:159:14:47:09 | Maggie | Magnetometer back online |
| 2013:159:21:39:03 | Missing Data | SP 6615 Maggie Dropped out |
| 2013:162:01:55:10 | Missing Data | Maggie is out |
| 2013:162:20:51:13 | Missing Data | SP 5748 Maggie drop out |
| 2013:162:20:52:13 | Maggie | SP 5779 Maggie operational |
| 2013:162:23:54:21 | Missing Data | Maggie offline |
| 2013:163:00:01:53 | Missing Data | Maggie online |
| 2013:163:00:17:03 | Missing Data | Maggie offline |
| 2013:165:04:27:22.8201 | Stop | Logging Stopped |
| 2013:172:03:17:15.2505 - 2013:172:03:17:42.7637 | Start / Stop | Test |
| 2013:184:08:04:58.6862 - 2013:184:08:05:14.4869 | Start / Stop | Test |
| 2013:186:06:48:31.0681 - 2013:186:06:54:33.5268 | Start / Stop | Test |
| 2013:196:04:57:39.9700 - 2013:196:04:57:43.4811 | Start / Stop | Test |
| 2013:198:00:30:23.4663 - 2013:198:17:21:43.3740 | Start / Stop | Test |
| 2013:198:17:37:06 | Missing Data | Maggie stopped transmitting |
| 2013:199:06:18:26.5480 - 2013:199:06:20:31.4364 | Start / Stop | Test |
| 2013:202:15:56:08.7997 - 2013:205:14:34:23.3477 | Start - Stop | Logged Data |
| 2013:202:17:38:19 | Missing Data | Maggie stopped transmitting SP 6441 |
| 2013:202:20:05:33 | Missing Data | Maggie stopped transmitting SP 5863 |
| 2013:202:22:38:03 | Missing Data | Maggie stopped transmitting SP 5281 |

| | | |
|---|---|---|
| 2013:203:15:07:44 | Missing Data | Lost magnetic data |
| 2013:203:15:08:16 | Missing Data | Lost magnetic data |
| 2013:204:13:00:11 | Missing Data | Maggie dropped out |
| 2013:204:13:02:06 | Maggie | Maggie online |
| 2013:204:17:16:19 | Missing Data | Maggie stopped transmitting |
| 2013:210:09:58:28.9151 - 2013:210:12:05:44.1770 | Start / Stop | Test |
| 2013:210:12:05:44.1770 | End | Logging Officially Ended |

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-23 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 ten seconds are displayed in the following table.*

| **Log Date** | **Event** | **Comment** |
|---|---|---|
| 2013:152:09:13:04.6560 | Start | Logging officially started |
| 2013:212:23:51:13.1454 | End | Logging officially ended |

tsgraw data sample:

```
tsgraw      2008:231:00:00:01.9179  B479CB5528A6D6ABFB2D
tsgraw      2008:231:00:00:11.9187  B474CB5428A799ABBB2D
tsgraw      2008:231:00:00:21.9176  B46FCB5328A70CAB8B2D
```

**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 ten seconds are displayed in the following table.*

| Log Date | Event | Comment |
|---|---|---|
| 2013:149:00:00:00.9033 | Start | Logging officially started |
| 2013:185:11:51:24 | Gravimeter | Gravimeter failure |
| 2013:214:08:10:28.5506 | End | Logging officially ended |

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 USS Unit**

The Applied Microsystems MicroSV probe in the uncontaminated seawater system did not work during the length of the cruise.

**File id**: svuss01
**Logging interval**: 1 second

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

| Log Date | Event | Comment |
|---|---|---|
| N/A | N/A | No Logging |

svuss01 data format:

```
svuss01     2011:100:00:00:08.6390   1540.62

svuss01     2011:100:00:00:09.6440   1540.62
```

**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 ten seconds are displayed in the following table.*

| Log Date | Event | Comment |
|---|---|---|
| 2013:149:00:00:00.3063 | Start | Logging officially started |
| 2013:212:23:53:48.6802 | End | Logging officially ended |

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 ten seconds are displayed in the following table.*

| Log Date | Event | Comment |
|---|---|---|
| 2013:158:20:43:34.4110 - 2013:158:20:55:02.7991 | Start / Stop | Intermittent Sensor Issues |
| 2013:187:08:56:39.7074 - 2013:187:10:00:29.5090 | Start / Stop | Intermittent Sensor Issues |

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. pCO2 System logged during first leg of cruise (Julian Date: 152-176). Logging stopped for port call into Vigo, Spain. pCO2 Computer damaged during port call and logging was suspended for remainder of MGL1307 cruise.

See below for more information.

**File id**: pco2
**Logging interval**: ~180 seconds

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

| Log Date | Event | Comment |
|---|---|---|
| 2013:152:09:18:31.1090 | Start | Logging officially started |
| 2013:152:19:36:53 | PCO2 | PCo2 Online and Operational |
| 2013:163:11:02:03 | PCO2 | Restart d/t time update |
| 2013:163:18:52:33 | PCO2 | Nitrogrn valve off-bottle movement -turn on again |

| | | |
|---|---|---|
| 2013:176:05:45:41.8507 | End | Logging ended for Port call. |
| 2013:199:23:54:58.1587 - 2013:199:23:57:27.9272 | Start / Stop (Bad Data) | Computer damaged – Logging test file. Data Corrupt. |

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 hundred and seven successful XBT drops (107 x T-5) were made during this cruise. Drops (Seq) 60, 62, 65, 71, and 73 were defective XBTs and did not deploy. The data from drops (Seq) 59, 67, 70, and 113 was not saved to disk due to operator error. The data sets are saved to the raw/XBT directory in the cruise archive. Refer to the MGL1307_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 #1 | |
|---|---|
| Applies to sequences 1-44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 69, 70, 72, 74, 76, 78, 79, 80, 82, 83, 85, 87, 88, 89, 91, 93, 94, 96, 97, 98, 100, 101. Please note additional exceptions * | |
| **AcquisitionParameterID** | MGL1307_ACQ01 |
| **FieldActivityID** | MGL1307 |
| **ReceiverType** | Sentry Solid Streamer and Ocean Bottom Seismometer |
| **SourceType** | Airgun |
| **Acquisition System Name** | Sercel Syntrak 960 |
| **Acquisition System Type** | MCS/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** | 270 m |
| **Source_to_Near_Channel** | 209.5 m |
| ***Number _of_channels_recorded** | 1872 channels – Seq 1-27 & 30-68 |
| ***Number _of_channels_recorded** | 1404 channels – Seq 28 @ SP 5858 & Seq 29 |
| ***Number _of_channels_recorded** | 1752 channels – Seq 69-101 |
| ***Number _of_cables** | 4 (except Seq 28 was reduced to 3 streamers at SP 5858) |
| ***Number_of_channels_each_cable** | 468 (S1 reduced to 348 channels Seq 69-101) |
| **Channel_length** | 12.5 m |
| **Cable_length** | 6000 m |
| **Cable_spacing** | 200 |
| ***Near_Channel_Number** | S1-468, S2-936, S3-1404, S4-1872 (Seq 1-27 & 30-68) |
| ***Near_Channel_Number** | S1-dead, S2-468, S3-936, S4-1404 (Seq 28 @ SP5858 & Seq 29) |
| ***Near_Channel_Number** | S1-368, S2-816, S3-1284, S4-1752 (Seq 69-101) |
| ***Cable_depth** | 12.0 m – Seq 1-3, 12m-15m – Seq 4, 15m – Seq 5-101 |
| **Number_sources** | 2 |
| **Sub-arrays_per_source** | 2 |
| **Alternate_Shooting** | Yes |
| **Source_separation** | 100 m |
| **Sub-array_separation** | 8.0 m |
| **Source_volume** | 3300 cu in |
| **Source_pressure** | 2000 psi nominal |
| **Source_make,model** | Bolt 1500LL & 1900LL |
| **Source_number** | 18 + 2 spare stbd array, 18 + 2 spare port array |
| **Source_depth** | 9.0 m |
| **Shot_control** | Distance |
| ***Shot_Interval** | Seq 2 – 75m, Seq 25,31,36,38 – 150m, All others 37.5 |
| **Sample_interval** | 2 ms |

| | |
|---|---|
| ***Record_length** | 15 s – Seq 1-41, 13 s – Seq 42-101 |
| **Compass_birds** | 88 Digicourse 5011 (22 per streamer) |
| **Recording_delay** | N/A |

| **Acquisition Parameter Table #2** | |
|---|---|
| Applies to sequences 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 71, 73, 75, 77, 81, 84, 86, 90, 92, 95, & 99. Please note additional exceptions * | |
| **AcquisitionParameterID** | MGL1307_ACQ02 |
| **FieldActivityID** | MGL1307 |
| **ReceiverType** | Sentry Solid Streamer and Ocean Bottom Seismometer |
| **SourceType** | Airgun |
| **Acquisition System Name** | Sercel Syntrak 960/OBS |
| **Acquisition System Type** | MCS/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** | 270 m |
| **Source_to_Near_Channel** | 209.5 m |
| ***Number _of_channels_recorded** | 1872 channels – Seq 1-27 & 30-68 |
| ***Number _of_channels_recorded** | 1404 channels – Seq 28 @ SP 5858 & Seq 29 |
| ***Number _of_channels_recorded** | 1752 channels – Seq 69-101 |
| **Number _of_cables** | 4 (except Seq 28 was reduced to 3 streamers at SP 5858 and Seq 29) |
| **Number_of_channels_each_cable** | 468 (S1 reduced to 348 channels Seq 69-101) |
| **Channel_length** | 12.5 m |
| **Cable_length** | 6000 m |
| **Cable_spacing** | 200 m |
| ***Near_Channel_Number** | S1-468, S2-936, S3-1404, S4-1872 (Seq 1-27 & 30-68) |
| ***Near_Channel_Number** | S1-dead, S2-468, S3-936, S4-1404 (Seq 28 @ SP5858 & Seq 29) |
| ***Near_Channel_Number** | S1-368, S2-816, S3-1284, S4-1752 (Seq 69-101) |
| ***Cable_depth** | 12.0 m – Seq 1-3, 12m-15m – Seq 4, 15m – Seq 5-101 |
| **Number_sources** | 2 |
| **Sub-arrays_per_source** | 2 |
| **Alternate_Shooting** | Yes |
| **Source_separation** | 100 m |
| **Sub-array_separation** | 8.0 m |
| **Source_volume** | 3300 cu in |
| **Source_pressure** | 2000 psi nominal |
| **Source_make,model** | Bolt 1500LL & 1900LL |
| **Source_number** | 18 + 2 spare stbd array, 18 + 2 spare port array |

| | |
|---|---|
| **Source_depth** | 9.0 m |
| **Shot_control** | Time |
| ***Shot_Interval** | 30 seconds for Seq 47, 61, 65, 71, 77, & 86 |
| ***Shot_Interval** | 60 seconds for Seq 45, 49, 51, 53, 55, 57, 59, 63, 67, 73, 75, 81, 84, 90, 92, 95, & 99 |
| **Sample_interval** | 2 ms |
| **Record_length** | 15 s – Seq 1-41, 13 s – Seq 42-101 |
| **Compass_birds** | 88 Digicourse 5011 (22 per streamer) |
| **Recording_delay** | N/A |

## B. Seismic Overview

## Physical Configuration

The towing configuration for the air guns and streamers is detailed in the document titled ***MGL1307_Offsets_2013-06-14.xls***.

## Offsets

All antenna and in-water offset drawings are in the file ***MGL1307_Offsets_2013-06-14.xls***

## Spectra INS (integrated navigation system)

Spectra was used for all timing and navigation during the cruise. Shotlogs were generated from spectra header logs, P190 and P294 files using shotlog processing code contained on the archive in /supplemental/code/shotlog.

## V. RV Langseth Gravity Tie Information

The Gravimeter was tied before and after the cruise at the tie points shown below:

| Date / Time | Ship Location | Reference Location | Mistie |
|---|---|---|---|
| 2013-05-30T07:53 | Vigo, Spain, Pierside<br>07:53 UTC<br>42 14.510 N<br>008 42.833 W | Muelle de Guixar<br>(Container Ship Dock) –<br>South of Bollard #6<br>08:30 UTC<br>42 14.510 N<br>008 42.626 W | Vigo, Spain, Pierside (L&R)<br>09:00 UTC<br>42 14.512 N<br>008 42.833 W |
| 2013-07-12T11:00 | Vigo, Spain, Pierside<br>42 13.836 N<br>008 44.234 W | Muelle de Guixar<br>(Container Ship Dock) –<br>South of Bollard #6<br>11:30 UTC<br>42 14.922 N<br>008 42.607 W | Vigo, Spain, Pierside (L&R)<br>13:00 UTC<br>42 13.836 N<br>008 44.235 W |
| 2013-08-02T07:18 | Vigo, Spain, Pierside<br>42 14.530 N<br>008 43.670 W | Muelle de Guixar<br>(Container Ship Dock) –<br>South of Bollard #6<br>07:46 UTC<br>42 14.894 N<br>008 42.615 W | Vigo, Spain, Pierside (L&R)<br>08:07 UTC<br>42 14.529 N<br>008 43.660 W |

Please refer to the documents located under MGL1307/docs/gravity_tie for detailed records.

## VI. Archive Contents

Key files are bolded.

| | |
|---|---|
| MGL1307/docs | Cruise documents and logs |
| MGL1307/docs/config | Configuration archive |
| MGL1307/docs/elog | Cruise elog |
| MGL1307/docs/gravity_tie | Gravity Tie information |
| MGL1307/docs/map | Cruise maps, track map |
| MGL1307/docs/offsets | Vessel/sensor offsets |
| MGL1307/docs/operations/ | Operations documents |
| MGL1307/docs/operations/Daily_Reports | Cruise Daily Reports from Chief Science Officer |
| MGL1307/docs/operations/NavLogs | Seismic navigation logs (spectra) |
| MGL1307/docs/operations/ObsLogs | Seismic acquisition logs (gun controller) |
| **MGL1307/docs/operations/MGL1307_B15_line_log_multi_channel_seismics.xls** | **Master line log table** |
| MGL1307/docs/permits | Clearance Documents |
| MGL1307/docs/waypoints | Waypoint files |
| MGL1307/docs/personnel | Personnel rosters, org chart, bunk and phone lists |

| | |
|---|---|
| MGL1307/docs/reports | Cruise Report and supplemental docs |
| **MGL1307/docs/reports/MGL1307_DataReport_v1.0.doc** | **This file** |
| **MGL1307/docs/offsets/MGL1307_Offsets_2013-06-14.xls** | **Vessel/sensor offsets** |
| MGL1307/docs/screencaps | Screen captures |
| MGL1307/processed | Processed data |
| MGL1307/processed/Knudsen | Knudsen processing (empty) |
| MGL1307/processed/obsip | Processed OBS logs |
| MGL1307/processed/SeisPos | Spectra SeisPos processed P190 and Reflex Data |
| MGL1307/processed/svp | Sound velocity profiles |
| MGL1307/raw | Raw data |
| MGL1307/raw/adcp | Raw ADCP data |
| MGL1307/raw/knudsen | Raw Knudsen sub-bottom profiler data |
| MGL1307/raw/multibeam | Raw EM122 data |
| MGL1307/raw/serial | Underway serial data: gps, tsg, weather, etc. |
| MGL1307/raw/spectra/P294 | Raw seismic navigation, p294 |
| MGL1307/raw/spectra/raw_P190 | Spectra underway p190 |
| MGL1307/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<br>N = North<br>S = South | n/a |
| ddmm.mmmmm | Longitude | Degrees/Minutes.decimal |
| a | Direction of Longitude<br>E = East<br>W = West | n/a |
| x | GPS Quality indicator<br>0 = fix not valid<br>1 = GPS Autonomous fix<br>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<br>N = North<br>S = South | n/a |
| ddmm.mmmmm | Longitude | Degrees/Minutes.decimal |
| a | Direction of Longitude<br>E = East<br>W = West | n/a |
| x | GPS Quality indicator<br>0 = fix not valid<br>1 = GPS Autonomous fix<br>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<br>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:

- KGDPT - Depth below transducer

**$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 |

**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 -129.212088  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 -129.212088  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<br>Four fixed digits of year.<br>Three fixed digits of julian day.<br>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, y.yzzz.z, @@.@@@@**

PCO2 Data

| Item | Definition | Value | Units |
|---|---|---|---|
| yyyyjjj.jjj | pco2 Computer Date/Time | n/a | Year/Julian Day.decimal<br>Four fixed digits of year.<br>Three fixed digits of julian day.<br>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 |
| 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 / | 0 to 15 | knots |

| | | | |
|---|---|---|---|
| | Speed Made Good | | |
| 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.<br>Two fixed digits of hours.<br>Two fixed digits of minutes.<br>Two fixed digits of seconds.<br>Three digits for decimal fractions of a second. |
| llll.lllll | Latitude | -90 to +90 | DegreeslMinutes.decimal.<br>Two fixed digits of degrees<br>Two fixed digits of minutes<br>Five digits for decimal minutes. |
| a | N (north) or S (south) | N or S | |
| yyyyy.yyyyy | Longitude | -180 to +180 | Degrees/Minutes.decimal.<br>Three fixed digits of degrees.<br>Two fixed digits of minutes.<br>Five digits for decimal minutes. |
| b | E (east) or W (west) | E or W | |
| t | GPS Quality Indicator | 0 = Fix not available or invalid<br>1 = CIA standard GPS; fix valid.<br>2 = DGS mode; fix valid.<br>3 = PPP mode; fix valid.<br>4 = RTK fixed<br>5 = RTK float<br>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 | n/a | Metres |

| | | | |
|---|---|---|---|
| | 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, yy 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.<br>2 fixed digits of hours.<br>2 fixed digits of minutes.<br>2 fixed digits of seconds.<br>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.<br>2 fixed digits of hours<br>2 fixed digits of minutes<br>2 fixed digits of seconds<br>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 Thermosalinograph**

Data from the Seabird TSG is output in the following format:

2008:199:02:23:43.0914 AE9FC8F927F34AA7DAC1 1527.40 27.94 23.47 5.17 31.90

yyyy:ddd:hh:mm:ss.ssss ttttccccxxxxxxvvvvvv aaaa.aa bb.bb cc.cc d.dd ee.ee

| Item | Definition | Units |
|---|---|---|
| yyyy | LDS Timestamp | year |
| ddd | LDS Timestamp | day of year |
| hh | LDS Timestamp | hour |
| mm | LDS Timestamp | minute |
| ss.ssss | LDS Timestamp | second |
| tttt | Raw internal temperature sensor data | n/a |
| cccc | Raw conductivity sensor data | n/a |
| xxxxxx | Raw external temperature sensor data | n/a |
| aaaa.aa | Speed of sound | m/s |
| bb.bb | Internal temperature | Degrees C |
| cc.cc | External temperature | Degrees C |
| d.dd | Conductivity | S/m |
| ee.ee | Salinity | ppm |

**SEAPATH 200 Inertial Navigation System**

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

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

## $INGGA, hhmmss.sss, llll.lllll, a, yyyyyyyyyyb, 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.<br>Two fixed digits of hours.<br>Two fixed digits of minutes.<br>Two fixed digits of seconds.<br>Three digits for decimal fractions of a second. |
| llll.lllll | Latitude | -90 to +90 | DegreeslMinutes.decimal.<br>Two fixed digits of degrees<br>Two fixed digits of minutes<br>Five digits for decimal minutes. |
| a | N (north) or S (south) | N or S | |
| yyyyy.yyyyy | Longitude | -180 to +180 | Degrees/Minutes.decimal.<br>Three fixed digits of degrees.<br>Two fixed digits of minutes.<br>Five digits for decimal minutes. |
| b | E (east) or W (west) | E or W | |
| t | GPS Quality Indicator | 0 = Fix not available or invalid<br>1 = CIA standard GPS; fix valid.<br>2 = DGS mode; fix valid.<br>3 = PPP mode; fix valid.<br>4 = RTK fixed<br>5 = RTK float<br>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.<br>2 fixed digits of hours<br>2 fixed digits of minutes<br>2 fixed digits of seconds<br>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 | |

**Langseth Shotlog Format**

Each Langseth shotlog contains shot records in the following format:

```
MGL1110MCS01  00924  2011:159:15:28:10.8208  152810.8208670  4059.5  565908.12N     1464326.41N
565906.79N     1464338.85N
lllllllllll  sssss  yyyy:mm:dd:hh:mm:ss.ssss hhmmss.ssssss  dddd.d  vv.vvvvvv  www.wwwwww xx.xxxxxx  yyy.yyyyyy
```

Langseth shotlog format

| Item | Definition | Units |
|---|---|---|
| lllllllllllllll | linename | n/a |
| sssssss | shot number | n/a |
| yyyy:mm:dd:hh:mm:ss.ssss | date/time | ISO8601 format |
| hhmmss.ssssss | time | hh = hour<br>mm = minutes<br>ss = seconds<br>.ssssss = decimal seconds |
| dddd.d | depth | meters |
| vv.vvvvvv | vessel lat | degrees, WGS84 |
| www.wwwwww | vessel lon | degrees, WGS84 |
| xx.xxxxxx | source lat | degrees, WGS84 |
| yyy.yyyyyy | source lon | degrees, WGS84 |

**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 | Celsius |

**RM Young Meteorological Station Data**

The meteorological data from the RM Young 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 | Barometer, instantaneous | knots |