RV Langseth
Data Reduction Summary

MGL1211

Astoria, OR – Astoria, OR

FINAL

V1.0, 2012-07-08

Lamont-Doherty Earth Observatory, Columbia University

Saturday May 26th 2012 08:00:00L

Date	Julian Date	Time	Port
2012-06-09	2012-160	0000 UTC, 0200L	Astoria, OR
2012-07-08	2012-190	1500 UTC, 0500L	Astoria, OR

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

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I. Background and Scientific Objectives

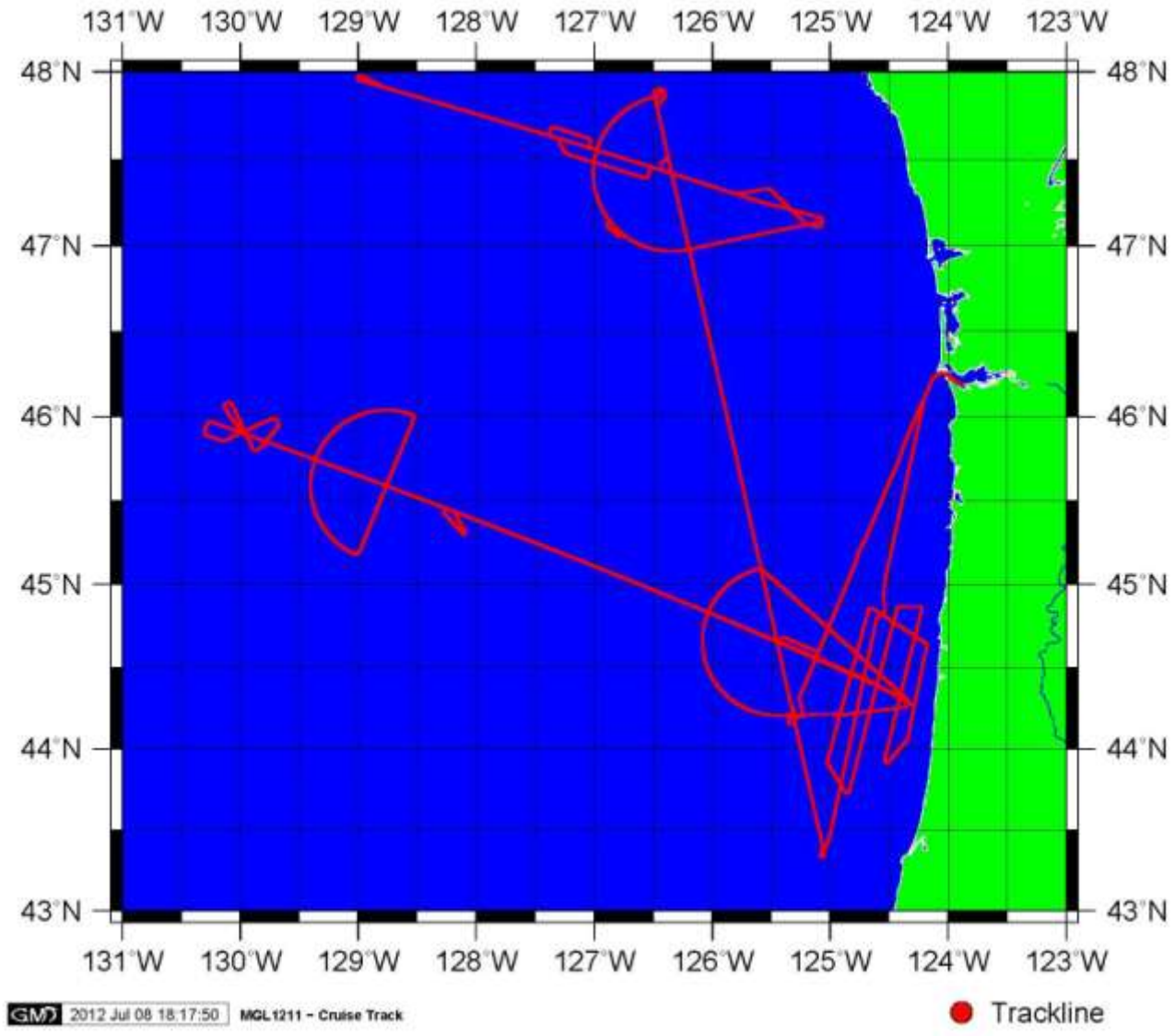
(Pulled from foreign clearance application information submitted by the PI)

Subduction zones, where two tectonic plates collide, are the sites of the world's most devastating earthquakes and tsunamis, of explosive arc volcanism, and high landslide hazard. As one tectonic plate descends beneath the other, water stored within the descending plate is released deep in the earth and is believed to play an important role in these subduction-related phenomena, contributing to the generation of arc magmas, of intraslab earthquakes at intermediate depths, and in the mechanical characteristics of the megathrust interface. Despite the importance of water bound in oceanic plates for key subduction processes, little is known about how the plate becomes hydrated, the extent and distribution of hydration, and how the state of hydration of the descending slab contributes to earthquake hazard at different subduction zones.

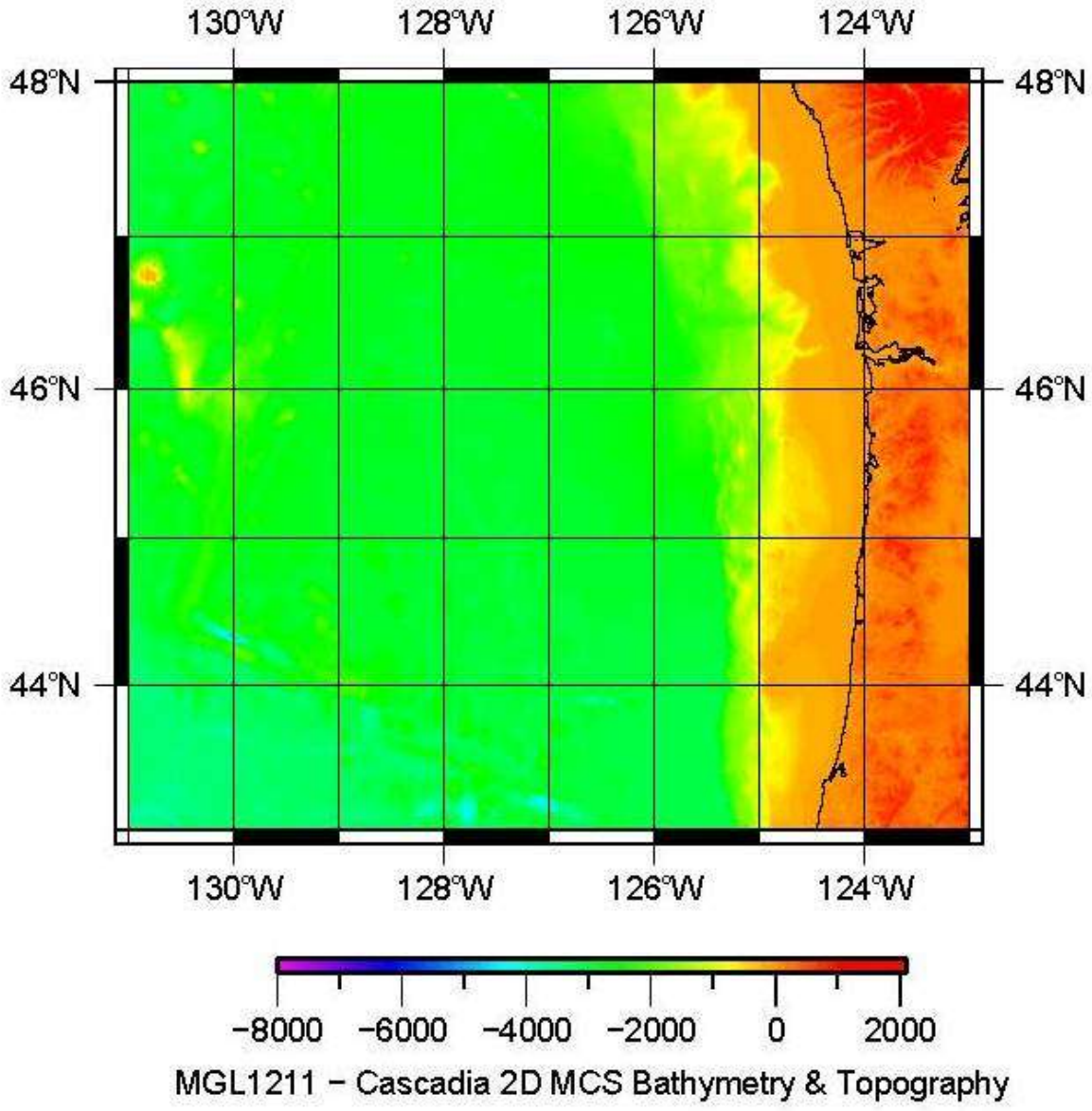
At the Cascadia subduction zone, where volcanic eruptions and megathrust and intraslab earthquakes pose significant hazards in the heavily populated northwestern US, the state of the down-going Juan de Fuca (JdF) plate is of particular interest. With the young age and therefore presumed warm state of the JdF plate, hydration of the oceanic lithosphere may be confined to the crust, limiting the potential volume of water stored in the plate to less than in other subduction systems. However, numerous observations support the presence of abundant water within the Cascadia subduction zone. Some of the water entering the subduction zone is transported within the sediment section and the highly porous upper crust, but seismicity located below the oceanic crust suggests the presence of water reaching into at least the shallowest mantle of the down-going plate. Regional variations in subduction zone properties and seismicity are observed along the Cascadia margin and variations in incoming plate hydration could be important.

Our study is designed to test the hypothesis that the JdF plate is significantly hydrated prior to subduction, transporting water into the subduction zone, and contributing to along-strike variations in structure and seismicity along the Cascadia margin. Progressive alteration of crustal and mantle rocks due to water circulation within the oceanic lithosphere can give rise to detectable changes in seismic velocities, and seismic techniques are uniquely suited for remote detection of plate hydration. Here, active source seismic data will be collected (long-streamer MCS and wide-angle OBS 2D profiles) to characterize crustal and shallow mantle velocities and distribution of faulting across complete transects of the JdF plate, from formation at the mid-ocean ridge, through alteration and hydration within the plate interior, to subduction at the Cascadia trench. Seismic data will also be collected along a 400 km long line parallel to the Cascadia subduction zone to characterize variations in the architecture and velocity structure of the down-going plate from Oregon to Washington. It is expected that differences in hydration of the downgoing plate may play a significant role in the seismic hazard of the Cascadia subduction zone along this heavily populated Pacific NW margin.

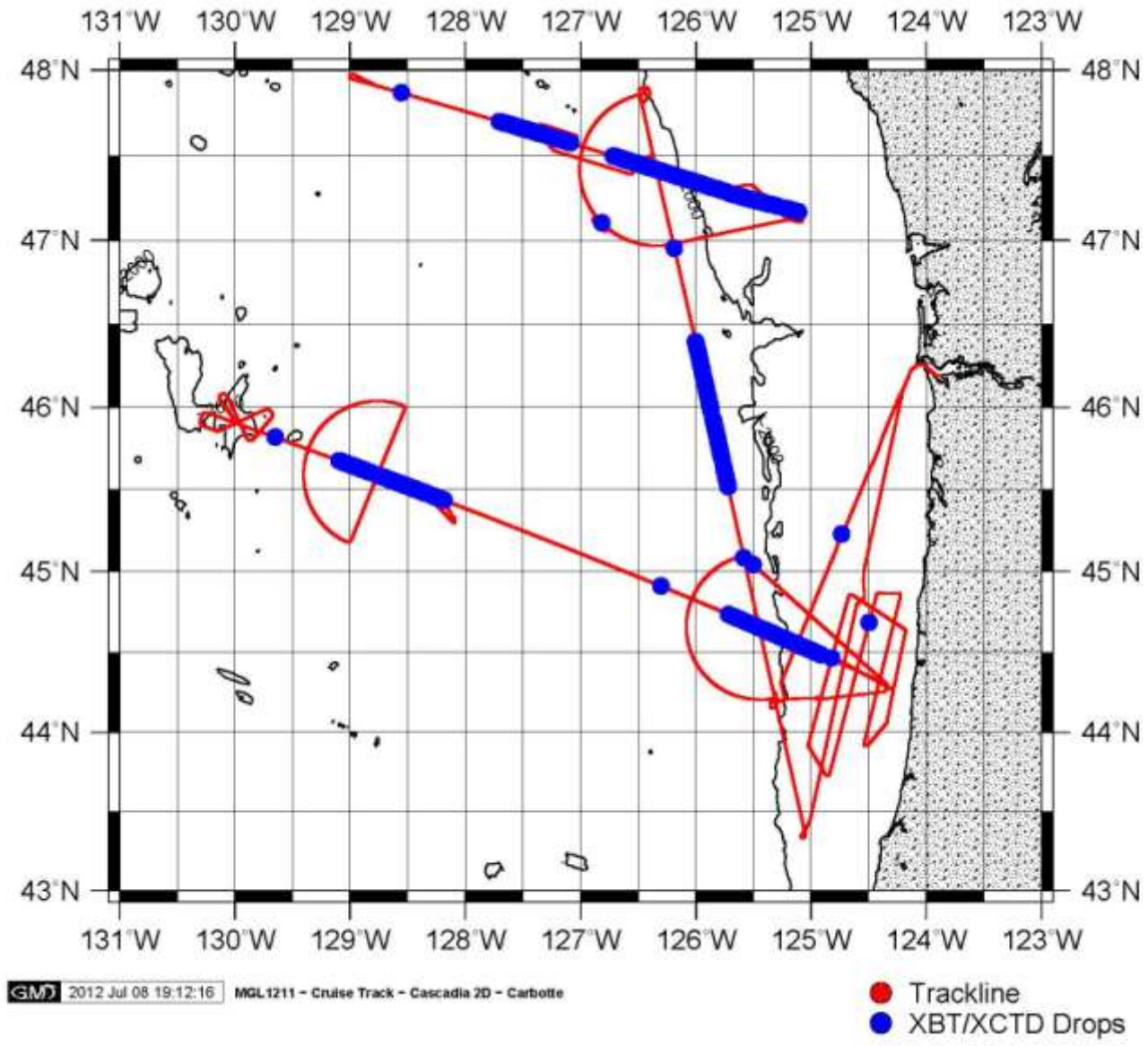
Cruise Track



MGL1211 Bathymetry



XBT Drops


131°W
130°W
129°W
128°W
127°W
126°W
125°W
124°W
123°W
48°N
47°N
46°N
45°N
44°N
43°N
GMT 2012 Jul 08 19:12:16
MGL1211 - Cruise Track - Cascadia 2D - Carbotte
Trackline
XBT/XCTD Drops

II. Personnel

Ship's Crew

1	Mark Landow	Captain
2	Robert Fischer	Chief Mate
3	David Wolford	2nd Mate
4	Zachary Lemite	3rd Mate
5	Jason Woronowicz	Bosun
6	Inocencio Rimando	AB
7	George Cereno	AB
8	Glenice James	AB
9	Jeromiel Webster	OS
10	Lakia Jordan	OS
11	Al Karlyn	Chief Engineer
12	Ryan Vetting	1st Asst. Engineer
13	Cameron Ruth	2nd Asst. Engineer
14	Chrisse Guilas	3rd Asst. Engineer
15	Philip Neis	Electrician
16	Jack Billings	Oiler
17	Rudy Florendo	Oiler
18	Fernando Uribe	Oiler
19	Michael McCoy	Steward
20	Ricardo Rios	Cook

Shipboard Technical Staff

1	Robert Steinhaus	Chief Science Officer
2	Jay Johnstone	Science Officer
3	David Martinson	Science Officer
4	Mike Martello	Navigator/Tech (Geomotive)
5	Carlos Gutierrez	Chief Source Mechanic
6	Mike Tatro	Source Mechanic (Geomotive)
7	West Groves	Source Mechanic (Geomotive)

Science Party

1	Suzanne Carbotte	Chief Scientist (Lamont-Doherty Earth Observatory)
2	Matthias Delescluse	Scientist (ENS, Paris)
3	Berta Biescas-Gorriz	Post Doc (Dalhousie University)
4	Guillermo Bornstein	Grad Student (BCSICSIC, Barcelona)
5	Laurel Childress	Grad Student (Northwestern University)
6	Aaron Farkas	Grad Student (Dalhousie University)
7	James Gibson	Grad Student (Lamont-Doherty Earth Observatory)
8	Shuoshuo Han	Grad Student (Lamont-Doherty Earth Observatory)
9	Gregory Horning	Grad Student (Woods Hole Oceanographic Institute)
10	Beatrice Barker	Grad Student (Massachusetts Institute of Technology)
11	Louise Watremez	Post Doc (Dalhousie University)
12	Helen Janiszewski	Grad Student (Lamont-Doherty Earth Observatory)
13	Milena Marianovic	Grad Student (Lamont-Doherty Earth Observatory)

Protected Species Observers

1	Heidi Ingram	Lead PSO (RPS-Geocet)
2	Emily Harris	PAM/PSO (RPS-Geocet)
3	Tatiana Moreno	PSO (RPS-Geocet)
4	Jami Allen	PSO (RPS-Geocet)
5	Katherine Douglas	PSO (RPS-Geocet)

III. Instrumentation Summary

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

Instrument Data Files

Instrument	Description	Data Set	Data Outputs	Files	Interval
FE700	Furuno FE700 Echosounder	N/A	serial logs	MGL-bath01.*	1s
EM122	Kongsberg EM122 Multibeam Sonar	Partial	raw output to file	See below	variable
			centerbeam serial logs	MGL-bath02.*	variable
KNUDSEN	Knudsen Engineering 3260 Sub-bottom Profiler	Full	KEA, KEB, SEG-Y	See below	variable
DS50	Furuno DS50 Doppler Speedlog	Full	serial logs	MGL-slog01.*	1s
XBT/XCT	Sippican MK21 XBT/XCTD Launcher	N/A	raw output to file	See below	n/a
			converted output to file	See below	n/a
WX1	RM Young 5103 Weather Bird and	Full	serial logs	MGL-wx01.*	1s
			mwv conversion	MGL-mwv01.*	1s
TSG	SeaBird SBE45 Thermosalinograph	Full	raw serial logs	MGL-tsgraw.*	1s
CNAV	C&C Tech. CNAV 2000 DGPS Receiver	Full	serial logs	MGL-cnav.*	1s
CNAV3050	C&C Tech. CNAV 3050 DGPS Receiver	Full	raw serial logs	MGL-cnav3050all.*	1s
			converted data	MGL-cnav3050.*	1s
MAG01	GeoMetrics 882 Magnetometer	N/A	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	N/A	serial logs	MGL-posmv.*	1s
SEAPATH	Konsberg SeaPath Integrated Nav System	Full	serial logs	MGL-seapath.*	1s
STU	Sercel Streamer Tension	Partial	serial logs	MGL-stu1.*	15s
MICROSV	Applied Microsystems Sound Velocity Pod Unit #1	Full	serial logs	MGL-svpod01.*	1s
MICROSV	Applied Microsystems Sound Velocity Pod Unit #2	Full	serial logs	MGL-svpod02.*	1s
SBE38	SeaBird SBE38 Pod Thermometer Pod Unit #1	Full	serial logs	MGL-temppod01.*	1s
SBE38	SeaBird SBE38 Pod Thermometer Pod Unit #2	Full	serial logs	MGL-temppod02.*	1s
PCO2	LDEO PCO2 System	Full	serial logs	MGL-pco2.*	~180s

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

Science Navigation Instrumentation

FE700

Logging interval: 1 second

File id: bath01

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

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

Log Date	Event	Comment
2012:150:13:39:29.1695 - 2012:150:14:24:10.8810	Missing data	Secured after 500 meters

bath01 data sample:

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

EM-122 Mutibeam

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 MGL1211/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)

Logging interval: variable with water depth

File id: bath02

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

Log Date	Event	Comment
2012:166:02:27:41.1886	Start	Logging officially started
2012:166:19:46:23.6396	BIST	2012:166:20:13:31.6147
2012:167:16:44:21.2140	BIST	2012:167:16:52:27.7072

2012:168:16:17:26.0011	BIST	2012:168:16:25:12.1805
2012:169:16:21:01.5193	BIST	2012:169:16:29:24.6813
2012:170:18:14:07.4370	BIST	2012:170:18:23:50.0464
2012:171:10:29:23.0102	BIST	2012:171:10:46:25.1438
2012:172:15:32:46.4849	BIST	2012:172:15:41:09.2138
2012:174:06:08:33.2590	BIST	2012:174:06:17:33.5926
2012:174:18:04:26.9795	BIST	2012:174:18:13:26.6530
2012:175:00:43:59.9022	BIST	2012:175:01:02:41.8663
2012:175:17:10:21.1131	BIST	2012:175:17:19:54.1361
2012:176:15:44:10.3854	BIST	2012:176:15:54:06.3714
2012:177:12:37:39.9448	BIST	2012:177:12:45:39.7328
2012:178:09:41:47.0319	BIST	2012:178:09:53:35.5299
2012:178:12:35:17.0401	BIST	2012:178:12:37:57.7711
2012:178:13:07:32.3107	BIST	2012:178:13:13:58.9236
2012:180:18:12:02.1774	BIST	2012:180:18:23:53.9955
2012:180:18:42:53.0572	BIST	2012:180:18:50:08.0952
2012:180:18:51:36.2561	BIST	2012:180:19:19:47.3640
2012:181:02:00:37.7328	BIST	2012:181:03:37:59.9304
2012:181:13:21:50.2856	BIST	2012:181:13:28:02.9519
2012:182:09:50:37.3318	BIST	2012:182:09:58:49.7063
2012:182:19:35:41.4684	BIST	2012:182:19:37:24.3569
2012:183:07:14:47.6432	BIST	2012:183:07:22:56.1696
2012:183:19:14:21.5392	BIST	2012:183:19:39:53.2971
2012:184:15:45:34.7046	BIST	2012:184:15:53:23.1181
2012:185:08:48:46.3540	BIST	2012:185:08:56:24.7491
2012:185:14:52:21.7102	BIST	2012:185:15:05:19.0171
2012:187:13:14:23.2098	BIST	2012:187:13:22:44.9548
2012:188:10:40:41.9973	BIST	2012:188:10:52:30.9203
2012:191:18:39:16.5528	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
```

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. Unit was secured while on station for coring operations and CTD casts.

There are two sets of segy data recorded/processed this cruise. The segy set in the /raw/knudsen directory are generated by the knudsen software. The segy set in the /processed/knudsen directory are post-processed in the SEGY-Rev0 format.

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
2012:162:00:00:00.6749	Start	Logging officially started
2012:191:18:39:16.5528	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.

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

Log Date	Event	Comment

2012:162:00:00:00.6749	Start	Logging officially started
2012:191:18:39:16.5528	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
```

CNAV2000

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
2012:162:00:00:00.0259	Start	Logging officially started
2012:191:18:39:16.0928	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
```

CNAV3050

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

2012:162:00:00:00.6329	Start	Logging officially started
2012:191:18:39:16.0288	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**
2012:162:00:00:00.0239	Start	Logging officially started
2012:191:18:39:16.7769	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 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. System was not in operation for MGL1211. It has been decommissioned and is awaiting upgrade.

File id: posmv
Logging interval: 1 second

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

Log Date	**Event**	**Comment**

2012:162:00:00:00.6979	N/A	decommissioned
2012:191:18:32:11.6757	N/A	Instrument failure

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.

Logging interval: 1 second

File id: seapath

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

Log Date	**Event**	**Comment**
2012:162:00:00:00.3939	Start	Logging officially started
2012:191:18:39:16.9444	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. Not used during 1211.

Logging interval: 15 seconds

File id: stu1

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

Log Date	Event	Comment
2012:162:20:03:44.1402	Partial	Source only on some OBS
2012:191:16:53:53.6708	Partial	Source only on some OBS

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

Magnetometer deployment/retrieval data gaps

Time	Event
2012:162:18:55:00.0000	Data collected only when Magnetometer is deployed
2012:169:17:16:44.2833	2012:169:23:05:09.4504
2012:170:05:06:17.3290	2012:170:05:25:23.7800
2012:170:05:56:54.3607	2012:170:06:05:10.4904
2012:172:05:51:40.7477	2012:172:06:28:43.5210
2012:172:13:15:38.1159	2012:173:04:20:16.5807
2012:173:10:26:38.9719	2012:173:10:31:35.9549
2012:173:14:26:16.8732	2012:173:14:28:19.8636
2012:173:15:17:52.7383	2012:173:15:30:19.6519
2012:173:15:42:33.6139	2012:173:16:03:55.5598
2012:174:15:57:01.9234	2012:174:17:12:16.0056
2012:174:17:12:24.0030	2012:174:17:22:46.8074
2012:174:17:23:02.7699	2012:174:18:00:30.6342

2012:174:18:01:12.6330	2012:174:18:41:40.7031
2012:177:14:08:40.4335	2012:177:18:12:45.7398
2012:181:04:55:42.8518	2012:181:07:50:00.3658
2012:183:13:03:18.4548	2012:183:18:37:56.1718
2012:183:18:37:56.1718	Maggie operations suspended for OBS fan shoots

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.

File id: tsgraw

Logging interval: 1 second

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

Log Date	**Event**	**Comment**
2012:162:01:19:27.7541	Start	Logging officially started
2012:191:15:53:14.5345	End	Logging officially ended

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 ten seconds are displayed in the following table.

Log Date	Event	Comment
2012:162:00:00:00.9419	Start	Logging officially started
2012:191:18:39:16.8808	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 Pod Unit #1

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

File id: svpod01
Logging interval: 1 second

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

Log Date	Event	Comment
2012:162:00:00:00.3469	Start	Logging officially started
2012:191:18:39:17.1709	End	Logging officially ended

svpod01 data format:

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

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

Applied Microsystems MicroSV Pod Unit #2

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

File id: svpod02
Logging interval: 1 second

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

Log Date	Event	Comment
2012:162:00:00:00.4629	Start	Logging officially started
2012:191:18:39:17.3029	End	Logging officially ended

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 ten seconds are displayed in the following table.

Log Date	Event	Comment
2012:162:00:00:00.2439	Start	Logging officially started
2012:191:18:39:17.1129	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
2012:162:00:00:00.8179	Start	Logging officially started
2012:191:18:39:16.8119	End	Logging officially ended

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.

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
2012:162:02:20:50.6694	Start	Logging officially started
2012:191:15:51:08.0021	End	Logging officially ended

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

Three hundred eighty four (384) XBT drops were made during this cruise. The type breakdown is as follows: 241 – T5, 117 – XSV02, 23 – T7, and 3 – T6. The data set is saved to the raw/XBT directory in the cruise archive. Refer to the MGL1211_Expendable_Drops.xls spreadsheet in the docs/operations directory of the cruise archive for more information.

IV. Seismic Summary

A. Acquisition Parameter Table

Sequences 1-6, 28-29, and 41.

Acquisition Parameter Table	
AcquisitionParameterID	MGL1211_ACQ01
FieldActivityID	MGL1211
ReceiverType	None
SourceType	Airgun
Acquisition System Name	None
Acquisition System Type	None
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	232.00 m
Source_to_Near_Channel	N/A
Number _of_channels_recorded	N/A
Number _of_cables	N/A
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	1
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	8 m
Source_volume	6600 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt Gun
Source_number	1
Source_depth	12.0 m
Shot_control	Distance
Shot_Interval	500 m
Sample_interval	N/A
Record_length	N/A
Compass_birds	N/A
Recording_delay	N/A

Sequences 7-15

Acquisition Parameter Table	
AcquisitionParameterID	MGL1211_ACQ02
FieldActivityID	MGL1211
ReceiverType	Sentry Solid Streamer
SourceType	Airgun
Acquisition System Name	Sercel Syntrak 960
Acquisition System Type	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	232.00 m
Source_to_Near_Channel	172.00 m
Number _of_channels_recorded	636
Number _of_cables	1
Number_of_channels_each_cable	636
Channel_length	12.5 m
Cable_length	8.15 km
Cable_spacing	N/A
Near_Channel_Number	636
Cable_depth	9.0 m
Number_sources	1
Sub-arrays_per_source	1
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	8 m
Source_volume	6600 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt Gun
Source_number	1
Source_depth	9.0 m
Shot_control	Distance
Shot_Interval	37.5 m
Sample_interval	2.0ms
Record_length	12s
Compass_birds	29 Digicourse 5011
Recording_delay	N/A

Sequence 14

Acquisition Parameter Table	
AcquisitionParameterID	MGL1211_ACQ03
FieldActivityID	MGL1211
ReceiverType	Sentry Solid Streamer
SourceType	Airgun
Acquisition System Name	Sercel Syntrak 960
Acquisition System Type	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	232.00 m
Source_to_Near_Channel	172.00 m
Number _of_channels_recorded	636
Number _of_cables	1
Number_of_channels_each_cable	636
Channel_length	12.5 m
Cable_length	8.15 km
Cable_spacing	N/A
Near_Channel_Number	636
Cable_depth	9.0 m
Number_sources	1
Sub-arrays_per_source	1
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	8 m
Source_volume	6600 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt Gun
Source_number	1
Source_depth	9.0 m
Shot_control	Distance
Shot_Interval	150 m
Sample_interval	2.0ms
Record_length	12s
Compass_birds	29 Digicourse 5011
Recording_delay	N/A

Sequences 16-20, 22-27

Acquisition Parameter Table	
AcquisitionParameterID	MGL1211_ACQ04
FieldActivityID	MGL1211
ReceiverType	Sentry Solid Streamer
SourceType	Airgun
Acquisition System Name	Sercel Syntrak 960
Acquisition System Type	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	232.00 m
Source_to_Near_Channel	172.00 m
Number _of_channels_recorded	636
Number _of_cables	1
Number_of_channels_each_cable	636
Channel_length	12.5 m
Cable_length	8.15 km
Cable_spacing	N/A
Near_Channel_Number	636
Cable_depth	9.0 m
Number_sources	1
Sub-arrays_per_source	1
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	8 m
Source_volume	6600 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt Gun
Source_number	1
Source_depth	9.0 m
Shot_control	Distance
Shot_Interval	500 m
Sample_interval	2.0ms
Record_length	12s
Compass_birds	29 Digicourse 5011
Recording_delay	N/A

Sequence 21

Acquisition Parameter Table	
AcquisitionParameterID	MGL1211_ACQ05
FieldActivityID	MGL1211
ReceiverType	Sentry Solid Streamer
SourceType	Airgun
Acquisition System Name	Sercel Syntrak 960
Acquisition System Type	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	232.00 m
Source_to_Near_Channel	172.00 m
Number _of_channels_recorded	636
Number _of_cables	1
Number_of_channels_each_cable	636
Channel_length	12.5 m
Cable_length	8.15 km
Cable_spacing	N/A
Near_Channel_Number	636
Cable_depth	9.0 m
Number_sources	1
Sub-arrays_per_source	1
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	8 m
Source_volume	3300 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt Gun
Source_number	1
Source_depth	9.0 m
Shot_control	Distance
Shot_Interval	37.5 m
Sample_interval	2.0ms
Record_length	12s
Compass_birds	29 Digicourse 5011
Recording_delay	N/A

Sequences 30-40
#FieldActivityID TREHU for sequences 30-38
#FieldActivityID MGL1211 for sequences 39-40

Acquisition Parameter Table	
AcquisitionParameterID	MGL1211_ACQ06
FieldActivityID	See above #
ReceiverType	N/A
SourceType	Airgun
Acquisition System Name	N/A
Acquisition System Type	N/A
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	232.00 m
Source_to_Near_Channel	N/A
Number _of_channels_recorded	N/A
Number _of_cables	N/A
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	1
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	8 m
Source_volume	6600 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt Gun
Source_number	1
Source_depth	12.0 m
Shot_control	Distance
Shot_Interval	170 m
Sample_interval	N/A
Record_length	N/A
Compass_birds	N/A
Recording_delay	N/A

B. Seismic Overview

Physical Configuration
The towing configuration for the air guns and streamers is detailed in the document titled ***MGL1211_Offsets.xls***.

Offsets
All antenna and in-water offset drawings are in the file ***MGL1211_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 postioning.

V. RV Langseth Gravity Tie Information

A gravity tie was done before and after the cruise in Astoria, Oregon. Please refer to the documents located under MGL1211/docs/gravity_tie for detailed records.

VI. Archive Contents

Key files are bolded.

MGL1211/docs	Cruise documents and logs
MGL1211/docs/config	Configuration archive
MGL1211/docs/elog	Cruise elog
MGL1211/docs/gravity_tie	Gravity Tie information
MGL1211/docs/map	Cruise maps, track map
MGL1211/docs/offsets	Vessel/sensor offsets
MGL1211/docs/operations/	Operations documents
MGL1211/docs/operations/Daily_Reports	Cruise Daily Reports from Chief Science Officer
MGL1211/docs/operations/NavLogs	Seismic navigation logs (spectra)
MGL1211/docs/operations/ObsLogs	Seismic acquisition logs (gun controller)
MGL1211/docs/operations/MGL1211_B15_line_log_multi_channel_seismics.xls	**Master line log table**
MGL1211/docs/permits	Clearance Documents
MGL1211/docs/waypoints	Waypoint files
MGL1211/docs/personnel	Personnel rosters, org chart, bunk and phone lists
MGL1211/docs/reports	Cruise Report and supplemental docs
MGL1211/docs/reports/MGL1211_DataReport_v1.0.doc	**This file**
MGL1211/docs/offsets/MGL1211_Offsets.xls	**Vessel/sensor offsets**
MGL1211/docs/screencaps	Screen captures
MGL1211/processed	Processed data
MGL1211/processed/reflex (3D data-sets only, not applicable to OBS and 2D)	Spectra reflex files
MGL1211/processed/shotlogs	Shot log files
MGL1211/processed/sprint	Sprint files
MGL1211/processed/svp	Sound velocity profiles
MGL1211/raw	Raw data
MGL1211/raw/adcp	Raw ADCP data
MGL1211/raw/knudsen	Raw Knudsen sub-bottom profiler data
MGL1211/raw/multibeam	Raw EM122 data
MGL1211/raw/serial	Underway serial data: gps, tsg, weather, etc.
MGL1211/raw/spectra/P1	Spectra p190
MGL1211/raw/spectra/P2	Spectra p294
MGL1211/raw/XBT	Raw XBT data

VII. Data Formats

Gravimeter data

The gravimeter serial data is output in the following format:

```
01:025610 01

01:xxxxxx ff
```

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

CNAV GPS receiver data

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

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

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

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

$GPVTG Sentence Fields

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

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

$GPGGA Sentence Fields

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

CNAV 3050 GPS receiver data

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

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

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

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

$GPVTG Sentence Fields

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

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

$GPGGA Sentence Fields

Item	Definition	Units
hhmms.ss	UTC time of position	Hours/Minutes/Seconds.decimal.
ddmm.mmmmm	Latitude	Degrees/Minutes.decimal.
a	Direction of Latitude N = North S = South	n/a
ddmm.mmmmm	Longitude	Degrees/Minutes.decimal
a	Direction of Longitude E = East W = West	n/a
x	GPS Quality indicator 0 = fix not valid 1 = GPS Autonomous fix 2 = GcGPS Corrected Fix	n/a
xx	Number of GPS satellites used in solution fix	n/a
x.x	Horizontal Dilution of Precision (HDOP)	n/a
xx.xx	C-NAV GPS receiver antenna altitude reference to Mean Sea Level (MSL)	n/a
M	Altitude units--M indicates meters	n/a

xx.xx	WGS-84 Geoidal separation distance from MSL based on the NIMA/NASA EGM96 15-minute (Earth Gravity Model)	Meters
M	Geosoidal separation units--M indicates meters	n/a
x.x	Age of GcGPS corrections used in solution fix	n/a
xyy	C-NAV GPS receiver reference identification	x is downlink satellite communication beam in use yy is the GPS correction signal mode/type being used
*hh	Checksum (hexadecimal representation) followed by CRLF terminator pair	n/a

EM122 Center Beam Depth

This page describes the EM122 centerbeam depth serial output, used for real-time depth display. For fulll multibeam data, please see the multibeam page.

The EM122 outputs serial data in the following formats:

- KIDPT - Depth below transducer

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

SDDBT sentence format

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

FE700 Navigational Echosounder data

The FE700 Navigational Echosounder outputs data in the following formats

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

$PFEC ,aaaa,x,x*hF

PFEC sentence format

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

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

SDDBT sentence format

Item	Definition	Units
x.x	Water depth	feet
f	f = feet	n/a
x.x	Water depth	meters

M	M = meters	n/a
x.x	Water depth	fathoms
F	F = fathoms	n/a
*hh	Checksum	n/a

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

SDDBS sentence format

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

Gyroscope data

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

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

$PCICM,HEALM,xxxx,x,xx*hh

ALM sentence format

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

$HEHDT,xxx.x,T*hh

HDT sentence format

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

$HEROT,-xxx.x,A*hh

HEROT sentence format

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

Geometrics 882 Magnetometer Data

The magnetometer serial data is output in the following format:

```
$ 53863.927,0652

$ xxxxx.xxx,vvvv
```

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

RM Young Meteorological Station Data

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

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

Langseth WX station sentence format

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

OBSIP Shotlog Format (not used on MGL1211)

Each OBSIP shotlog contains a header followed by shot records:

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

Shot records are in the following format:

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

OBSIP record format

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

LDEO PCO2 System

PCO2 outputs data in the following sentence format:

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

PCO2 Data

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

LDEO PCO2 + CNav + TSG + WX01 + SBE38 Systems

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

yyyyjjj.jjj aaaa.aa bb.bb cccc.cc ddd.dd e.ee fff.f gggg.gg hh i k, llll.llllllm, nnnnn.nnnnnno, pppp.pp, q.qq, r.rr, s.ss, tt.tt, uu.u, vvv, w.w, xxx.x, y.yy, zzz.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, 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 / 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.llll, a, yyyyy.yyyyy, b, t, nn, v.v, x.x, M,,,c.c,rrrr*hh

$INGGA-Global System Position Fix Data

Item	Definition	Value	Units
$INGGA	Header	$INGGA	
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.llll	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	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, 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,y.y

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.llll, a, yyyyy.yyyyy, b, t, nn, v.v, x.x, M,,,c.c,rrrr*hh

$INGGA-Global System Position Fix Data

Item	Definition	Value	Units
$INGGA	Header	$INGGA	
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.llll	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