

# RV Langseth Data Reduction Summary

## MGL1111

Dutch Harbor, AK – Dutch Harbor, AK

NOT FINAL

V1.2, 2011-09-02

Lamont-Doherty Earth Observatory, Columbia University

Friday September 2 2011 08:00:00L

Date	Julian Date	Time	Port
2011-08-07	2011-219	0000 UTC, 1600L	Dutch Harbor, AK
2011-09-04	2011-247	1600 UTC, 0800L	Dutch Harbor, AK

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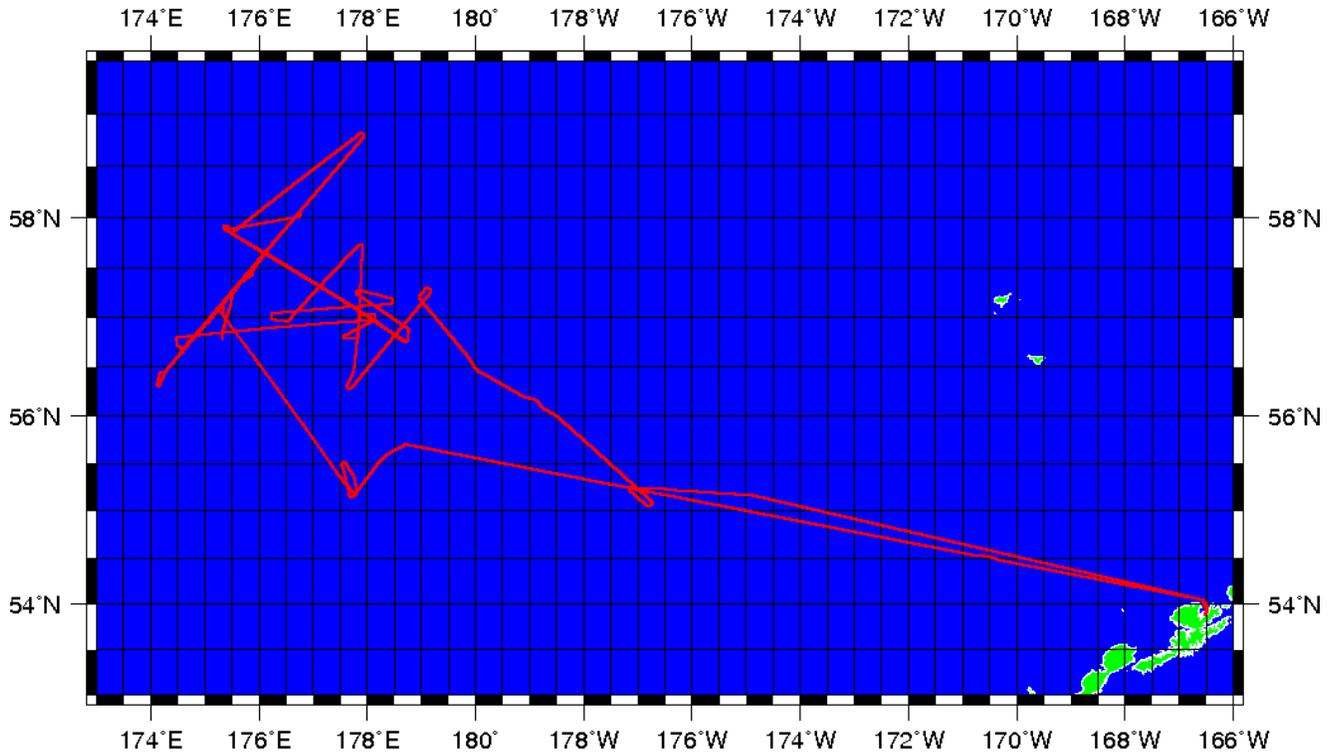
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## **I. Background and Scientific Objectives**

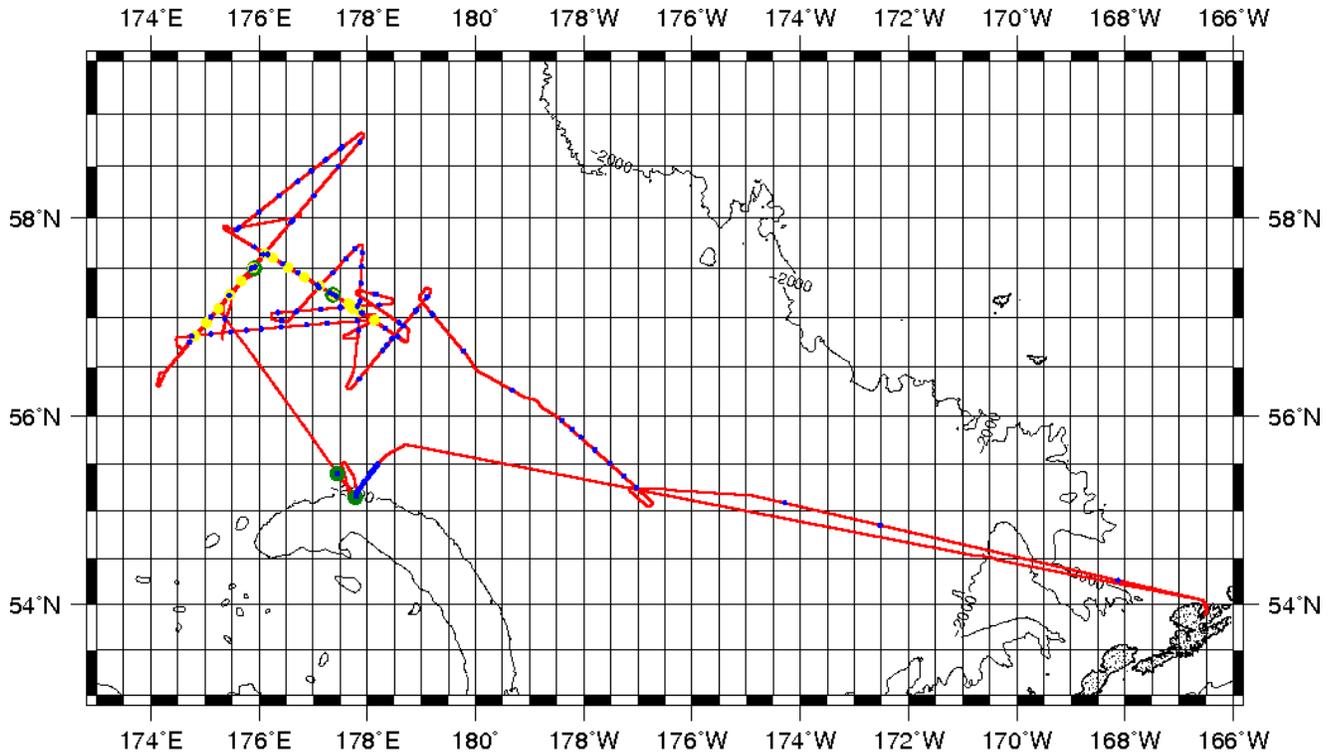
This project is part of the U.S Extended Continental Shelf Project (<http://continentalshef.gov/>) to establish the full extent of the U.S. continental shelf, consistent with international law. This particular leg will use marine geophysics in the Gulf of Alaska for the purpose of determining geologic framework, crustal nature and sediment thickness within and beyond the U.S. EEZ, from 2000m isobath (approx.) to 350 nm from the territorial baselines.

**Figure 1 – Cruise Track**



 2011 Sep 02 17:05:21 MGL1111 - Cruise Track

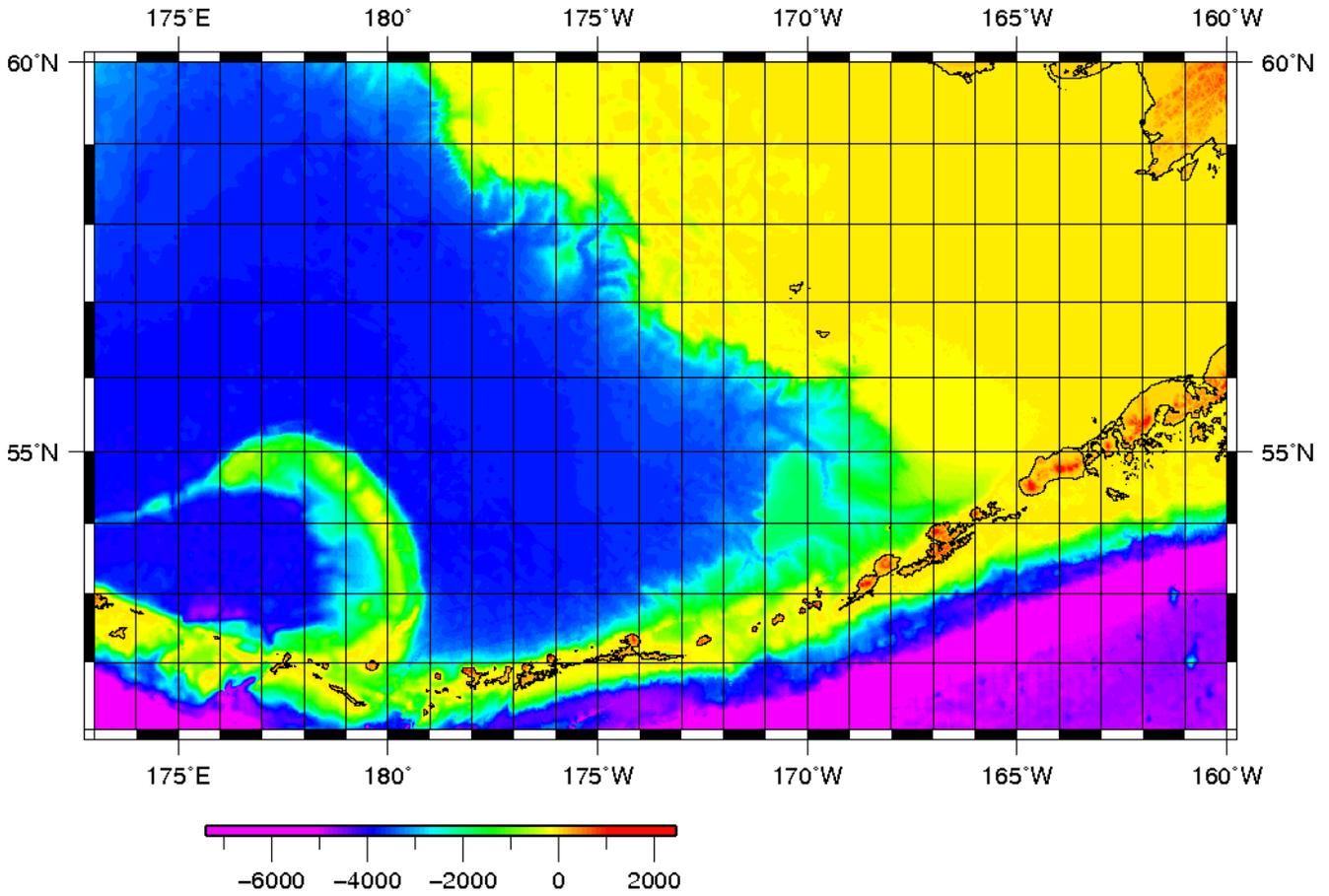
**Figure 2 – Cruise Track, XBT/XCTD Drops, OBS, & CTD Casts Locations**



2011 Sep 02 17:05:27 MGL1111 - Cruise Track - USECS - Barth

- Trackline
- XBT/XCTD Drops
- CTD Cast Locations
- OBS Locations

**Figure 3 – Bering Sea, Alaska Topography & Bathymetry**



MGL1111 – Bering Sea, Alaska Bathymetry & Topography

## II. Personnel

### Shipboard Technical Staff

1	David Martinson	Chief Science Officer
2	Megan Meyer	Science Officer
3	David Ng	Chief IT/Nav
4	Bern McKiernan	Watch Leader/Acquisition
5	Mark Stanton Wooley	Acquisition Leader
6	Mike Martello	Navigation Leader
7	Toby Martin	Navigation
8	Christopher Taylor Francis	Chief Sound Source Mechanic
9	Carlos Gutierrez	Sound Source Mechanic
10	Jenny White	Sound Source Mechanic
11	Peter DalFerro	Sound Source Mechanic

### Ship's Crew

1	Mark Landow	Captain
2	Stanley Zeigler	Chief Mate
3	David Wolford	2 <sup>nd</sup> Mate
4	West Wilson	3 <sup>rd</sup> Mate
5	Ricardo Redito	Bosun
6	Matthew Ursin	AB
7	Inocencio Rimando	AB
8	Peter Piscitello	AB
9	Jeromiel Webster	OS
10	Joshua Schaffner	OS
11	Steve Pica	Chief Engineer
12	Ryan Vetting	1 <sup>st</sup> Asst. Engineer
13	Trevor Lapham	2 <sup>nd</sup> Asst. Engineer
14	Clayton Busenga	3 <sup>rd</sup> Asst. Engineer
15	Mike Blackburn	Electrician
16	Rodolfo Florendo	Oiler
17	Fernando Uribe	Oiler
18	Robert Jones	Oiler
19	Hervin McLean Fuller	Steward

20	Leoncio Martires	Cook
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**MMO**

1	Dara Cameron	PSO
2	Meghan Piercy	PSO
3	Emily Ellis	PSO
4	Amanda Harrison	PSO
5	Heidi Ingram	PSO

**Science Party**

1	Ginger Barth	Chief Scientist
2	Warren Wood	Co-chief Scientist
3	Wayne Baldwin	Scientist
4	Jorden Hayes	Scientist
5	Jennifer Henderson	Scientist
6	Nina Lebedeva-Ivanova	Scientist
7	Thomas O'Brien	Scientist
8	David Scholl	Scientist
9	Ray Sliter	Scientist
10	Peter Triezenberg	Scientist

### 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 section 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	Full	serial logs	MGL-bath01.*	1s
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	1 Per Drop	raw output to file	See below	n/a
			converted output to file	See below	n/a
WX1	RM Young 5103 Weather Bird and Translator	Full	serial logs	MGL-wx01.*	1s
			mwv conversion	MGL-mwv01.*	1s
TSG	SeaBird SBE45 Thermosalinograph	Full	raw serial logs	MGL-tsgraw.*	1s
CNAV	C&C Tech. CNAV 2000 DGPS Receiver	Full	serial logs	MGL-cnav.*	1s
CNAV3050	C&C Tech. CNAV 3050 DGPS Receiver	Full	raw serial logs	MGL-cnav3050all.*	1s
			converted data	MGL-cnav3050.*	1s
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	Kongsberg SeaPath Integrated Nav System	Full	serial logs	MGL-seapath.*	1s
STU	Sercel Streamer Tension	Full	serial logs	MGL-stu1.*	15s
TAGGER	Spectrum Instruments intelligent reference TM-4	None	serial logs	MGL-tagger01.*	shot
			filtered logs	MGL-shot01.*	shot
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
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 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
2011:219:15:06:28.6050	Start	Logging officially started
2011:245:16:54:00.3457	End	Logging officially ended

bath01 data sample:

bath01	2008:220:13:45:42.0681	\$SDBT,,,,,,
bath01	2008:220:13:45:42.0690	\$SDBS,,,,,,
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 MGL1111/raw/multibeam. Center beam depth is recorded separately to serial log. The MicroSV (svpod01) probe in the pod supplied sound velocity to the EM122.

**Logging interval:** variable with water depth

**File id:** bath02

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

<b>Log Date</b>	<b>Event</b>	<b>Comment</b>
2011:220:21:31:49.2542	Start	Logging officially started
2011:233:11:26:28.5512 - 2011:233:11:36:15.3995	Missing data	Secured for OBS deployment
2011:233:12:51:28.5464 - 2011:233:12:59:33.6233	Missing data	Secured for OBS deployment
2011:233:13:47:40.6094 - 2011:233:13:58:59.6626	Missing data	Secured for OBS deployment
2011:233:14:39:22.1728 - 2011:233:14:48:57.8425	Missing data	Secured for OBS deployment
2011:233:15:32:39.2003 - 2011:233:15:46:21.8796	Missing data	Secured for OBS deployment
2011:233:17:13:07.5085 - 2011:233:17:23:25.6241	Missing data	Secured for OBS deployment
2011:233:18:42:31.8912 - 2011:233:18:54:01.7088	Missing data	Secured for OBS deployment
2011:233:20:16:26.7115 - 2011:233:20:24:27.7162	Missing data	Secured for OBS deployment
2011:233:21:54:52.1534 - 2011:233:22:16:19.1648	Missing data	Secured for OBS deployment
2011:233:23:42:15.1536 - 2011:233:23:54:07.1202	Missing data	Secured for OBS deployment
2011:234:00:39:56.5705 - 2011:234:01:11:42.7085	Missing data	Secured for OBS deployment
2011:234:02:48:37.5037 - 2011:234:08:08:28.0792	Missing data	Secured for CTD cast
2011:234:09:07:17.9518 - 2011:234:09:21:16.0648	Missing data	Secured for OBS deployment
2011:234:10:41:36.1190 - 2011:234:10:48:47.7776	Missing data	Secured for OBS deployment
2011:234:12:08:59.9195 - 2011:234:12:21:05.7097	Missing data	Secured for OBS deployment
2011:234:13:37:23.3936 - 2011:234:13:49:00.7436	Missing data	Secured for OBS deployment
2011:234:15:06:18.1991 - 2011:234:15:16:10.5365	Missing data	Secured for OBS deployment
2011:234:16:36:36.3580 - 2011:234:16:47:57.2422	Missing data	Secured for OBS deployment

2011:238:20:01:49.9517 - 2011:238:21:30:31.0025	Missing data	Secured for OBS recovery
2011:239:00:21:56.4524 - 2011:239:02:27:20.9972	Missing data	Secured for OBS recovery
2011:239:02:46:59.6371 - 2011:239:04:18:50.8210	Missing data	Secured for OBS recovery
2011:239:04:40:04.5720 - 2011:239:06:12:35.5730	Missing data	Secured for OBS recovery
2011:239:07:19:44.8106 - 2011:239:08:46:23.9939	Missing data	Secured for OBS recovery
2011:239:09:25:53.7912 - 2011:239:12:29:41.8198	Missing data	Secured for CTD cast
2011:239:15:08:25.5950 - 2011:239:17:19:02.5433	Missing data	Secured for OBS recovery
2011:239:18:23:03.9281 - 2011:239:19:57:00.4344	Missing data	Secured for OBS recovery
2011:239:21:09:56.0052 - 2011:239:23:44:23.4122	Missing data	Secured for OBS recovery
2011:240:00:46:11.5053 - 2011:240:02:17:24.3177	Missing data	Secured for OBS recovery
2011:240:02:39:05.5647 - 2011:240:02:43:37.5596	Missing data	Secured for OBS recovery
2011:240:02:46:13.7483 - 2011:240:04:15:37.4605	Missing data	Secured for OBS recovery
2011:240:06:02:30.0548 - 2011:240:07:57:05.6046	Missing data	Secured for OBS recovery
2011:240:16:57:46.9975 - 2011:240:18:41:10.2250	Missing data	Secured for OBS recovery
2011:240:20:25:12.4300 - 2011:240:22:01:26.5582	Missing data	Secured for OBS recovery
2011:241:02:17:22.8883 - 2011:241:03:58:07.2820	Missing data	Secured for OBS recovery
2011:241:05:10:47.0050 - 2011:241:06:37:00.8005	Missing data	Secured for OBS recovery
2011:245:16:25:22.6503	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.

### 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
2011:219:15:13:22.8806	Start	Logging officially started
2011:245:16:54:12.3752	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
2011:219:00:00:00.0331	Start	Logging officially started

2011:245:16:54:15.3374	End	Logging officially ended
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**wx01 data format:**

wx01	2011:130:00:00:00.3553	19.0	18.6	19.3	22.5	328	328	2	16.6	17.1	3.7
	21.1 355 355	0	28.2	31.1	28.0	31.2	96	85	97	1006	
wx01	2011:130:00:00:01.2983	18.8	18.6	19.3	22.5	331	328	2	16.2	17.1	3.7
	21.1 355 355	0	28.2	31.1	28.0	31.2	96	85	97	1006	

**File id:** mwv01

**Logging interval:** 1 second

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

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

Log Date	Event	Comment
2011:219:00:00:00.0331	Start	Logging officially started
2011:245:16:54:06.3420	End	Logging officially ended

**mwv01 data sample:**

mwv01	2008:231:00:00:00.5173	6.1	6.6	6.6	8.8	354	321	5	0.0	0.0	0.0
	0.0 355 355	0	*****	*****	*****	*****	8	8	8	1009.7	
mwv01	2008:231:00:00:01.5172	5.9	6.6	6.6	8.8	353	321	5	0.0	0.0	0.0
	0.0 355 355	0	*****	*****	*****	*****	8	8	8	1009.6	
mwv01	2008:231:00:00:02.5190	6.3	6.6	6.6	8.8	354	321	5	0.0	0.0	0.0
	0.0 355 355	0	*****	*****	*****	*****	8	8	8	1009.8	

**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
2011:219:00:00:00.0371	Start	Logging officially started

2011:239:20:38:21.0155 - 2011:239:20:38:42.4975	Missing data	Reason not specified
2011:239:20:38:42.8485 - 2011:239:20:38:53.7870	Missing data	Reason not specified
2011:245:16:54:01.0058	End	Logging officially ended

cnav data format:

<pre>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</pre>
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## 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 attached as a separate file, in the same directory, called "checktimes\_cnav3050.txt". Most, if not all gaps are caused by the logging system trying to convert non-ASCII characters from the cnav3050all set to the cnav3050 set.*

cnav3050 data format:

<pre>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</pre>
---

## 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
2011:219:00:00:00.8961	Start	Logging officially started
2011:245:16:54:03.0919	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.

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
2011:219:00:00:00.1531	Start	Logging officially started
2011:245:16:54:07.5820	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 Integrated Nav

The Kongsberg Seapath is an integrated 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
2011:219:00:00:00.0451	Start	Logging officially started
2011:245:16:54:10.5311	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
2011:219:00:00:02.3130	Start	Logging officially started
2011:224:03:59:17.5963 - 2011:224:03:59:54.3909	Missing data	Reason not specified
2011:224:21:17:45.9759 - 2011:224:21:20:03.6066	Missing data	Restart equipment
2011:224:21:45:39.5537 - 2011:224:21:47:04.5594	Missing data	Restart equipment
2011:245:16:54:05.6388	End	Logging officially ended

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

Time	Event
2011:222:09:39:25.1573 - 2011:222:09:41:30.7886	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					

### Spectrum Instruments TDM-4 Event Logger (not in operation for this cruise)

The Event logger time stamps time-break triggers from DigiShot in all fire modes. This instrument was not used on this cruise, and instead recorded a different set of serially logged data.

**File id:** tagger01

**Logging interval:** 1 second

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

Log Date	Event	Comment
2011:219:00:00:00.0289	Start	Logging officially started
2011:245:16:54:13.0271	End	Logging officially ended

tagger1 data format:

tagger1	2008:231:00:00:00.0383	#51,08182008,000001
tagger1	2008:231:00:00:00.2027	#79,00000000
tagger1	2008:231:00:00:00.2948	#68,2
tagger1	2008:231:00:00:00.3689	#70,0
tagger1	2008:231:00:00:00.4010	#56,-00000
tagger1	2008:231:00:00:00.4210	#72,FF

### 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
2011:222:22:28:00.0000	Begin maggie deployment
2011:222:22:47:00.0000	Maggie powered on to test deck lead connection
2011:222:22:51:00.0000	Maggie powered on & in position
2011:224:17:59:00.0000	Secured for retrieval

2011:224:18:12:00.0000	Maggie on board
2011:224:22:02:00.0000	Preparing for deployment
2011:224:22:16:00.0000	Maggie powered on and logging
2011:227:03:55:00.0000	Maggie secured for retrieval
2011:227:04:04:00.0000	Maggie on deck
2011:227:06:47:00.0000	Begin deployment
2011:227:06:53:00.0000	Maggie powered on and logging
2011:228:15:43:00.0000	Maggie on board
2011:228:18:01:00.0000	Deploy maggie
2011:228:18:10:00.0000	Maggie powered on and logging
2011:229:11:00:00.0000	Recover maggie due to weather and source maintenance
2011:229:11:07:00.0000	Maggie on board
2011:229:17:55:00.0000	Deploy maggie
2011:229:18:02:00.0000	Maggie in position and logging
2011:233:03:17:00.0000	Maggie powered down
2011:233:03:22:00.0000	Maggie on board
2011:236:09:07:00.0000	Deploying maggie
2011:236:09:14:00.0000	Maggie powered on and logging
2011:238:15:00:00.0000	Maggie power secured
2011:238:15:03:00.0000	Begin maggie retrieval
2011:238:15:09:00.0000	Maggie on board
2011:241:09:04:00.0000	Deploy maggie for bias calibration test
2011:241:09:09:00.0000	Maggie deployed
2011:241:11:14:00.0000	Start retrieving maggie
2011:241:11:19:00.0000	Maggie on board and secured
2011:242:18:18:00.0000	Start maggie deployment
2011:242:18:22:00.0000	Maggie deployed
2011:242:22:56:00.0000	Maggie power secured
2011:242:23:01:00.0000	Maggie on board

**Logging interval:** 1 second

**File id:** mag01

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

<b>Log Date</b>	<b>Event</b>	<b>Comment</b>
2011:222:00:59:16.7630	Start	Logging officially started
2011:222:00:59:35.7599 - 2011:222:22:47:06.7246	Missing data	Testing new deck lead
2011:222:22:47:50.7195 - 2011:222:22:51:13.8372	Missing data	Secured for deployment
2011:224:17:59:40.4034 - 2011:224:22:16:46.0789	Missing data	Secured for retrieval
2011:227:03:54:40.9023 - 2011:227:06:53:15.5692	Missing data	Secured for source maintenance
2011:228:15:34:55.9914 - 2011:228:18:09:58.3295	Missing data	Secured for retrieval
2011:229:11:00:07.4492 - 2011:229:18:02:38.9182	Missing data	Secured for retrieval
2011:242:22:56:21.3945	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-45 Thermosalinograph**

The Seabird TSG output is logged by LDS to the “tsgraw” set. Note that the “tsconv” set is no longer supported with the SBE-45 instrument.

**File id:** tsgraw

**Logging interval:** 1 second

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

<b>Log Date</b>	<b>Event</b>	<b>Comment</b>
2011:221:19:15:27.6928	Start	Logging officially started
2011:241:15:02:31.0261 - 2011:241:16:10:11.0162	Missing data	Loose serial cable
2011:245:15:15:59.6909	End	Logging officially ended

tsgraw data sample:

tsgraw	2011:233:23:59:53.5781	11.4574,	3.75157,	33.0665
--------	------------------------	----------	----------	---------

### 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
2011:219:00:00:00.2331	Start	Logging officially started
2011:245:16:54:15.4104	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
2011:219:00:00:00.3541	Start	Logging officially started
2011:245:16:54:12.6273	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
2011:219:00:00:00.7831	Start	Logging officially started
2011:245:16:54:12.6082	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

### 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
2011:221:00:31:23.3867	Start	Logging officially started
2011:245:16:54:12.8662	End	Logging officially ended

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.*

<b>Log Date</b>	<b>Event</b>	<b>Comment</b>
2011:219:00:00:00.7230	Start	Logging officially started
2011:245:16:54:13.7272	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.*

<b>Log Date</b>	<b>Event</b>	<b>Comment</b>
2011:219:00:00:00.4221	Start	Logging officially started
2011:245:16:54:14.0363	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. The system started logging correctly on Julian day 223.

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
2011:221:02:11:55.8597	Start	Logging officially started
2011:223:08:31:58.4066 - 2011:223:16:16:15.1511	Missing data	Restart as program is not running properly
2011:223:16:16:36.1890 - 2011:223:17:16:15.0548	Missing data	Reason not specified
2011:223:17:31:35.1583 - 2011:223:18:53:41.9476	Missing data	Reason not specified
2011:223:19:07:56.9764 - 2011:223:20:52:27.6004	Missing data	Reason not specified
2011:223:21:16:23.2412 - 2011:223:21:26:52.6813	Missing data	Reason not specified
2011:245:15:15:26.5504	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
Equil					0
pco2	2011:130:00:30:00.5374	2011130.02198	2370.02	37.53	1007.14
	404.42	28.46	386.8	5000.00	19
Equil					0

## Mk21 XBT System

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

One hundred and twenty XBT drops (105x T-5 and 15x T-7) were made during this cruise. In addition, eight XCTD drops (7x XCTD-1 and 1x XCTD-2) were made. The data set are saved to the raw/XBT directory in the cruise archive. Refer to the MGL1111\_Expendable\_Drops.xls spreadsheet in the docs/operations directory of the cruise archive for more information.

## Seabird SBE19 CTD System

**Files: \*.bl, \*.hdr, \*.hex, \*.mrk, \*.nav, \*.txt**

Four CTD casts using a winch were made during this cruise. The data set are saved to the raw/ctd directory in the cruise archive. The XML configuration file is included with the data files, called mgl11-11.xmlcon, located in the same directory.

## Seabird SBE 911 plus CTD System

**Files: \*.hex, \*.txt**

Twenty CTD casts by hand were made during this cruise. The data set are saved to the raw/ctd directory in the cruise archive. The XML configuration file is included with the data files, called SBE19\_2221.xmlcon, located in the same directory.

## IV. Seismic Summary

### A. Acquisition Parameter Table

<b>Acquisition Parameter Table</b>	
AcquisitionParameterID	MGL1111_ACQ01
FieldActivityID	MGL1111
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	223.10 m
Source_to_Near_Channel	162.00 m
Number_of_channels_recorded	636
Number_of_cables	1
Number_of_channels_each_cable	636
Channel_length	12.5 m
Cable_length	8.0 km
Cable_spacing	N/A
Near_Channel_Number	N/A
Cable_depth	9.0 m
Number_sources	1
Sub-arrays_per_source	4
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	8.0 m
Source_volume	6600 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_number	36 + 4 spare
Source_depth	9.0 m
Shot_control	Distance
Shot_Interval	50 m
Sample_interval	2ms
Record_length	16s
Compass_birds	30 Digicourse 5011
Recording_delay	N/A

<b>Acquisition Parameter Table</b>	
AcquisitionParameterID	MGL1111_ACQ02
FieldActivityID	MGL1111
ReceiverType	Ocean-Bottom Seismometer

<b>SourceType</b>	Airgun
<b>Acquisition System Name</b>	WHOI OBS
<b>Acquisition System Type</b>	OBS
<b>Seismic_Nav_System</b>	C-Nav 3050 primary
<b>Survey_datum</b>	WGS84
<b>Navigation Reference Point</b>	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
<b>NRP to source</b>	223.10 m
<b>Source_to_Near_Channel</b>	N/A
<b>Number_of_channels_recorded</b>	N/A
<b>Number_of_cables</b>	N/A
<b>Number_of_channels_each_cable</b>	N/A
<b>Channel_length</b>	N/A
<b>Cable_length</b>	N/A
<b>Cable_spacing</b>	N/A
<b>Near_Channel_Number</b>	N/A
<b>Cable_depth</b>	N/A
<b>Number_sources</b>	1
<b>Sub-arrays_per_source</b>	4
<b>Alternate_Shooting</b>	No
<b>Source_separation</b>	N/A
<b>Sub-array_separation</b>	8.0 m
<b>Source_volume</b>	6600 cu in
<b>Source_pressure</b>	2000 psi nominal
<b>Source_make,model</b>	Bolt 1500LL & 1900LL
<b>Source_number</b>	36 + 4 spare
<b>Source_depth</b>	9.0 m
<b>Shot_control</b>	Distance
<b>Shot_Interval</b>	150 m
<b>Sample_interval</b>	N/A
<b>Record_length</b>	N/A
<b>Compass_birds</b>	N/A
<b>Recording_delay</b>	N/A

## **B. Seismic Overview**

The primary objectives of the cruise were 14 multi-channel 2D seismic lines acquired using an 8 kilometer towed streamer, 3 OBS lines, both using one source with four sub-array set up deployed by Lamont-Doherty Earth Observatory.

## **Physical Configuration**

The towing configuration for the air guns and streamers is detailed in the document titled *MGL1111\_Offsets.xls*.

## **Offsets**

All antenna and in-water offset drawings are in the file *MGL1111\_Offsets.xls*

## **Spectra**

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 point located at the pier in Dutch Harbor.

Date / Time	Ship Location	Reference Location	Mistie
2011-08-07T21:52	Dutch Harbor, AK, Pierside 53 54.1764 N 166 31.6533 W	Alongside Dutch Harbor airport; next to WWII National Historic Area Visitor Center	Dutch Harbor, AK, Pierside 53 54.185 N 166 31.660 W

Please refer to the documents located under [MGL1111/docs/gravity\\_tie](https://www.mgl1111.gov/docs/gravity_tie) for detailed records.

## VI. Archive Contents

Key files are bolded.

MGL1111/docs	Cruise documents and logs
MGL1111/docs/config	Configuration archive
MGL1111/docs/elog	Cruise elog
MGL1111/docs/gravity_tie	Gravity Tie information
MGL1111/docs/map	Cruise maps, track map
MGL1111/docs/offsets	Vessel/sensor offsets
MGL1111/docs/operations/	Operations documents
MGL1111/docs/operations/Daily_Reports	Cruise Daily Reports from Chief Science Officer
MGL1111/docs/operations/NavLogs	Seismic navigation logs (spectra)
MGL1111/docs/operations/ObsLogs	Seismic acquisition logs (gun controller)
<b>MGL1111/docs/operations/MGL1111_B15_line_log_multi_channel_seismics.xls</b>	<b>Master line log table</b>
MGL1111/docs/permits	Clearance Documents
MGL1111/docs/waypoints	Waypoint files
MGL1111/docs/personnel	Personnel rosters, org chart, bunk and phone lists
MGL1111/docs/reports	Cruise Report and supplemental docs
<b>MGL1111/docs/reports/MGL1111_DataReport_v1.1.doc</b>	<b>This file</b>
<b>MGL1111/docs/offsets/MGL1111_Offsets.xls</b>	<b>Vessel/sensor offsets</b>
MGL1111/docs/screenshots	Screen captures
MGL1111/processed	Processed data
MGL1111/processed/reflex (3D data-sets only, not applicable to OBS and 2D)	Spectra reflex files
MGL1111/processed/shotlogs	Spectra shot log files
MGL1111/processed/sprint	Spectra spring files
MGL1111/processed/svp	Sound velocity profiles
MGL1111/raw	Raw data
MGL1111/raw/adcp	Raw ADCP data
MGL1111/raw/ctd	Raw CTD data
MGL1111/raw/knudsen	Raw Knudsen sub-bottom profiler data
MGL1111/raw/multibeam	Raw EM122 data
MGL1111/raw/serial	Underway serial data: gps, tsg, weather, etc.
MGL1111/raw/spectra/P1	Spectra underway p190
MGL1111/raw/spectra/P2	Raw seismic navigation, p294
MGL1111/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

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

### **CNAV GPS receiver data**

CNAV outputs data in NMEA 0183 compatible format. Currently\* the following sentence types are enabled:  
 \$GPVTG-GPS Velocity, Track made good and Ground speed data (computed by the CNAV GPS receiver).  
 \$GPGGA-Global Positioning System Fix data (computed by the CNAV GPS receiver).

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

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

##### \$GPVTG Sentence Fields

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

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

##### \$GPGGA Sentence Fields

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

		communication beam in use yy is the GPS correction signal mode/type being used
*hh	Checksum (hexadecimal representation) followed by CRLF terminator pair	n/a

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

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

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

\$GPGGA-Global Positioning System Fix data (computed by the CNAV GPS receiver).

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

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

\$GPVTG Sentence Fields

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, dddm.mmmmm, a, dddm.mmmmm, a, x, xx, x.x, xx.xx, M, xx.xx, M, x.x, xyy\*hh**

\$GPGGA Sentence Fields

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

xyy	C-NAV GPS receiver reference identification	x is downlink satellite communication beam in use yy is the GPS correction signal mode/type being used
*hh	Checksum (hexadecimal representation) followed by CRLF terminator pair	n/a

### **EM122 Center Beam Depth**

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

The EM122 outputs serial data in the following formats:

KGDPT - Depth below transducer

**SDBT,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

**\$SDBT,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

**\$SDBS,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

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

HDT sentence format

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

**\$SHEROT,-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 yy.yyyyyy vv.vvvvvv www.wwwwww dddd.d
llllllllllllllll
```

OBSIP record format

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

## LDEO PCO2 System

PCO2 outputs data in the following sentence format:

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

### PCO2 Data

Item	Definition	Value	Units
yyyyyjjj.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, pp.pppp,  
 q.qqqqq, rr.rrrr, ss.s, ttt, uu.u, vvvv, w.ww, xxx.x, yy.yyyy

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
pp.pppp	TSG Internal Temperature	n/a	Celcius
q.qqqqq	TSG Conductivity	n/a	S/m
rr.rrrr	TSG Salinity	25 to 40	ppm
ss.s	WX01 Bird 1 Wind Speed 60 sec avg	n/a	knots
ttt	WX01 Bird 1 Wind Direction 60 sec avg	0 to 360	degrees
uu.u	WX01 Temperature Instantaneous	n/a	Celcius
vvvv	WX01 Ship Barometer Instantaneous	n/a	mbar
w.ww	CNav Speed Over Ground / Speed Made Good	0 to 15	knots
xxx.x	CNav Course Made Good	0 to 360	degrees
yy.yyyy	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, hhhmss.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	
hhmss.sss	UTC time of position	n/a	Hours/Minutes/Seconds.decimal. Two fixed digits of hours. Two fixed digits of minutes. Two fixed digits of seconds. Three digits for decimal fractions of a second.
llll.llll	Latitude	-90 to +90	Degrees Minutes.decimal. Two fixed digits of degrees Two fixed digits of minutes Five digits for decimal minutes.
a	N (north) or S (south)	N or S	
yyyyy.yyyyy	Longitude	-180 to +180	Degrees/Minutes.decimal. Three fixed digits of degrees. Two fixed digits of minutes. Five digits for decimal minutes.
b	E (east) or W (west)	E or W	
t	GPS Quality Indicator	0 = Fix not available or invalid 1 = CIA standard GPS; fix valid. 2 = DGS mode; fix valid. 3 = PPP mode; fix valid. 4 = RTK fixed 5 = RTK float 6 = free inertial	
nn	Number of satellites used in fix	0 to 32	
v.v	Horizontal dilution of precision		
x.x	Altitude of the IMU above or below the mean sea level. A negative value indicates below sea level.	n/a	Metres
M	Units of measure = metres	M	

Null	Null		
Null	Null		
c.c	Age of differential corrections in records since last RTCM-104 message.	0 to 99.9	Seconds
rrr	DGPS reference station identity	0000 to 1023	
*hh	Checksum	00 - FF	
/CR/LF	Carriage return and line feed	/CR/LF	

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

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

\$INHDT-Heading - True data

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

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

\$INVTG-Course over ground and Ground speed data

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

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

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

\$INGST-GPS pseudorange noise statistics

Item	Definition	Value	Units
\$INGST	Header	\$INGST	
hhmmss.sss	UTC time of position	n/a	Hours/Minutes/Seconds.decimal. 2 fixed digits of hours. 2 fixed digits of minutes. 2 fixed digits of seconds. Three digits for decimal fractions of a second.
null	Not supported	null	
smjr.smjr	Standard Deviation of semi-major axis of	n/a	Metres

	error ellipse		
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:

**tsgraw 2011:233:23:59:53.5781 11.4574, 3.75157, 33.0665**

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

<b>Item</b>	<b>Definition</b>	<b>Units</b>
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
xxxxxx	Raw salinity sensor data	n/a

## 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, hhmss.sss, lll.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	
hhmss.sss	UTC time of position	n/a	Hours/Minutes/Seconds.decimal. Two fixed digits of hours. Two fixed digits of minutes. Two fixed digits of seconds. Three digits for decimal fractions of a second.
lll.llll	Latitude	-90 to +90	Degrees Minutes.decimal. Two fixed digits of degrees Two fixed digits of minutes Five digits for decimal minutes.
a	N (north) or S (south)	N or S	
yyyyy.yyyyy	Longitude	-180 to +180	Degrees/Minutes.decimal. Three fixed digits of degrees. Two fixed digits of minutes. Five digits for decimal minutes.
b	E (east) or W (west)	E or W	
t	GPS Quality Indicator	0 = Fix not available or invalid 1 = CIA standard GPS; fix valid. 2 = DGS mode; fix valid. 3 = PPP mode; fix valid. 4 = RTK fixed 5 = RTK float 6 = free inertial	
nn	Number of satellites used in fix	0 to 32	
v.v	Horizontal dilution of precision		
x.x	Altitude of the IMU above or below the mean sea level. A negative value indicates below sea level.	n/a	Metres
M	Units of measure = metres	M	
Null	Null		
Null	Null		
c.c	Age of differential corrections in records since last RTCM-104 message.	0 to 99.9	Seconds
rrr	DGPS reference station identity	0000 to 1023	

*hh	Checksum		
/CR/LF	Carriage return and line feed	/CR/LF	

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

\$INHDT-Heading - True data

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

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

\$INVTG-Course over ground and Ground speed data

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

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

\$INZDA-Time and date

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

**Langseth Shotlog Format**

Each Langseth shotlog contains shot records in the following format:

MGL1111MCS01 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
llllllllllll	linename	n/a
sssssss	shot number	n/a
yyyy:mm:dd:hh:mm:ss.ssss	date/time	ISO8601 format
hhmmss.ssssss	time	hh = hour mm = minutes ss = seconds .sssss = decimal seconds
ddd.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

**SVHW,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

**SVBW,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 iiiii 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

### Spectrum TM-4 time and frequency system data

The TM-4 is used as an event logger to log shot times from digishot. The 'tagger' data set includes all output from the TM-4. The 'shot' data set includes only the event messages (message #62)

Spectra provides primary shot timing aboard Langseth. The TM-4 is used for qc and backup purposes.

#### Message descriptions

Message #	Type	Form	Explanation
50	ACKNOWLEDGE	CRLF	
51	DATE AND TIME	MMDDYYYY,HHMMSSCRLF	MMDDYYYY is UTC month, day, and year HHMMSS is UTC hours, minutes and seconds
52	POSITION	WWW.WW,X,YYYY.YY,Z,A,NCRLF	W = latitude in DDMM.MM X = hemisphere N or S Y = longitude in DDDMM.MM Z = hemisphere E or W A = GPS availability (0 = not available, 1 = available) N = number of satellites used (0-9, A[10], B[11], C[12])
53	ALTITUDE	SXXXXX,MCRLF	S = sign (+ or -) X = altitude (5 digits) M = altitude units (meters)
55	MASK ANGLE AND MAP DATUM SETTING	X,47CRLF	X = 0 for 5 degrees X = 1 for 15 degrees X = 2 for 20 degrees 47 = two digit map datum code (fixed at WGS84)
56	USER TIME BIAS	SXXXXXCRLF	S = sign (+ or -) X = bias value (5 digits)
57	TIMING MODE	XCRLF	X = 0 for Dynamic Timing Mode X = 1 for Static Timing Mode X = 3 for Auto Survey Mode
59	GEOMETRIC QUALITY AND ALMANAC STATUS	X,YCRLF	X = GQ (0-9) Y = 0 (Almanac OK) Y = 1 (no Almanac) Y = 2 (Almanac is old)
60	TIME PORT DATA RATE AND MULTIPLEXER #1 STATUS	X,YCRLF	X = 0 (1200 baud) Y = 0 for 10 MHz output X = 1 (2400 baud) Y = 1 for 5 MHz output X = 2 (4800 baud) Y = 2 for 1 MHz output X = 3 (9600 baud) Y = 3 for 100 kHz output X = 4 (19200 baud) Y = 4 for 10 kHz output X = 5 (38400 baud) Y = 5 for 1 kHz output X = 6 (57600 baud) Y = 6 for IRIG output (if installed) X = 7 (115200 baud) Y = 7 for PPS output

			Y = 8 for OFF (newer TM-4's only)
61	TIMING STATUS	W,CRLF	W = 0 (time not valid) W = 1 (Time Valid)
62	EVENT TIME-TAG	MMDDYYYY,HHMMSS.SS SSSSSCRLF	MMDDYYYY = UTC date of event HHMMSS.SSSSSS = UTC time of event
63	POP/ETT STATUS	X,P,MMDDYYYY,HHMMSS .SSSSSS,RRRRRRRRCRLF	X = 0 for ETT/POP OFF X = 1 for POP One-Shot X = 2 for POP Repeat X = 3 for ETT P = + for positive polarity P = - for negative polarity P = 0 when POP/ETT Mode is OFF MMDDYYYY is the POP date (UTC) HHMMSS.SSSSSS is the POP time (UTC) RRRRRRRR is the POP repeat interval
64	OSCILLATOR TUNING MODE	XCRLF	X = 1 for Mode 1 (oscillator warm-up) X = 2 for Mode 2 (course adjust) X = 3 for Mode 3 (course adjust standby) X = 4 for Mode 4 (fine adjust) X = 5 for Mode 5 (fine adjust hold) Note: See OSCILLATOR MODES on page 11 of the Spectrum manual for an explanation of these Oscillator Tuning Modes.
65	ALARM STATUS	X,Y,ZCRLF	X = 0 for No Coast condition X = 1 for Coast Alarm condition See Message #79 for Coast Timer. Y = 0 for Antenna Good Y = 1 for Antenna Current Sense Fault condition Z = 0 for 10 MHz Frequency Output Good Z = 1 for 10 MHz Frequency Output Fault condition See HARDWARE FAULT MONITORING on page 14 of Spectrum manual for an explanation of Antenna Alarm.
68	MULTIPLEXER #2 STATUS	XCRLF	X = 0 for 10 MHz output X = 1 for Mux1 mirror X = 2 for PPS X = 3 for output option 1 X = 4 for output option 2 X = 5 for output option 3 X = 6 for baseband IRIG (if installed) X = 7 for baseband NASA-36 (if installed) X = 8 for OFF (newer TM-4's only)
69	TRACKING	VV,W,X,Y,....VV,W,X,Y,ZC	VV = PRN of satellite being tracked

	CHANNEL STATUS	RLF	<p>W = constellation status:  0 = not included in current constellation  1 = included in current constellation  X = tracking status:  A = acquisition/reacquisition  S = searching  0-9 = SQ  Y = Ephemeris status:  0 = not collected  1 = collected  Z = receiver status:  2 = search the sky  3 = Almanac collect  4 = Ephemeris collect  5 = acquisition  6 = position  NOTE: VV,W,X,Y repeats twelve times,  corresponding to each of the twelve  channels.</p>
70	SERIAL TIME MESSAGE FORMAT	XCRLF	<p>X = 0 for standard output  X = 1 for NTP output (optional)  X = 2 for NMEA output</p>
71	SERIAL TIME CODE FORMAT	XCRLF	<p>X = 0 for IRIG B output  X = 1 for NASA-36 output</p>
72	ETT PARAMETERS	X,PCRLF	<p>X = 0 (ETT off)  X = 1 (ETT on)</p>
74	POP PARAMETERS (Simultaneous ETT/POP units)	X,P,MMDDYYYY,HHMMSS .SSSSSS,RRRRRRR,WCR LF	<p>X = 0 for POP Off  X = 1 for POP One-Shot  X = 2 for POP Repeat  P = + for positive polarity  P = - for negative polarity  MMDDYYYY is the POP date (UTC)  HHMMSS.SSSSSS is the POP time  (UTC)  RRRRRRR is the POP repeat interval in  milliseconds  W = 0 for 1 <math>\mu</math>s pulse width  W = 1 for 10 <math>\mu</math>s pulse width  W = 2 for 100 <math>\mu</math>s pulse width  W = 3 for 1 ms pulse width  W = 4 for 10 ms pulse width  W = 5 for 50 ms pulse width  W = 6 for 100 ms pulse width  W = 7 for 250 ms pulse width  W = 8 for Level Hold</p>
75	SPEED OVER LAND and HEADING	SSS.SS,HHH.HCRLF	<p>SSS.SS indicates speed over land in  meters/sec  HHH.H indicates course in degrees decimal</p>

76	ADDITIONAL NMEA INFORMATION	DDMM.MMMM,N,DDMM.MMMM,W,SAAAA.A,M,G,UU,PP.P,ZZZ.ZZ,YYY.YCRLF	DDMM.MMMM is latitude in degrees and decimal minutes N is north or south (N, S) DDMM.MMMM is longitude in degrees and decimal minutes W is west or east (W, E) S is sign of altitude above or below sea level (+,-) AAAA.A is altitude (in meters) (0-18000) M is altitude units (meters) G is GPS status (0= fix not valid, 1= fix valid) UU is number of satellites used in navigation solution (0-12) PP.P is estimated horizontal dilution of precision (0-99.9) ZZZ.ZZ is speed over ground in knots YYY.Y is course over ground in degrees
77	PHASE LOCK STATUS	X,CRLF	.
78	ADDITIONAL USER OPTION SETTINGS	A,B,C,D,E,FCRLF	A = 0 for Antenna Alarm Disabled A = 1 for Antenna Alarm Enabled (default) B = 0 for PPS Source 0 (See Message #24 for definitions) B = 1 for PPS Source 1 B = 2 for PPS Source 2 B = 3 for PPS Source 3 Fields C-F are reserved.
79	COAT TIMER	HHHHMMSSCRLF	HHHHMMSS = Amount of time (Hours, Minutes, Seconds) that the unit has been in Coast (Mode 3 or Mode 5)
80	PHASE LOCK STATUS	X, CRLF	.
81	LEAP SECONDS?GPS TIME	X,Y,Â±ZZCRLF	X = 0 for TM-4 operation in GPS Time (reserved for future feature, currently disabled) X = 1 for TM-4 operation in UTC Time (default) Y = 0 for Leap Second data not valid Y = 1 for Leap Second data valid Â±ZZ = UTC/GPS Time Offset, in whole seconds The difference between UTC Time and GPS Time is the number of Leap Seconds that have been introduced to UTC Time since the beginning of GPS Time. (GPS Time is never adjusted for Leap Seconds.) The Â±ZZ-UTC OffsetÂ±ZZ from GPS

		<p>Time is in the information data stream broadcast by the GPS satellites. The TM-4 stores the previously known value, but until the TM-4 makes contact with satellites and downloads the current "UTC Offset", the data cannot be considered to be valid.</p>
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### **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