

RV Langseth Data Reduction Summary

MGL1202

Honolulu, Hawaii – Apra Harbor, Guam

FINAL

V1.0, 2012-01-28

Lamont-Doherty Earth Observatory, Columbia University

Monday Jan 23 2012 08:00:00L

Date	Julian Date	Time	Port
2012-01-09	2012-009	1930 UTC, 0930L	Honolulu, Hawaii
2012-01-23	2012-023	0109 UTC, 1609L	Apra Harbor, Guam

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Table of Contents

Table of Contents	4
I. Background and Scientific Objectives.....	6
II. Personnel	7
III. Instrumentation Summary.....	8
IV. RV Langseth Gravity Tie Information.....	19
V. Archive Contents.....	19
VI. Data Formats.....	20

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

I. Background and Scientific Objectives

Transit from Honolulu, Hawaii to Apra Harbor, Guam.

Six ARGO floats were deployed throughout the transit. In addition, a HARP mooring recovery was made on 2012-01-17. More information for both can be found in the \docs\operations folder.

II. Personnel

Shipboard Technical Staff

1	Megan Meyer	Science Tech
2	Bern McKiernan	Science Tech

Ship's Crew

1	Mark Landow	Captain
2	Stanley Zeigler	Chief Mate
3	David Wolford	2 nd Mate
4	Sea Chan	3 rd Mate
5	Ricardo Redito	Bosun
6	Peter Piscitello	AB
7	George Cereno	AB
8	Petronio Paragas	AB
9	Jeromiel Webster	OS
10	Martin Anthony	OS
11	Stephen Pica	Chief Engineer
12	Ryan Vetting	1 st Asst. Engineer
13	Peter Moser	2 nd Asst. Engineer
14	Amanda Sedano	3 rd Asst. Engineer
15	Philip Neis	Electrician
16	Gregory Marshal	Oiler
17	Jerald Chase	Oiler
18	Pamfilo Igama	Oiler
19	Stephen Sniezak	Steward
20	Leoncio Martires	Cook

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.*	1 s
EM122	Kongsberg EM122 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.*	1 s
XBT/XCT	Sippican MK21 XBT/XCTD Launcher	6 drops	raw output to file	See below	n/a
			converted output to file	See below	n/a
WX1	RM Young 5103 Weather Bird and	Full	serial logs	MGL-wx01.*	1 s
			mwv conversion	MGL-mwv01.*	1 s
TSG	SeaBird SBE45 Thermosalinograph	Full	raw serial logs	MGL-tsgraw.*	1 s
CNAV	C&C Tech. CNAV 2000 DGPS Receiver	Full	serial logs	MGL-cnav.*	1 s
CNAV3050	C&C Tech. CNAV 3050 DGPS Receiver	Full	raw serial logs	MGL-cnav3050all.*	1 s
			converted data	MGL-cnav3050.*	1 s
BGM	Bell Aerospace BGM-3 Gravimeter	Full	serial logs	MGL-vc01.*	1 s
GYRO	Simrad GC80 Gyrocompass/AD100	Full	serial logs	MGL-gy01.*	1 s
POSMV	Applanix POSMV Integrated Nav System	Full	serial logs	MGL-posmv.*	1 s
SEAPATH	Kongsberg SeaPath Integrated Nav System	Full	serial logs	MGL-seapath.*	1 s
MICROSV	Applied Microsystems Sound Velocity Pod Unit #1	Full	serial logs	MGL-svpod01.*	1 s
MICROSV	Applied Microsystems Sound Velocity Pod Unit #2	Full	serial logs	MGL-svpod02.*	1 s
MICROSV	Applied Microsystems Sound Velocity USS Unit	Full	serial logs	MGL-svuss01.*	1 s
SBE38	SeaBird SBE38 Pod Thermometer Pod Unit #1	Full	serial logs	MGL-temppod01.*	1 s
SBE38	SeaBird SBE38 Pod Thermometer Pod Unit #2	Full	serial logs	MGL-temppod02.*	1 s
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
2012:009:01:20:48.4371	Start	Logging officially started
2012:023:01:30:34.7273	End	Logging officially ended

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 MGL1202/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.

Log Date	Event	Comment
2012:009:19:36:50.5190	Start	Logging officially started
2012:010:20:46:49.8561 - 2012:010:20:54:41.3332	Missing data	BIST Test
2012:012:22:40:57.9854 - 2012:012:22:50:42.8004	Missing data	BIST Test

2012:014:01:11:05.7991 - 2012:014:01:19:11.4860	Missing data	BIST Test
2012:015:20:32:10.8335 - 2012:015:20:42:19.9597	Missing data	BIST Test
2012:017:19:08:50.5528 - 2012:017:21:05:01.7977	Missing data	Secured for HARP Recovery
2012:020:23:12:21.6428 - 2012:020:23:23:18.9684	Missing data	BIST Test
2012:023:00:39:37.9373	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
2012:009:00:00:00.0206	Start	Logging officially started
2012:024:23:59:58.7625	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
2012:009:00:00:00.1096	Start	Logging officially started
2012:024:23:59:59.4436	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		

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
2012:009:00:00:00.1096	Start	Logging officially started
2012:024:23:59:59.4436	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
2012:009:00:00:00.0306	Start	Logging officially started
2012:024:23:59:59.9556	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
2012:009:00:00:00.0306	Start	Logging officially started
2012:024:23:59:59.9556	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
2012:009:00:00:00.6666	Start	Logging officially started
2012:024:23:59:59.9096	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
2012:009:00:00:00.0136	Start	Logging officially started
2012:010:19:10:32.3700 - 2012:010:19:13:32.5288	Missing data	Restarted due to position degradation
2012:024:23:59:59.9706	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
2012:009:00:00:00.1116	Start	Logging officially started
2012:024:23:59:59.9925	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

SBE-45 Thermosalinograph

The Seabird TSG output is logged by LDS to the “tsgraw” set. The “tsgconv” set is no longer used and supported.

File id: tsgraw

Logging interval: 1 second

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

Log Date	Event	Comment
2012:009:20:09:39.3795	Start	Logging officially started
2012:019:18:57:13.1266 - 2012:019:18:58:05.3549	Missing data	Reason not specified
2012:019:19:42:19.1141 - 2012:019:19:42:56.4817	Missing data	Reason not specified
2012:019:19:45:19.4410 - 2012:019:19:46:33.7941	Missing data	Reason not specified
2012:022:23:27:43.7268	End	Logging officially ended

tsgraw data sample:

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

BGM-3 Gravimeter

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

File id: vc01

Logging interval: 1 second

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

Log Date	Event	Comment
2012:009:00:00:00.9536	Start	Logging officially started
2012:024:23:59:59.7816	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
2012:009:00:00:00.8667	Start	Logging officially started
2012:024:23:59:59.4166	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
2012:009:00:00:00.2516	Start	Logging officially started
2012:024:23:59:59.6006	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. Note that the instrument started failing on Jan 16th (julian day 016) with the first signs of failure around 00:51:17 UTC.

File id: svuss01

Logging interval: 1 second

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

Log Date	Event	Comment
2012:011:20:17:42.5238	Start	Logging officially started
2012:018:21:38:49.8236 – 2012:018:21:39:01.2581	Missing data	Reason not specified
2012:024:23:59:59.5386	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.

Log Date	Event	Comment
2012:009:00:00:00.5716	Start	Logging officially started
2012:024:23:59:59.6136	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
2012:009:00:00:00.5316	Start	Logging officially started
2012:024:23:59:59.9336	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
----------	-------	---------

2012:009:20:14:58.7152	Start	Logging officially started
2012:022:23:26:22.6453	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

Six XBT drops (1x T-5/20 & 5x T-7) were made during this cruise. The data set are saved to the raw/XBT directory in the cruise archive. Refer to the MGL1202_Expendable_Drops.xls spreadsheet in the docs/operations directory of the cruise archive for more information.

IV. RV Langseth Gravity Tie Information

The Gravimeter was tied before and after the cruise at the tie point located at the pier in Kodiak.

Date / Time	Ship Location	Reference Location	Mistie
2011-12-31T19:31:00	Honolulu, HI, Pierside 21 18.977 N 157 53.183 W	US Army Museum 21 16.758 N 157 50.056 W	Honolulu, HI, Pierside 20:47 UTC 21 18.950 N 157 53.166 W
2012-01-24T00:39:09	Apra Harbor, Guam, Sierra Pier Guam Naval Base 13 25.9651 N 144 39.6789 W □	Northern end of Sierra Pier by 500 marker 13 26.071 N 144 39.738 W □	Apra Harbor, Guam, Sierra Pier Guam Naval Base 03:32 UTC 13 25.973 N 144 39.671 W □

Please refer to the documents located under MGL1202/docs/gravity_tie for detailed records.

V. Archive Contents

Key files are bolded.

MGL1202/docs	Cruise documents and logs
MGL1202/docs/elog	Cruise elog
MGL1202/docs/gravity_tie	Gravity Tie information
MGL1202/docs/map	Cruise maps, track map
MGL1202/docs/operations/	Operations documents
MGL1202/docs/operations/Daily_Reports	Cruise Daily Reports from Chief Science Officer
MGL1202/docs/waypoints	Waypoint files
MGL1202/docs/personnel	Personnel rosters, org chart, bunk and phone lists
MGL1202/docs/reports	Cruise Report and supplemental docs
MGL1202/docs/reports/MGL1202_DataReport_v1.0.doc	This file
MGL1202/raw	Raw data
MGL1202/raw/adcp	Raw ADCP data
MGL1202/raw/knudsen	Raw Knudsen sub-bottom profiler data
MGL1202/raw/multibeam	Raw EM122 data
MGL1202/raw/serial	Underway serial data: gps, tsg, weather, etc.
MGL1202/raw/XBT	Raw XBT data

VI. 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-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
*hh	Checksum (hexadecimal representation)	n/a

\$GPGGA,hhmmss.ss, ddm m.mmmmm, a, ddm m.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
ddmm.mmmmm	Latitude	Degrees/Minutes/Seconds
a	Direction of Latitude N = North S = South	n/a
ddmm.mmmmm	Longitude	Degrees/Minutes/Seconds
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 beam in use yy is the GPS correction 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
*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
hhmmss.ss	UTC time of position	Hours/Minutes/Seconds
ddmm.mmmmm	Latitude	Degrees/Minutes/Seconds
a	Direction of Latitude N = North S = South	n/a
ddmm.mmmmm	Longitude	Degrees/Minutes/Seconds
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	Meters

	EGM96 15-minute (Earth Gravity Model)	
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 beam in use yy is the GPS correction 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

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

SDDBT sentence format

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

FE700 Navigational Echosounder data

The FE700 Navigational Echosounder outputs data in the following formats

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

\$PFEC ,aaaa,x,x*hF

PFEC sentence format

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

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

SDDBT sentence format

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

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

SDDBS sentence format

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

Gyroscope data

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

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

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

ALM sentence format

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

\$HEHDT,xxx.x,T*hh

HDT sentence format

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

\$HEROT,-xxx.x,A*hh

HEROT sentence format

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

Geometrics 882 Magnetometer Data

The magnetometer serial data is output in the following format:

\$ 53863.927,0652

\$ xxxxx.xxx,vvvv

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

RM Young Meteorological Station Data

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

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

Langseth WX station sentence format

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

OBSIP Shotlog Format

Each OBSIP shotlog contains a header followed by shot records:

```
#obsipshotfile v1.0
#shotnumber date time sourceLat sourceLon shipLat shipLon waterDepth sciTag
0001280 2009-08-27 05:08:49.807873 48.495334 -129.201444 48.494097 -129.203017 2530.6
MGL0910_05
0001279 2009-08-27 05:12:33.961869 48.491860 -129.204474 48.490060 -129.205425 2526.4
MGL0910_05
0001278 2009-08-27 05:16:36.302883 48.488608 -129.206115 48.486807 -129.206944 2530.3
MGL0910_05
0001277 2009-08-27 05:19:51.053880 48.485157 -129.209212 48.483406 -129.209755 2526.1
MGL0910_05
0001276 2009-08-27 05:24:01.863875 48.480813 -129.212088 48.479293 -129.213152 2516.1
MGL0910_05
```

Shot records are in the following format:

```
0001276 2009-08-27 05:24:01.863875 48.480813 -129.212088 48.479293 -129.213152 2516.1
MGL0910_05
sssssss yyyy-mm-dd hh:mm:ss.ssssss xx.xxxxxx yy.yyyyyy vv.vvvvvv www.wwwwww dddd.d
1111111111111111
```

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
1111111111111111	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.dec Four fixed digits of year Three fixed digits of julian day. Five fixed digits for decimal part of 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, lll.lllllm, 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	
yyyyjjj.jjj	pco2 Computer Date/Time	n/a	Year/Julian Day. Four fixed digits Three fixed digits Five fixed digits 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
lll.lllllm	CNav Latitude	0 to 90, N/S	degrees/minutes
nnnnn.nnnnnno	CNav Longitude	0 to 180, E/W	degrees/minutes
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	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	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	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 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 Thermosalinograph, Converted

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

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

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

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

Seabird SBE-21 Thermosalinograph Data

Data from the SBE-21 TSG is output in the following format:

2008:199:02:23:43.0914 AE9FC8F927F34AA7DAC1

yyyy:ddd:hh:mm:ss.ssss ttttccccxxxxxvvvvvv

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
xxxxxx	Raw external temperature sensor data	n/a
vvvvvv	Auxilliary voltage	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, 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	
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	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:

```
MGL1202MCS01    00924    2011:159:15:28:10.8208  152810.8208670  4059.5  565908.12N
1464326.41N      565906.79N      1464338.85N
1111111111111  sssss  yyyy:mm:dd:hh:mm:ss.ssss hhmmss.ssssss  dddd.d  vv.vvvvvv  www.wwwwww
xx.xxxxxx  yy.yyyyyy
```

Langseth shotlog format

Item	Definition	Units
	linename	n/a
ssssss	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
dddd.d	depth	meters
vv.vvvvvv	vessel lat	degrees, WGS84
www.wwwwww	vessel lon	degrees, WGS84
xx.xxxxxx	source lat	degrees, WGS84
yy.yyyyyy	source lon	degrees, WGS84

Speed log data

Speed log data is formatted in the following sentences:

- VHW - Water speed and heading
- VBW - Dual Ground/Water Speed

\$VHW,x.x,T,x.x,M,x.x,N,x.x,K*hh

VHW sentence fields

Item	definition	units
x.x	degrees true	?
T	T=true	n/a
x.x	degrees Magnetic	?
M	M = Magnetic	n/a
x.x	Speed of vessel relative to water	Knots/hour
N	N = Nots	n/a
x.x	Speed of vessel relative to water	Km/hour
K	K = Kilometers	n/a
*hh	Checksum	n/a

\$VBW,x.x,x.x,A,x.x,x.x,A*hh

VBW sentence fields

Item	Definition	Units
x.x	Longitudinal water speed, "-" means astern	?
x.x	Transverse water speed, "-" means port	?
A	A = Data Valid	n/a
x.x	Longitudinal ground speed, "-" means astern	?
x.x	Transverse ground speed, "-" means port	?
A	A = data valid, V = data invalid	n/a
*hh	Checksum	n/a

Streamer Tension Unit Data

STU outputs data in the following sentence format:

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

STU Data

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

Applied Microsystems Sound Velocity Probe Data

The sound velocity probe serial data is output in the following format:

1479.35

xxxx.xx

Item	Definition	Units
xxxx.xx	Sound Velocity	m/s

Seabird SBE38 Thermometer Probe Data

The sound velocity probe serial data is output in the following format:

8.2221

xx.xxxx

Item	Definition	Units
xx.xxxx	Temperature	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.SSS SSSSCRLF	MMDDYYYY = UTC date of event HHMMSS.SSSSSSS = 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.SSSSSSS 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,ZCRLF	VV = PRN of satellite being tracked

	CHANNEL STATUS	F	<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,RRRRRRRR,WCRLF	<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) RRRRRRRR is the POP repeat interval in milliseconds W = 0 for 1 μs pulse width W = 1 for 10 μs pulse width W = 2 for 100 μs 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,DDDMM.MMMM,W,SAAAAA.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) DDDMM.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 (+,-) AAAAA.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

			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.
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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