RV Langseth
Data Reduction Summary

MGL1601

Cape Verde Islands – Cape Verde Islands

V1.0, 2016-02-16

Lamont-Doherty Earth Observatory, Columbia University

January 3rd 2016 00:00L

Date	Julian Date	Time	Port
2016-01-03	003	1024 UTC, 1224L	Mindelo, CVI
2016-02-26	057	0000 UTC, 0200L	Mindelo, CVI

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

Table of Contents

I. Background and Scientific Objectives (taken from the Science Support Plan)

Cruise Overview

MGL1601 is an active seismic survey using both ocean bottom seismometers and multichannel streamer, in the South Atlantic Ocean near the mid-Atlantic ridge, West of Namibia. The research aims to collect seismic imagery of the magma plumbing system of the arc volcano throughout the crust and into the upper mantle. The proposed survey area is shown in Figure 1.2. The principal investigators (PIs) and science party objectives will drive this program on the *R/V Langseth* with the coordination and advisement of the technical staff headed by the Office of Marine Operations (OMO) at Lamont Doherty Earth Observatory (LDEO).

The proposed seismic survey requests 4 string source arrays and 7 Ocean Bottom Seismometers (OBS) and a 1008 channel (12600m) towed streamer. The survey program will be dynamic and varying dependent on the seabed conditions, weather conditions, and maximizing the science objectives.

Other supporting equipment shall consist of a Kongsberg EM122 Multibeam echosounder, Knudsen 3260 3.5 kHz Sub-bottom Profiler, Bell Aerospace BGM-3 gravimeter, and the Geometrics 882 magnetometers. LDEO will ensure that the equipment in use meets the manufacturer's specifications, and also meets internal quality requirements. The technicians onboard are proficient in the operations of standard systems, but are not experts. If the investigation requires expertise in any of the acquisition, including data processing, staff the science party accordingly (i.e. sail a data processor equipped with the proper equipment to complete the science objectives, including software). Other science studies will be ongoing, per scientist request and shipboard specifications.

In addition to the operations of the air-sound-source array, a Multi-beam echosounder (MBES) and a Sub-Bottom Profiler (SBP) will also be operated from the Langseth continuously throughout the survey. All planned geophysical data acquisition activities would be conducted by LDEO with on-board assistance by the scientists who have proposed the study. The vessel would be self-contained, and the crew would live aboard the vessel for the entire cruise.

The principal investigator (PI) is Robert Reece (Texas A&M University). He will be onboard for the survey operations, as well as XX other scientists/students (total of XX scientists), XX LDEO/contract technicians and XX Protected Species Observers (PSOs).

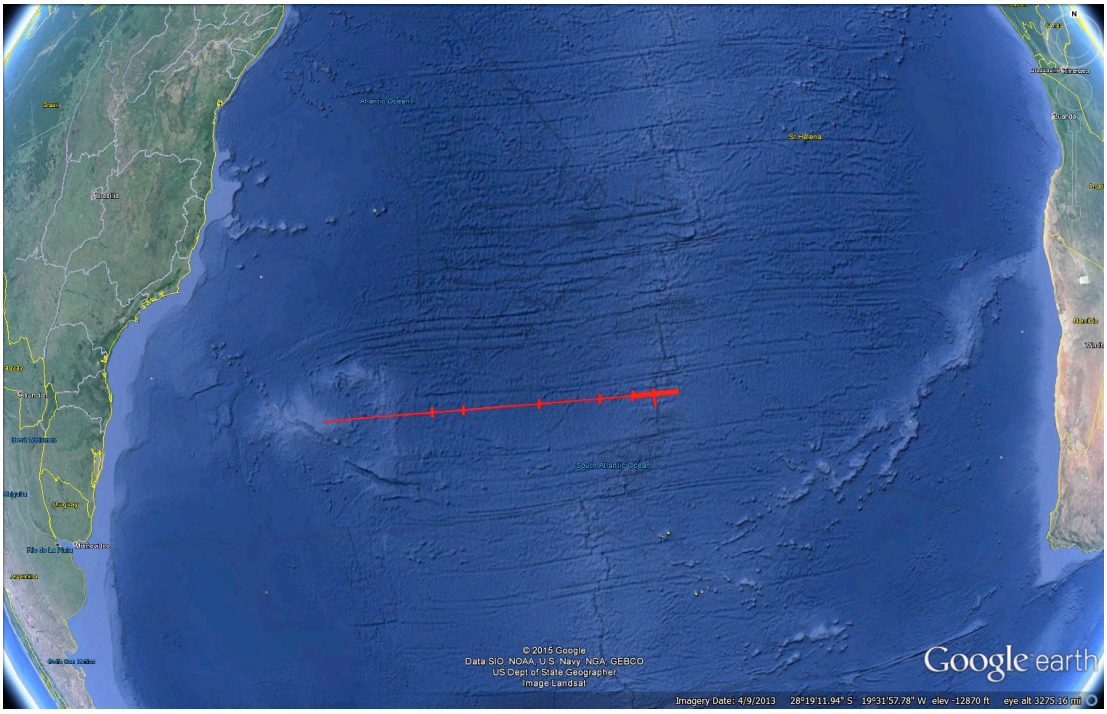
The cruise is expected to take 53 days to complete; currently mobilization is scheduled to start on/about January 1st, 2016 and completion of demobilization on/about February 24th, 2016. The ship is scheduled to sail on January 1st from Praia Cape Verde. Scientists will be permitted onboard the day before sailing. At the end of the cruise, the scientists must disembark the day after the ship arrives in port. Porto Grande, Cape Verde is the planned port call location.

Port –

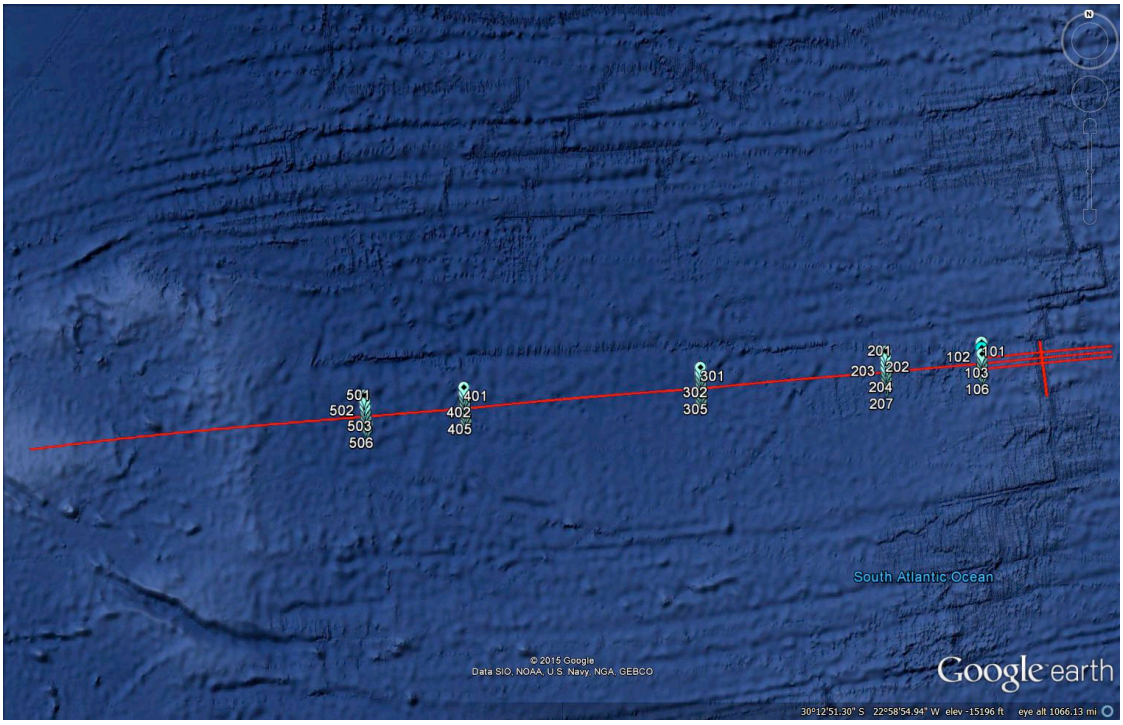
Porto Grande Mindelo, Sao Vicente CVI (Cape Verde Islands)

Porto Grande Mindelo, Sao Vicente CVI (Cape Verde Islands)

Trackline and Bathymetry –



MGL1601 – Overview of Survey Area



MGL1601 – Survey Plan showing OBS locations and MCS lines.

II. Personnel

Shipboard Technical Staff

Participant	Group/Affiliation	Position
Robert Steinhaus	L-DEO OMO	Chief Science Officer
Todd Jensvold	L-DEO OMO	Science Officer
David Martinson	L-DEO OMO	Science Officer
Tom Spoto	L-DEO OMO	Chief Source Mechanic
Carlos Gutierrez	L-DEO OMO	Source Mechanic
Josh Kasinger	L-DEO OMO	Source Mechanic
Klayton Curtis	Geomotive	Contractor (ACQ)
Shane Traceski	Geomotive	Contractor (NAV)
Graeme Stewart	Geomotive	Contractor (ACQ)
Andrej Smiskal	Geomotive	Contractor (Compressors)

Ship's Crew

1	Landow, Mark C.	Master
2	Crum, Breckenridge C.	Chief Mate
3	Reed, Mason D.	2nd Mate
4	Dexter, Timothy S.	3rd Mate
5	Woronowicz, Jason J.	Bosun
6	Cereno, George G.	AB
7	Shaffner, Joshua A.	AB
8	Webster, Jeromiel J.	AB
9	Putnam, Aaron J.	OS
10	Raines, Gregory S.	OS
11	Tucke, Matthew S.	Chief Engr.
12	Williams, Richard G.	1st Asst. Engr.
13	Nasta, Joseph R.	3rd Asst. Engr.
14	Collins, Christian M.	3rd Asst. Engr.
15	Handley, Braden J.	Oiler
16	Uribe, Guillermo F.	Oiler
17	Florendo, Rodolfo A.	Oiler
18	Fleenor, Carl A.	Electrician
19	Rosson, Eric J.	Steward
20	Rios, Ricardo	Cook

MMO

Participant	Group/Affiliation	Position
Amanda Dubuque	RPS-Geocet	Lead PSO
Amy Piko	RPS-Geocet	PAM operator / PSO
Cassandra Ashley	RPS-Geocet	PSO
Sheila O'Dea	RPS-Geocet	PSO
Heidi Malizia	RPS-Geocet	PSO

Science Party

#	Name	Position	Misc
1	Reece, Robert S.	Chief Scientist	b.reece@geos.tamu.edu
2	Christeson, Gail L.	Chief Scientist	gail@ig.utexas.edu
3	Amara, Akhil V.	Graduate Student	
4	Estep, Justin D.	Graduate Student	
5	Greene, John A.	Graduate Student	
6	Henning, Lindsay R.	Graduate Student	
7	Koch, Clinton D.	Graduate Student	
8	Worman, Stacey L.	Graduate Student	
9	Wright, Alexis L.	Graduate Student	
10	Kot, Daniel S.	WHOI OBS	
11	Lemmond, Peter C.	WHOI OBS	

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.

Instrument Data Files

Instrument	Description	Data Set	Data Outputs	Files	Interval
FE700	Furuno FE700 Echosounder	Not used	serial logs	MGL-bath01.*	N/A
EM122	Kongsberg EM122 Multibeam Sonar	Full	Center beam data	MGL-bath02.*	variable
KNUDSEN	Knudsen Engineering 3260 Sub-bottom Profiler	Full	KEA, KEB, SEG-Y	See below	variable
DS50	Furuno DS50 Doppler Speedlog	Full	serial logs	MGL-slog01.*	1s
XBT/XCTD	Sippican MK21 XBT/XCTD Launcher	134 drops	raw output to file	See below	n/a
			converted output to file	See below	n/a
WX1	RM Young 5103 Weather Bird and	Full	serial logs	MGL-wx01.*	1s
			mwv conversion	MGL-mwv01.*	1s
TSG	SeaBird SBE45 Thermosalinograph	Full	raw serial logs	MGL-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
MAG01	GeoMetrics 882 Magnetometer	On deploy	serial logs	MGL-mag01.*	1s
BGM	Bell Aerospace BGM-3 Gravimeter	Full	serial logs	MGL-vc01.*	1s
GYRO	Simrad GC80 Gyrocompass/AD100	Full	serial logs	MGL-gy01.*	1s
POSMV	POSMV Integrated Nav	Full	serial logs	MGL-posmv*	ls
SEAPATH	Kongsberg SeaPath Integrated Nav System	Full	serial logs	MGL-seapath.*	1s
MICROSV	Applied Microsystems Sound Velocity USS Unit	Full	serial logs	MGL-svuss01.*	1s
ADCP	RDI Current Profiler	Not used	serial logs	None	N/A
PCO2	LDEO PCO2 System	Not used	serial logs	MGL-pco2.*	N/A
Vaisala	Vaisala WXT-520 Ultrasonic Weather Station	Full	serial logs	MGL-vaisala.*	1s

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 - Not in use on MGL1601

The FE700 was not in use on MGL1601.

EM-122 Multibeam

The EM122 multibeam sonar was operated throughout the cruise. The system is designed for deeper water, and does not track ground well in less than 50m of water.

EM122 swath data is saved to the cruise archive under MGL1601/raw/multibeam. Center beam depth is recorded separately to serial log. A daily built in self test (BIST) is done on the EM122 at which time logging of data is secured. Data gaps are approximately 8-12 minutes in duration, and every effort is made to schedule them during turns or areas where coverage already exists. See MGL1601/docs/elog for times and durations of tests.

File id: bath02
Logging interval: variable with water depth

bath02 data format:

```
bath02      2008:192:00:00:12.6663  $KGDPT,2938.25,0.0,12000.0*4a
bath02      2008:192:00:00:30.3301  $KGDPT,2954.08,0.0,12000.0*4f
```

Knudsen Engineering 3260 Sub-bottom Profiler

The Knudsen 3260 is a chirp echosounder/sub-bottom profiler.

File id: n/a
Logging interval: Variable with water depth

The Knudsen 3260 is a chirp echosounder/sub-bottom profiler. It was in operation for the length of the cruise. Data written in proprietary KEB, KEA, and SEGY format. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

DS50 Speedlog

The Furuno DS-50 is a Doppler speed log. It was not in operation for the duration of the cruise.

File id: slog01
Logging interval: 1 second

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
```

RM Young Integrated Weather

The weather station is used to log wind speed, direction, air temperature, and barometric pressure. The unit was functioning during the cruise. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

File id: wx01
Logging interval: 1 second

wx01 data format:

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

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

CNAV2000

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. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

File id: cnav
Logging interval: 1 second

cnav data format:

```
cnav  2008:231:00:00:00.6936
$GPGGA,000000.00,1434.94372,N,10444.85748,W,2,8,1.1,15.52,M,-20.60,M,9,0108*65
cnav  2008:231:00:00:00.7137  $GPVTG,006.5,T,,M,9.64,N,17.85,K*53
```

CNAV3050

The C-NAV 3050 is a global satellite-based differential receiver. This is the best individual receiver currently on the ship. This system was operational during the cruise. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

File id: cnav3050
Logging interval: 1 second

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. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

File id: gy01
Logging interval: 1 second

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. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

File id: posmv
Logging interval: 1 second

posmv data format:

```
posmv 2008:231:00:00:00.0885
      $INGGA,235959.842,1434.95002,N,10444.85734,W,2,,1.1,12.71,M,,,9.0,0108*2E
posmv 2008:231:00:00:00.0889  $INHDT,15.0,T*11
posmv 2008:231:00:00:00.2047  $INVTG,7.0,T,,M,9.7,N,17.9,K*46
posmv 2008:231:00:00:00.3208  $INGST,235959.842,,0.9,0.9,0.0,0.9,0.9,2.5*51
posmv 2008:231:00:00:00.4411  $PASHR,235959.842,15.05,T,-
0.58,0.48,0.15,0.069,0.069,0.045,2,0*05
posmv 2008:231:00:00:00.4412  $INZDA,235959.0000,17,08,2008,,*73
```

SeaPath Integrated Nav

The Kongsberg Seapath is an inertial navigation system. Operational for the duration of the cruise. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

File id: seapath
Logging interval: 1 second

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
```

Geometrics 882 Magnetometer

The Geometrics 882 magnetometer is towed behind the ship. Raw serial output is logged using LDS. Deployment is dependent upon seismic operations. Data collected only when Magnetometer is deployed. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

Logging interval: 1 second

File id: mag01
mag01 data sample:

```
mag01 2015:329:00:00:01.2776  $ 45499.940,0881,0691
mag01 2015:329:00:00:01.3735  $ 45500.167,0879,0691
mag01 2015:329:00:00:01.4695  $ 45499.940,0874,0691
```

SBE-45 Thermosalinograph

The Seabird TSG output is logged by LDS to the "tsgraw" set. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

File id: tsgraw
Logging interval: 1 second

tsgraw data sample:

```
tsgraw      2015:337:00:01:15.3000  t1= 18.9500, c1= 5.17155, s= 39.1095,
sv=1522.706, t2= 18.7851
tsgraw      2015:337:00:01:25.3004  t1= 18.9526, c1= 5.17196, s= 39.1105,
sv=1522.715, t2= 18.7878
tsgraw      2015:337:00:01:35.3018  t1= 18.9539, c1= 5.17219, s= 39.1113,
sv=1522.720, t2= 18.7892
```

BGM-3 Gravimeter

The Bell Aerospace BGM-3 Gravimeter operated normally during the length of this cruise. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

File id: vc01
Logging interval: 1 second

vc01 data format:

```
vc01  2011:130:00:00:08.2866  01:024436 00
vc01  2011:130:00:00:09.2926  01:024548 00
```

AML Oceanographic – Micro-X SV-Xchange sensor Unit

The AML Micro-X SV probe operated normally during the length of this cruise. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

File id: svuss01
Logging interval: 1 second

svuss01 data format:

```
svuss01     2015:338:00:00:15.1382   1521.897
svuss01     2015:338:00:00:16.1282   1521.900
```

LDEO PCO2 System

The LDEO PCO2 system output is logged by LDS to the "pco2" set. The LDEO PCO2 system was not in operation for the duration of the cruise.

File id: pco2
Logging interval: ~180 seconds

pco2 data format:

```
pco2  2011:130:00:27:11.9162  2011130.02002        2370.39      37.54     1007.07
          404.51      28.42       386.9   5000.00         19           0
Equil

pco2  2011:130:00:30:00.5374  2011130.02198        2370.02      37.53     1007.14
          404.42      28.46       386.8   5000.00         19           0
Equil
```

Mk21 XBT System

Files: *.RDF,*.EDF

134 XBT drops were made during this cruise. The data set(s) are saved to the raw/XBT directory in the cruise archive. Refer to the MGL1601 Expendable Drops.xls spreadsheet in the docs/operations directory of the cruise archive for more information.

Sonobuoy System

Files: *.SEG, *.SEGY
Sonobuoy not in use on MGL1601.

Vaisala Meteorological Ultrasonic Integrated Weather

The weather station is used to log wind speed, direction, air temperature, relative humidity, precipitation, dew point, and barometric pressure. The unit was functioning during the cruise. Reference MGL1601/docs/elog for information on any data gaps or degraded operation.

File id: vaisala
Logging interval: 1 second

vaisala data format:

```
vaisala     2015:346:00:00:00.0038 $WIMWV,129,R,15.7,N,A*04
vaisala     2015:346:00:00:00.9930 $WIXDR,A,125,D,0,A,129,D,1,A,134,D,2,S,15.3,N
,0,S,15.7,N,1,S,16.5,N,2,C,14.2,C,0,C,14.4,C,1,H,52.9,P,0,P,1018.3,H,0,V,0.00,M,0,Z
,0,s,0,R,0.0,M,0,V,0.0,M,1,Z,0,s,1,R,0.0,M,1,R,66.5,M,2,R,0.0,M,3*6D
```

IV. Seismic Summary

A. Acquisition Parameter Table

Acquisition Parameter Table	
AcquisitionParameterID	MGL1601_ACQ01 (Seq 01 -06)
FieldActivityID	MGL1601
ReceiverType	WHOI Ocean Bottom Seismometer
SourceType	Airgun
Acquisition System Name	WHOI Ocean Bottom Seismometer
Acquisition System Type	OBS
Seismic_Nav_System	C-Nav 3050 primary
Survey_datum	WGS84
Navigation Reference Point	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 200 calculated center of gravity) waterline
NRP to source	205 m
Source_to_Near_Channel	N/A
Number_of_channels_recorded	N/A
Number_of_cables	N/A
Number_of_channels_each_cable	N/A
Channel_length	N/A
Cable_length	N/A
Cable_spacing	N/A
Near_Channel_Number	N/A
Cable_depth	N/A
Number_sources	1
Sub-arrays_per_source	4
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	6.0 m
Source_volume	6600 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_number	36 + 4 spare
Source_depth	9.0 m
Shot_control	Distance
Shot_Interval	150 m
Sample_interval	N/A
Record_length	N/A
Compass_birds	N/A
Recording_delay	N/A

Acquisition Parameter Table	
AcquisitionParameterID	MGL1601_ACQ02 (Seq 07 - 30)
FieldActivityID	MGL1601
ReceiverType	SERCEL Sentinel Solid Streamer
SourceType	Airgun
Acquisition System Name	SERCEL SEAL 408 recording system
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	205 m
Source_to_Near_Channel	217.7 m
Number_of_channels_recorded	1008
Number_of_cables	1
Number_of_channels_each_cable	1008
Channel_length	12.5 m
Cable_length	12600 m (12.6km)
Cable_spacing	N/A
Near_Channel_Number	1
Cable_depth	9.0m +/- 1m
Number_sources	1
Sub-arrays_per_source	4
Alternate_Shooting	No
Source_separation	N/A
Sub-array_separation	6.0 m
Source_volume	6600 cu in
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_number	36 + 4 spare
Source_depth	9.0 m
Shot_control	Distance
Shot_Interval	37.5 m
Sample_interval	2.0 ms
Record_length	15.0 s (Seq 7-28) 14.0 s (Seq 29) 12 S (Seq 30)
Compass_birds	43
Recording_delay	N/A

Physical Configuration

The towing configuration for the air guns and streamers is detailed in the document titled ***MGL1601_Offsets_MCS_Line.xls*** and ***MGL1601_Offsets_Source_Only***.

Offsets

All antenna and in-water offset drawings are in the file ***MGL1601_Offsets_MCS_Line.xls*** and ***MGL1601_Offsets_Source_Only***.

Spectra

Spectra was used for all timing and navigation during the cruise. Spectra generated UKOOA P294 and P190 files for the MCS line(s) acquired.

Sprint

Sprint was used for post processing of Spectra UKOOA P294 files to produce UKOOA P190 files with improved positioning.

V. RV Langseth Gravity Tie Information

Date / Time	Ship Location	Reference Location	Mistie
2016-01-02T13:51	Porto Grande Sao Vicente, CVI	Third Bollard from shore side	Mindelo, CVI
2016-02-27T07:24	Porto Grande Sao Vicente, CVI	Third Bollard from shore side	Mindelo, CVI

Please refer to the documents located under MGL1601/docs/gravity_tie for detailed records.

VI. Archive Contents

Key files are bolded.

MGL1601/docs	Cruise documents and logs
MGL1601/docs/config	Configuration archive
MGL1601/docs/elog	Cruise elog
MGL1601/docs/gravity_tie	Gravity Tie information
MGL1601/docs/map	Cruise maps, track map
MGL1601/docs/offsets	Vessel/sensor offsets
MGL1601/docs/operations/	Operations documents
MGL1601/docs/operations/Daily_Reports	Cruise Daily Reports from Chief Science Officer
MGL1601/docs/operations/NavLogs	Seismic navigation logs (spectra)
MGL1601/docs/operations/ObsLogs	Seismic acquisition logs (gun controller)
MGL1601/docs/operations/MGL1601_B15_line_log_multi_channel_seismics .xls	**Master line log table**
MGL1601/docs/permits	Clearance Documents
MGL1601/docs/waypoints	Waypoint files
MGL1601/docs/personnel	Personnel rosters, org chart, bunk and phone lists
MGL1601/docs/reports	Cruise Report and supplemental docs
MGL1601/docs/reports/MGL1601_DataReport_v1.0.doc	**This file**
MGL1601/docs/offsets/MGL1601_Offsets_MCS.xls	**Vessel/sensor offsets**
MGL1601/docs/screencaps	Screen captures
MGL1601/processed	Processed data
MGL1601/processed/reflex (3D data-sets only, not applicable to OBS and 2D)	Spectra reflex files
MGL1601/processed/obsip	Shot log files
MGL1601/processed/sprint	Sprint UKOOA P190s
MGL1601/processed/svp	Sound velocity profiles
MGL1601/raw	Raw data
MGL1601/raw/adcp	Raw ADCP data
MGL1601/raw/knudsen	Raw Knudsen sub-bottom profiler data
MGL1601/raw/MarkeyWinch	DESH-5 Winch Tension / Payout data files
MGL1601/raw/multibeam	Raw EM122 data
MGL1601/raw/serial	Underway serial data: gps, tsg, weather, etc.
MGL1601/raw/sonobuoy	Raw sonobuoy data
MGL1601/raw/spectra/P1	Spectra underway p190

MGL1601/raw/spectra/P2	Raw seismic navigation, p294
MGL1601/raw/XBT	Raw XBT data

VII. Data Formats

Gravimeter data

The gravimeter serial data is output in the following format:

```
01:025610 01

01:xxxxxx ff
```

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

CNAV GPS receiver data

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

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

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

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

$GPVTG Sentence Fields

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

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

$GPGGA Sentence Fields

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

CNAV 3050 GPS receiver data

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

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

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

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

$GPVTG Sentence Fields

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

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

$GPGGA Sentence Fields

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

EM122 Center Beam Depth

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

The EM122 outputs serial data in the following formats:

- KIDPT - Depth below transducer

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

SDDBT sentence format

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

FE700 Navigational Echosounder data

The FE700 Navigational Echosounder outputs data in the following formats

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

$PFEC ,aaaa,x,x*hF

PFEC sentence format

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

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

SDDBT sentence format

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

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

SDDBS sentence format

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

Gyroscope data

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

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

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

ALM sentence format

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

$HEHDT,xxx.x,T*hh

HDT sentence format

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

$HEROT,-xxx.x,A*hh

HEROT sentence format

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

Geometrics 882 Magnetometer Data

The magnetometer serial data is output in the following format:

```
$ 53863.927,0652

$ xxxxx.xxx,vvvv
```

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

RM Young Meteorological Station Data

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

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

Langseth WX station sentence format

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

OBSIP Shotlog Format

Each OBSIP shotlog contains a header followed by shot records:

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

Shot records are in the following format:

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

OBSIP record format

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

LDEO PCO2 System

PCO2 outputs data in the following sentence format:

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

PCO2 Data

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

LDEO PCO2 + CNav + TSG + WX01 + SBE38 Systems

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

yyyyjjj.jjj aaaa.aa bb.bb cccc.cc ddd.dd e.ee fff.f gggg.gg hh i k, llll.llllllm, nnnnn.nnnnnno, pppp.pp, q.qq, r.rr, s.ss, tt.tt, uu.u, vvv, w.w, xxx.x, y.yy, zzz.z, @@.@@@@

PCO2 Data

Item	Definition	Value	Units
yyyyjjj.jjj	pco2 Computer Date/Time	n/a	Year/Julian Day.decimal Four fixed digits of year. Three fixed digits of julian day. Five fixed digits for decimal fractions of a julian day.
aaaa.aa	CO2 Raw Signal	n/a	mVolts
bb.bb	CO2 Analyzer Cell Temperature	n/a	Celcius
cccc.cc	PCO2 Barometer	n/a	mbar
ddd.dd	VCO2	n/a	ppm
e.ee	Equilibrator Water Temp	n/a	Celcius
fff.f	pCO2	n/a	uatm
gggg.gg	Flow Controller	n/a	mVolts
hh	Flow Meter	n/a	cc/min
i	Sample ID #	0 to 16	integer
k	Sample ID	Equil, Atmos, Nitrogen,CC18798, CA07163, C15551, or CC63668	alphanumeric
llll.llllllm	CNav Latitude	0 to 90, N/S	degrees/minutes.decimal/direction
nnnnn.nnnnnno	CNav Longitude	0 to 180, E/W	degrees/minutes.decimal/direction
pppp.pp	TSG Speed of Sound	n/a	m/s
q.qq	TSG Internal Temperature	n/a	Celcius
r.rr	TSG External Temperature	n/a	Celcius
s.ss	TSG Conductivity	n/a	S/m
tt.tt	TSG Salinity	25 to 40	ppm
uu.u	WX01 Bird 1 Wind Speed 60 sec avg	n/a	knots
vvv	WX01 Bird 1 Wind Direction 60 sec avg	0 to 360	degrees
w.w	WX01 Temperature Instantaneous	n/a	Celcius
xxx.x	WX01 Ship Barometer Instantaneous	n/a	mbar
y.yy	CNav Speed Over Ground / Speed Made Good	0 to 15	knots
zzz.z	CNav Course Made Good	0 to 360	degrees
@@.@@@@	SBE38 Temperature Probe	n/a	Celcius

POS/MV Position and Orientation System for Marine Vessels

POS/MV outputs data using the NMEA 0183 format at rates of up to fifty sentences per second. The following seven different sentence formats are available.

- 1. $INGGA-Global System Position Fix Data
- 2. $INHDT-Heading - True data
- 3. $INVTG-Course over ground and Ground speed data
- 4. $INGST-GPS pseudorange noise statistics
- 6. $PRDID-Attitude data
- 7. $INZDA-Time and date

$INGGA, hhmmss.sss, llll.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.llllll	Latitude	-90 to +90	DegreeslMinutes.decimal. Two fixed digits of degrees Two fixed digits of minutes Five digits for decimal minutes.
a	N (north) or S (south)	N or S	
yyyyy.yyyyy	Longitude	-180 to +180	Degrees/Minutes.decimal. Three fixed digits of degrees. Two fixed digits of minutes. Five digits for decimal minutes.
b	E (east) or W (west)	E or W	
t	GPS Quality Indicator	0 = Fix not available or invalid 1 = CIA standard GPS; fix valid. 2 = DGS mode; fix valid. 3 = PPP mode; fix valid. 4 = RTK fixed 5 = RTK float 6 = free inertial	
nn	Number of satellites used in fix	0 to 32	
v.v	Horizontal dilution of precision		
x.x	Altitude of the IMU above or below the	n/a	Metres

	mean sea level. A negative value indicates below sea level.		
M	Units of measure = metres	M	
Null	Null		
Null	Null		
c.c	Age of differential corrections in records since last RTCM-104 message.	0 to 99.9	Seconds
rrr	DGPS reference station identity	0000 to 1023	
*hh	Checksum	00 - FF	
/CR/LF	Carriage return and line feed	/CR/LF	

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

$INHDT, x.x, T*hh

$INHDT-Heading - True data

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

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

$INVTG-Course over ground and Ground speed data

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

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

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

$INGST-GPS pseudorange noise statistics

Item	Definition	Value	Units
$INGST	Header	$INGST	
hhmmss.sss	UTC time of position	n/a	Hours/Minutes/Seconds.decimal. 2 fixed digits of hours. 2 fixed digits of minutes. 2 fixed digits of seconds. Three digits for decimal fractions of a second.
null	Not supported	null	
smjr.smjr	Standard Deviation of semi-major axis of error ellipse	n/a	Metres
smnr.smnr	Standard deviation of semi-minor axis of error ellipse	n/a	Metres
o.o	Orientaion of semi-major axis ellipse	0 to 359.9	Degrees from true north
l.l	Standard deviation of latitude	n/a	Metres
y.y	Standard deviation of longitude	n/a	Metres
a.a	Standard deviation of Altitude	n/a	Metres
*hh	Checksum	n/a	
/CR/LF	Carriage return and line feed	/CR/LF	

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

Note that commas separate all items

Two attitude data strings are available. The strings are identical except for the definition of roll and pitch angles. One string uses Tate-Bryant angles and the

other uses TSS angles. Use the POS/MV Controller program to set the required angle convention.

$PRDID, PPP.PP, RRR.RR, xxx.xx*hh

$PRDID-Attitude data

Item	Definition	Value	Units
$PRDID	Header	$PRDID	
PPP.PP	Pitch	-90.00 to +90.00	Degrees
RRR.RR	Roll	-90.00 to +90.00	Degrees
xxx.xx	Sensor heading	0 to 359.99	Degrees
*hh	Checksum	n/a	
/CR/LF	Carriage return and line feed	/CR/LF	

Note that commas separate all items

Two attitude data strings are available. The strings are identical except for the definition of roll and pitch angles. One string uses Tate-Bryant angles and the other uses TSS angles. Use the POS/MV Controller program to set the required angle convention.

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

$INZDA-Time and date

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

RM Young Rain Gauge & Eppley PSP data

RM Young Rain Gauge & Eppley PSP data is formatted in the following sentences:

x.xxxxxx,y.y

Sentence field

Instrument	Item	definition	units
Eppley PSP	x.xxxxxx	voltage	mV
RM Young Rain Gauge	y.y	amount of rain	mm

Seabird SBE-45 Thermosalinograph Data

Data from the SBE-45 TSG is output in the following format:

```
2012:050:06:02:01.0294   27.2958,  5.51684,  34.7768

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

Item	Definition	Units
yyyy	year	n/a
ddd	day of year	n/a
hh	hours	n/a
mm	minutes	n/a
ss.ssss	seconds	n/a
tttt	Raw internal temperature sensor data	n/a
cccc	Raw conductivity sensor data	n/a
xxxx	Raw salinity sensor data	n/a

SEAPATH 200 Intertial Navigation System

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

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

$INGGA, hhmmss.sss, llll.llll, a, yyyyy.yyyyy, b, t, nn, v.v, x.x, M,,,c.c,rrrr*hh

$INGGA-Global System Position Fix Data

Item	Definition	Value	Units
$INGGA	Header	$INGGA	
hhmmss.sss	UTC time of position	n/a	Hours/Minutes/Seconds.decimal. Two fixed digits of hours. Two fixed digits of minutes. Two fixed digits of seconds. Three digits for decimal fractions of a second.
llll.llll	Latitude	-90 to +90	DegreeslMinutes.decimal. Two fixed digits of degrees Two fixed digits of minutes Five digits for decimal minutes.
a	N (north) or S (south)	N or S	
yyyyy.yyyyy	Longitude	-180 to +180	Degrees/Minutes.decimal. Three fixed digits of degrees. Two fixed digits of minutes. Five digits for decimal minutes.
b	E (east) or W (west)	E or W	
t	GPS Quality Indicator	0 = Fix not available or invalid 1 = CIA standard GPS; fix valid. 2 = DGS mode; fix valid. 3 = PPP mode; fix valid. 4 = RTK fixed 5 = RTK float 6 = free inertial	
nn	Number of satellites used in fix	0 to 32	
v.v	Horizontal dilution of precision		
x.x	Altitude of the IMU above or below the mean sea level. A negative value indicates below sea level.	n/a	Metres
M	Units of measure = metres	M	
Null	Null		
Null	Null		

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

$INHDT, x.x, T*hh

$INHDT-Heading - True data

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

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

$INVTG-Course over ground and Ground speed data

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

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

$INZDA-Time and date

Item	Definition	Value	Units
$INZDA	Header	$INZDA	
hhmmss.sss	UTC time	n/a	Hours/Minutes/Seconds.decimal. 2 fixed digits of hours 2 fixed digits of minutes 2 fixed digits of seconds Three digits for decimal fractions of a second
DD	Day of month	01 to 31	
MM	Month of year	01 to 12	
YYYY	Year		

Null	Null	
Null	Null	
*hh	Checksum	n/a
/CR/LF	Carriage return and line feed	/CR/LF

Speed log data

Speed log data is formatted in the following sentences:

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

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

VHW sentence fields

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

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

VBW sentence fields

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

Streamer Tension Unit Data

STU outputs data in the following sentence format:

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

STU Data

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

AML Oceanographic Micro-X XChange Sound Velocity Probe Data

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

```
1479.35
```

```
xxxx.xx
```

Item	Definition	Units
xxxx.xx	Sound Velocity	m/s

Seabird SBE38 Thermometer Probe Data

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

```
8.2221
```

```
xx.xxxx
```

Item	Definition	Units
xx.xxxx	Temperature	Celcius

RM Young Meteorological Station Data

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

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

Langseth WX station sentence format

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

Viasala Ultrasonic Meteorological Station Data

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

$WIMWV,105,R,3.8,N,A*32
$WIMWV,x.x,R,y.y,N,A*32

Item	Definition	Units
x.x	Wind direction value: Wind direction is given in relation to the devices north-south axis.	Degrees
R	Wind direction unit (R = relative)	n/a
y.y	Wind speed value	Knots
N	Wind speed unit (knots	n/a
A	Data status: A = valid, V = Invalid	n/a

$WIXDR,A,105,D,0,A,105,D,1,A,105,D,2,S,3.7,N,0,S,3.8,N,1,S,3.9,N,2,C,27.2,C,0,C,28.4,C,1,H,70.5,P,0,P,1013.5,H,0,V,0.00,M,0,Z,0,s,0,R,0.0,M,0,V,0.0,M,1,Z,0,s,1,R,0.0,M,1,R,1.7,M,2,R,0.0,M,3*6D

$WIXDR,A,xxx,D,0,A,xxx,D,1,A,xxx,D,2,S,x.x,N,0,S,x.x,N,1,S,x.x,N,2,C,xx.x,C,0,C,xx.x,C,1,H,xx.x,P,0,P,xxxx.x,H,0,V,x.xx,M,0,Z,0,s,0,R,x.x,M,0,V,x.x,M,1,Z,0,s,1,R,x.x,M,1,R,x.x,M,2,R,x.x,M,3*6D

Item	Definition	Units
A	**Transducer id 0 type (Wind Direction)**	**n/a**
xxx	Transducer id 0 data (min wind direction)	Degrees
D	Transducer id 0 units (degrees, min wind direction)	n/a
0	Transducer id for min wind direction	n/a
A	Transducer id 1 type (wind direction)	n/a
xxx	Transducer id 1 data (average wind direction)	Degrees
D	Transducer id 1 units (degrees, average wind direction)	n/a
1	Transducer id for average wind direction	n/a
A	Transducer id 2 type (wind direction)	n/a
xxx	Transducer id 2 data (max wind direction)	Degrees
D	Transducer id 2 units (degrees, max wind direction)	n/a
2	Transducer id for max wind direction	n/a
S	**Transducer id 0 type (wind speed)**	**n/a**
x.x	Transducer id 0 data (min wind speed)	Knots
N	Transducer id 0 units (Knots, min wind speed)	n/a
0	Transducer id for min wind speed	n/a
S	Transducer id 1 type (wind speed)	n/a
x.x	Transducer id 1 data (average wind speed)	Knots
N	Transducer id 1 units (Knots, average wind speed)	n/a
1	Transducer id for average wind speed	n/a
S	Transducer id 2 type (wind speed)	n/a
x.x	Transducer id 2 data (max wind speed)	Knots
N	Transducer id 2 units (Knots, max wind)	n/a
2	Transducer id for max wind speed	n/a

C	**Transducer id 0 type (Temperature)**	**n/a**
xx.x	Transducer id 0 data (Temperature)	Celcius
C	Transducer id 0 units (C, Temperature)	n/a
0	Transducer id for Temperature	n/a
C	**Transducer id 1 type (temperature)**	**n/a**
xx.x	Transducer id 1 data (Tp internal temperature)	Celcius

C	Transducer id 1 units (C, Tp internal temperature)	n/a
1	Transducer id for Tp internal temperature	n/a
H	**Transducer id 0 type (Humidity)**	**n/a**
xx.x	Transducer id 0 data (Humidity)	% Reletive Humidity
P	**Transducer id 0 units (%, Humidity)**	**n/a**
0	Transducer id for Humidity	n/a
P	**Transducer id 0 type (Pressure)**	**n/a**
xxxx.x	Transducer id 0 data (Pressure)	hPA
H	Transducer id 0 units (hPa, Pressure)	n/a
0	Transducer id for Pressure	n/a

V	**Transducer id 0 type (Accumulated rainfall)**	**n/a**
x.xx	Transducer id 0 data (Accumulated rainfall)	millimeters
I	Transducer id 0 units (mm, Accumulated rainfall)	n/a
0	Transducer id for Accumulated rainfall	n/a
Z	**Transducer id 0 type (Rain duration)**	**n/a**
xx	Transducer id 0 data (Rain duration)	seconds
s	Transducer id 0 units (s, Rain duration)	n/a
0	Transducer id for Rain duration	n/a
R	**Transducer id 0 type (Rain intensity)**	**n/a**
x.x	Transducer id 0 data (Rain intensity)	mm/hr
M	Transducer id 0 units (mm/h, Rain intensity)	n/a
0	Transducer id for Rain intensity	n/a
V	**Transducer id 1 type (Hail accumulation)**	**n/a**
x.x	Transducer id 1 data (Hail accumulation)	hits/cm2
M	Transducer id 1 units (hits/cm2, Hail accumulation)	n/a
1	Transducer id for Hail accumulation	n/a
Z	**Transducer id 1 type (Hail duration)**	**n/a**
x	Transducer id 1 data (Hail duration)	seconds
s	Transducer id 1 units (s, Hail duration)	n/a
1	Transducer id for Hail duration	n/a
R	**Transducer id 1 type (Hail intensity)**	**n/a**
x.x	Transducer id 1 data (Hail intensity)	hits/cm2h
M	Transducer id 1 units (hits/cm2h, Hail intensity)	n/a
1	Transducer id for Hail intensity	n/a

R	**Transducer id 1 type (Rain peak intensity)**	**n/a**
x.x	Transducer id 1 data (Rain peak intensity)	mm/h
M	Transducer id 1 units (mm/h, Rain peak intensity)	n/a
2	Transducer id for Rain peak intensity	n/a
R	**Transducer id 1 type (Hail peak intensity)**	**n/a**
x.x	Transducer id 1 data (Hail peak intensity)	hits/cm2
M	Transducer id 1 units (hits/cm2, Hail peak intensity)	n/a