

RV Langseth Data Reduction Summary

MGL2204 – Manzanillo

Dr. Anne Becel

Manzanillo, Mexico

V2.1, 2022-09-13

Lamont-Doherty Earth Observatory, Columbia University

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Table of Contents

Table of Contents	4
I. Background and Scientific Objectives	5
II. Personnel	6
III. Instrumentation Summary	8
IV. Data Strings	9
V. Acquisition Parameter Table(s)	14
VI. RV Langseth Gravity Tie Information	20
VII. Archive Contents	21
VIII. Data Formats	22
IX. Log file(s) Descriptive	38

I. Background and Scientific Objectives

Subduction zone megathrusts exhibit a wide spectrum of slip behavior, including locking and slip in great earthquakes, creeping, and transient slow-slip events. Yet, many questions remain about what controls the down-dip and along-strike variability in fault slip behavior. Fluids delivered into the subduction zone by the incoming plate are commonly invoked to explain slip behavior, in particular, the location of slow slip. However, the volume and distribution of fluids in the incoming plate and their fate at depth vary between subduction zones and are poorly known. This project involves the acquisition and analysis of marine, active-source seismic data aboard the R/V Marcus G. Langseth within the Guerrero Gap and neighboring segments at the Middle America subduction zone, offshore Mexico as this is one of the best-known examples in the world of along-strike variations in slip behavior of the plate boundary. The seismic data will allow us to constrain plate boundary properties and the distribution of fluids in both the incoming plate and within the subduction zone. This project has broad implications for earthquake hazard assessment in the subduction zone off Mexico and subduction zones worldwide and will also provide prime constraints on Earth's water budget. This study will also nicely complement an ongoing international project using amphibious geodetic and seismic deployments in our proposed study area.

We also propose that if the contingency time (5.3 days) is not fully utilized for technical issues or bad weather, it will be used for new site surveys for a future drilling proposal related to high-resolution paleoceanography (contingency lines). Kassandra Costa from WHOI (kacosta@whoi.edu) designed the profiles for site surveys.

We propose to gather ~2000 km of 2-D seismic reflection data and 1373 km of ocean-bottom seismometer (OBS) refraction data with the R/V Marcus G. Langseth. The proposed survey consists of 8 multichannel seismic lines, of which 6 are coincident OBS refraction lines. 6 lines are perpendicular to the margin, and 2 profiles are trench parallel profiles, one across the oceanic plate before subduction and one across the forearc. We will start the program with the refraction component. Refraction data will be acquired with short period, 4-comp OBS and the 6600 cu.in Langseth's airgun array towed at a 12m depth. Shot spacing will be 400m (155.5 s at 5 kts) and the sampling rate will be 200 Hz. We will use an OBS spacing of either 12 km or 10 km. There will be 124 OBS deployments in total. After the refraction component will be completed, we will deploy the 15-km long streamer and 6600 cu.in source. The airgun array and the streamer will be towed at a depth of 12m and 15m, respectively to enhance low frequencies that allow for deep seismic imaging. Shot spacing for the multichannel seismic reflection component will be 50m and the data will be collected at a speed of 4.1 knots. Record length and sampling rate will be 18 s and 2 ms, respectively. The seismic pulses will be triggered at a pressure of 1,950-2,000 psi.

In addition, we will also want to acquire underway data: (1) Deep water Multibeam bathymetry (EM122) (2) Gravimetry (Bell BGM-3 Gravimeter) (3) Marine Magnetic (4) 3.5khz sub-bottom profiler data and (5) Expandable bathythermograph (XBT)

II. Personnel

Shipboard Technical Staff

Participant	Group/Affiliation	Position
Todd Jensvold	LDEO	Chief Science Officer
Alan Thompson	LDEO	Tech
Cody Bahlau	LDEO	Tech
Josh Kasinger	LDEO	Chief Source Mechanic
Brian Agee	LDEO	Source Mechanic
Jacob Greenberg	Contractor	Contract Mech
Randy Wiggins	Contractor	Contract Mech
Ray Hatton	Contractor	Contract Mech

Ship's Crew

1	Landow, Mark	Master
2	Wolford, David	Chief Mate
3	Woronowicz, Jason J	2nd Mate
4	Bommer, Christian	3rd Mate
5	Cohan, Sean	3rd Mate
6	Cereno, George G.	Bosun
7	Robison, William J.	AB
8	White, Joselyn N.	AB
9	Hammond, Robert D.	Oiler
10	Woods, Shayna	OS
11	Tucke, Matthew S.	Chief Engr.
12	Romero, Michael A.	1st Asst. Engr.
13	Lear, Garret	2nd Asst. Engr.
14	Sebach, Stefan	3rd Asst. Engr.
15	Florendo, Rodolfo A.	Oiler
16	Davis Jr., Steven P.	Oiler
17	McLean-Fuller, Hervin	Steward
18	Martires, Leoncio R.	Cook

PSO

Participant	Group/Affiliation	Position
Amanda Ella Dubuque	RPS	Lead PSO
Cassandra Ashley Frey	RPS	PSO/PAM
Yessica Vincencio Murillo	RPS	PSO/PAM
Felipe Rodriguez Moreno	RPS	PSO/PAM
Heber Huizar Contreras	RPS	PSO/PAM

Science Party

	Participant	Group/Affiliation	Function	Gender	Email Address
1	Anne Becel	LDEO	PI	F	annebcl@lde.columbia.edu
2	Víctor Manuel Cruz Atienza	UNAM	PI	M	cruz.atienza@gmail.com
3	Brian Boston	LDEO	PI	M	brianb@ldeo.columbia.edu
5	Donna Shillington	NAU	PI	F	Donna.Shillington@nau.edu
6	Jorge Arturo Real Pérez	UNAM	Scientist	M	real@igeofisica.unam.mx
7	Tanner Acquisto	LDEO	Scientist	M	acquisto@ldeo.columbia.edu
8	Brandon Shuck	LDEO	Scientist	M	bshuck@ldeo.columbia.edu
9	Josh Burstein	NAU	Scientist	M	jab2399@nau.edu
10	Daniel Kot	WHOI	OBS Tech	M	dkot@whoi.edu

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 Acquisition Parameter sheet(s).

Instrument Data Files

Instrument	Description	Data Set	Data Outputs	Files	Interval
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
DS80	Furuno DS80 Doppler Speed log	Full	serial logs	MGL-slog01.*	1s
XBT/XCTD	Sippican MK21 XBT/XCTD Launcher	16 drops	raw output to file	See below	n/a
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	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 Inertial Navigation System	Full	serial logs	MGL-posmv*	1s
SEAPATH	Seapath 330 Inertial Navigation System	Full	serial logs	MGL-seapath.*	1s
MICROSV	Applied Microsystems Sound Velocity USS Unit	Full	serial logs	MGL-svuss01.*	1s
ADCP	RDI OS 75 Current Profiler	Full	serial logs	MGL-adcp.*	variable
Vaisala1	Vaisala WXT-520 Ultrasonic Weather Station	Full	serial logs	MGL-vaisala1.*	1s
Vaisala2	Vaisala WXT-520 Ultrasonic Weather Station	Full	serial logs	MGL-vaisala2.*	1s

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

IV. Data Strings

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 MGL2204/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 MGL2204/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 converted to SEG Y format (if requested). Reference MGL2204/docs/elog for information on any data gaps or degraded operation.

DS80 Speedlog

The Furuno DS-80 is a Doppler speed log. It was 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
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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 MGL2204/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 MGL2204/docs/elog for information on any data gaps or degraded operation.

File id: cnav3050all

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,9.0,0358*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 MGL2204/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 Inertial Navigation System

The POS/MV is a receiver that uses CNAV input in addition to its own antennae, an inertial sensor and optional RTG, WTC, or WAAS corrections and a Kalman filter to produce a smooth navigation output and very accurate heading. Reference MGL2204/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 330 Inertial Navigation System

The Kongsberg Seapath is an inertial navigation system. Operational for the duration of the cruise. Reference MGL2204/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 MGL2204/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 MGL2204/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 MGL2204/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 MGL2204/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

Mk21 XBT System

Files: *.RDF,*.EDF

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 MGL2204 Expendable Drops.xls spreadsheet in the docs/operations directory of the cruise archive for more information.

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 operational for the duration of the cruise. Reference MGL2204/docs/elog for information on any data gaps or degraded operation.

File id: vaisala1 and vaisala2

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

V. Acquisition Parameter Table(s)

Acquisition Parameter Table 1	
FieldActivityID	MGL2204
Acquisition_sequence(s)	Seq 1
ReceiverType	OBS
SourceType	Airgun
Acquisition System Name	OBS
Acquisition System Type	OBS
Seismic_Nav_System	C-Nav 3050 primary
Survey_datum	WGS84
Navigation Reference Point (primary GPS antenna)	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 330 calculated center of gravity) waterline
Antenna(NRP)_to_source	230 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	Applicable to multi-streamer MCS only
Near_Channel_Number	N/A
Cable_depth	N/A
Number_sources	1
Sub-arrays_per_source	4
Flipflop_shooting (dual source alternating)	False
Source_separation	Applicable to flipflop (dual source alternating) only
Sub-array_separation	6.0 m
Source_volume	6600 cubic inches
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_element_number	36 + 4 spare
Source_depth	12 m
Shot_control	Distance
Shot_Interval	400 m
Sample_interval	N/A
Record_length	N/A
Compass_birds	N/A
Recording_delay	False
Active_tail_buoy	False
Multiple_ships	False

Acquisition Parameter Table 2	
FieldActivityID	MGL2204
Acquisition_sequence(s)	Seq 2, 5, 6 ,9, 10, 11, 12, 14, 16, 17, & 19
ReceiverType	OBS
SourceType	Airgun
Acquisition System Name	OBS
Acquisition System Type	OBS
Seismic_Nav_System	C-Nav 3050 primary
Survey_datum	WGS84
Navigation Reference Point (primary GPS antenna)	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 330 calculated center of gravity) waterline
Antenna(NRP)_to_source	230 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	Applicable to multi-streamer MCS only
Near_Channel_Number	N/A
Cable_depth	N/A
Number_sources	1
Sub-arrays_per_source	4
Flipflop_shooting (dual source alternating)	False
Source_separation	Applicable to flipflop (dual source alternating) only
Sub-array_separation	6.0 m
Source_volume	6600 cubic inches
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_element_number	36 + 4 spare
Source_depth	12 m
Shot_control	Distance
Shot_Interval	300 m
Sample_interval	N/A
Record_length	N/A
Compass_birds	N/A
Recording_delay	False
Active_tail_buoy	False
Multiple_ships	False

Acquisition Parameter Table 3	
FieldActivityID	MGL2204
Acquisition_sequence(s)	Seq 3 ,4, & 8
ReceiverType	OBS
SourceType	Airgun
Acquisition System Name	OBS
Acquisition System Type	OBS
Seismic_Nav_System	C-Nav 3050 primary
Survey_datum	WGS84
Navigation Reference Point (primary GPS antenna)	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 330 calculated center of gravity) waterline
Antenna(NRP)_to_source	230 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	Applicable to multi-streamer MCS only
Near_Channel_Number	N/A
Cable_depth	N/A
Number_sources	1
Sub-arrays_per_source	4
Flipflop_shooting (dual source alternating)	False
Source_separation	Applicable to flipflop (dual source alternating) only
Sub-array_separation	6.0 m
Source_volume	6600 cubic inches
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_element_number	36 + 4 spare
Source_depth	12 m
Shot_control	Distance
Shot_Interval	250 m
Sample_interval	N/A
Record_length	N/A
Compass_birds	N/A
Recording_delay	False
Active_tail_buoy	False
Multiple_ships	False

Acquisition Parameter Table 4

FieldActivityID	MGL2204
Acquisition_sequence(s)	Seq 7, 13, 15, & 18
ReceiverType	OBS
SourceType	Airgun
Acquisition System Name	OBS
Acquisition System Type	OBS
Seismic_Nav_System	C-Nav 3050 primary
Survey_datum	WGS84
Navigation Reference Point (primary GPS antenna)	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 330 calculated center of gravity) waterline
Antenna(NRP)_to_source	230 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	Applicable to multi-streamer MCS only
Near_Channel_Number	N/A
Cable_depth	N/A
Number_sources	1
Sub-arrays_per_source	4
Flipflop_shooting (dual source alternating)	False
Source_separation	Applicable to flipflop (dual source alternating) only
Sub-array_separation	6.0 m
Source_volume	6600 cubic inches
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_element_number	36 + 4 spare
Source_depth	12 m
Shot_control	Distance
Shot_Interval	50 m
Sample_interval	N/A
Record_length	N/A
Compass_birds	N/A
Recording_delay	False
Active_tail_buoy	False
Multiple_ships	False

Acquisition Parameter Table 5

FieldActivityID	MGL2204
Acquisition_sequence(s)	Seq 20 - 47
ReceiverType	MCS/OBS
SourceType	Airgun
Acquisition System Name	Sercel Seal 408/OBS
Acquisition System Type	MCS/OBS
Seismic_Nav_System	C-Nav 3050 primary
Survey_datum	WGS84
Navigation Reference Point (primary GPS antenna)	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 330 calculated center of gravity) waterline
Antenna(NRP)_to_source	240 m
Source_to_Near_Channel	209.7
Number_of_channels_recorded	1200
Number_of_cables	1
Number_of_channels_each_cable	1200
Channel_length	12.5 m
Cable_length	15K
Cable_spacing	Applicable to multi-streamer MCS only
Near_Channel_Number	1
Cable_depth	12 m
Number_sources	1
Sub-arrays_per_source	4
Flipflop_shooting (dual source alternating)	False
Source_separation	Applicable to flipflop (dual source alternating) only
Sub-array_separation	6.0 m
Source_volume	6600 cubic inches
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_element_number	36 + 4 spare
Source_depth	12 m
Shot_control	Distance
Shot_Interval	50 m
Sample_interval	2 ms
Record_length	18 s
Compass_birds	52
Recording_delay	False
Active_tail_buoy	True
Multiple_ships	False

Acquisition Parameter Table 6

FieldActivityID	MGL2204
Acquisition_sequence(s)	Seq 48 - 57
ReceiverType	MCS/OBS
SourceType	Airgun
Acquisition System Name	Sercel Seal 408/OBS
Acquisition System Type	MCS/OBS
Seismic_Nav_System	C-Nav 3050 primary
Survey_datum	WGS84
Navigation Reference Point (primary GPS antenna)	Fore/Aft+29.5 m, Stb/pt +0.00 m, vertical +16.9 m Keel, centerline, ~frame 42 (Seapath 330 calculated center of gravity) waterline
Antenna(NRP)_to_source	240 m
Source_to_Near_Channel	162.63
Number_of_channels_recorded	528
Number_of_cables	1
Number_of_channels_each_cable	528
Channel_length	96 channels at 6.25, and 432 channels 12.5 m
Cable_length	6000 m
Cable_spacing	Applicable to multi-streamer MCS only
Near_Channel_Number	1
Cable_depth	6 m
Number_sources	1
Sub-arrays_per_source	2 (array 1 & 2)
Flipflop_shooting (dual source alternating)	False
Source_separation	Applicable to flipflop (dual source alternating) only
Sub-array_separation	6.0 m
Source_volume	3300 cubic inches
Source_pressure	2000 psi nominal
Source_make,model	Bolt 1500LL & 1900LL
Source_element_number	36 + 4 spare
Source_depth	6 m
Shot_control	Distance
Shot_Interval	25 m
Sample_interval	1 ms
Record_length	10 s
Compass_birds	21
Recording_delay	False
Active_tail_buoy	True
Multiple_ships	False

Physical Configuration

The towing configuration for the air guns, streamers, antennas, and in-water offsets are detailed in the document titled *MGL2204_Offsets_Source_Only.xls*, *MGL2204_Offsets_MCS_9000m_Streamers.xls*, and *MGL2204_Offsets_MCS_6000m_Streamers.xls*

Orca

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

Seispos

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

VI. RV Langseth Gravity Tie Information

Please refer to the documents located under MGL2204/docs/gravity_tie for detailed records.

VII. Archive Contents

MGL2204/docs	Cruise documents
MGL2204/docs/elog	Cruise elog
MGL2204/docs/gravity_tie	Gravity Tie information
MGL2204/docs/map	Cruise maps, track map
MGL2204/docs/offsets	Vessel/sensor offsets
MGL2204/docs/operations/	Operations documents
MGL2204/docs/operations/Daily_Reports	Cruise Daily Reports
MGL2204/docs/operations/NavLogs	Orca Nav logs
MGL2204/docs/operations/ObsLogs	MCS/Source logs
MGL2204/docs/MGL2204_B15_line_log_multi_channel_seismics	Master line log table
MGL2204/docs/MGL2204_SEAL408_line_configuration_by_sequence	Seismic configuration log
MGL2204/docs/MGL2204_Expendable_Drops_Complete	XBT log
MGL2204/docs/tapelogs	Seal 408 line logs
MGL2204/docs/permits	Associated permitting
MGL2204/docs/waypoints	Waypoint files
MGL2204/docs/personnel	Rosters, org charts etc.
MGL2204/docs/reports	Associated reports
MGL2204/docs/reports/MGL2204_DataReport_v1.0.doc	This file
MGL2204/docs/offsets/MGL2204_Offsets_MCS.xls	Vessel/sensor offsets
MGL2204/docs/screencaps	Screen captures
MGL2204/processed	Processed data
MGL2204/processed/knudsen	Knudsen segy
MGL2204/processed/reflex	Orca reflex files
MGL2204/processed/obsip	OBS Shot log files
MGL2204/processed/seispos	Seispos UKOOA P190s
MGL2204/processed/seispos_processing_databases	P190 backup database
MGL2204/processed/svp	Sound velocity profiles
MGL2204/raw	Raw data
MGL2204/raw/adcp	Raw ADCP data
MGL2204/raw/knudsen	Raw Knudsen data
MGL2204/raw/MarkeyWinch	DESH-5 winch data
MGL2204/raw/multibeam	Raw EM122 data
MGL2204/raw/serial	Underway serial data
MGL2204/raw/Orca/P1 (incomplete set)	Orca underway p190
MGL2204/raw/Orca/P2	Orca UKOOA p294
MGL2204/raw/XBT	Raw XBT data

VIII. 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. mmmmm, a, ddm. mmmmm, a, x, xx, x.x, xx.xx, M, xx.xx, M, x.x, xyy*hh

\$GPGGA Sentence Fields

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

CNAV 3050 GPS receiver data

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

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

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

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

\$GPVTG Sentence Fields

Item	Definition	Units
xxx.x	Course over ground (COG)	Degrees from True North
T	Indicates course relative to True North	n/a
M	COG	Degrees from Magnetic North
m.mm	Speed over ground (SOG)	Nautical miles per hour (knots)
N	Indicates that the speed over ground is in knots	n/a
n.nn	SOG	km/h
K	Indicates that the SOG is in km/h	n/a
*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.decimal.
ddmm.mmmmm	Latitude	Degrees/Minutes.decimal.
a	Direction of Latitude N = North S = South	n/a
ddmm.mmmmm	Longitude	Degrees/Minutes.decimal
a	Direction of Longitude E = East W = West	n/a
x	GPS Quality indicator 0 = fix not valid 1 = GPS Autonomous fix 2 = GcGPS Corrected Fix	n/a
xx	Number of GPS satellites used in solution fix	n/a
x.x	Horizontal Dilution of Precision (HDOP)	n/a
xx.xx	C-NAV GPS receiver antenna altitude reference to Mean Sea Level (MSL)	n/a
M	Altitude units--M indicates meters	n/a
xx.xx	WGS-84 Geoidal separation distance from MSL based on the NIMA/NASA EGM96 15-minute (Earth Gravity Model)	Meters
M	Geosoidal separation units--M indicates meters	n/a
x.x	Age of GcGPS corrections used in solution fix	n/a
xyy	C-NAV GPS receiver reference identification	x is downlink satellite communication beam in use yy is the GPS correction signal mode/type being used
*hh	Checksum (hexadecimal representation) followed by CRLF terminator pair	n/a

EM122 Center Beam Depth

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

The EM122 outputs serial data in the following formats:

- KIDPT - Depth below transducer

\$KIDPT,x.x,x.x,hh.h*hh

SDDPT sentence format

Item	Definition	Units
x.x	Water depth	meters
x.x	Offset from transducer; positive means distance from transducer to water line, negative means distance from transducer to keel	meters
hh.h* hh	Checksum	n/a

Furuno GC80 Gyroscope data

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

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

\$PTKM,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

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 yy.yyyyyy vv.vvvvvv www.wwwwww dddd.d llllllllllll
```

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
llllllllllll	linename	n/a

POS/MV Inertial Navigation System

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

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

\$INHDT, x.x, T*hh

\$INHDT-Heading - True data

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

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

\$INVTG-Course over ground and Ground speed data

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

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

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

\$INGST-GPS pseudorange noise statistics

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

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 330 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, hhhmmss.sss, llll.lllll, a, yyyyyy.yyyyyy, 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.lllll	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.yyyyyy	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	0 to 99.9	Seconds

	corrections in records since last RTCM-104 message.		
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

DS 80 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

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

Vaisala Ultrasonic Meteorological Station Data
The meteorological data from the Vaisala 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

IX. Log file(s) Descriptive

BirdLogs

The directory /docs/operations/BirdLogs/ contains meta-data (when logged) for the Digicourse compass/cable levelers (birds). Attributes (when logged) are “fin angle”, “depth”, and “battery”.

Daily_Reports

The directory /docs/operations/Daily_Reports/ contains the daily production report compiled by the CSO.

GunLogs

The directory /docs/operations/GunLogs/ contains source errors/changes in “source only” operations.

NavLogs

The directory /docs/operations/NavLogs/ contains line logs for the Orca Integrated Navigation System on a sequence by sequence basis.

Seismic_Support_Plan

The directory /docs/operations/Seismic_Support_Plan/ contains all of the revisions of the plan which details the intended survey activity.

Seal_Report

The directory /docs/operations/Seal_report/ contains sequence by sequence logs for the Seal408 MCS system detailing critical attributes ie: file number, shotpoint, source volume, etc.

Standing_orders

The directory /docs/operations/Standing_orders/ contains watch-stander duties and responsibilities documents and log syntax documentation.

StreamerSheets

The directory /docs/operations/StreamerSheets/ contains serial number and configuration documentation for each streamer deployed during the cruise.