LMG0306

Cruise Data Report

Sep 22 – Oct 5, 2003

Table of Contents

Introduction

The LMG data acquisition systems continuously log data from a suite of instrumentation throughout the cruise. This document describes the format of that data and its location on the distribution CDs. It also contains important information that describes how this data was processed and points out instrument failures or other known problems with acquisition.

The data collected during this cruise is distributed on a CD-ROM written in ISO9660 level-1 format. This data format has very strict requirements on filenames and organization. However, it is readable by virtually every computing platform.

All of the data has been archived with the Unix “tar” command and/or compressed using Unix “gzip” compression. Tar files have a “.tar” extension and Gzipped files have a “.gz” extension. Tools are available on all platforms for uncompressing and de-archiving these formats. On Macintosh, Stuffit Expander with DropStuff will open a tar archive and uncompress gzipped and Unix compressed files. For Windows9X, WinZip, a shareware utility included on this CD (remember, it is shareware) will open these files.

IMPORTANT: Read the last section in this document, Acquisition Problems and Events, for important information that may affect the processing of this data.

Archive Data Extraction

It is often useful to know exactly how an archive was produced when expanding its contents. Tar files were created using the following commands:

```
tar cvLf archive-file files-to-be-archived
```

To create a list of the files in the archive:

```
tar tvf  archive-file  > contents.list
```

To extract the files from the archive:

```
tar xvf  archive-file file(s)-to-extract
```

G-zipped files will have a ".gz" extension on the filename. These files can be decompressed after de-archiving, using:

```
gunzip filename.gz
```

CD Directory Structure

ADCP/
- Pingdata
- Gentoo

CAL/
- SVP_CALS.TAR
- TSG_CALS.TAR
- MET_CALS.TAR

ISOBARS/
- Isobars.tar

JGOF/
- lmgjgof.tar

PCO2/
- lmgpco2.tar

QC_PLOTS/
- lmgqc.tar

REPORT/
- report.doc
- report.html
- report.txt

RVDAS/

Poseidon/
- lmguw.tar
- lmgnav.tar

Cyclone/
- lmguw.tar
- lmgnav.tar
- lmgjgof.tar
- lmgpco2.tar
- lmgqc.tar

SALTS/
- SB_Salt.*

TCO2/
- TCO2_Log.bmp

UTILITY/
- Winzip
- Stuffit Expander

XBT/
- DAT.ZIP
- EFILES.ZIP
- SFILES.ZIP
- NAV.ZIP
- LOG.ZIP
- XBTLog.*

XCTD/
- edf.zip
- rdf.zip
- XCTDLog.*

Distribution Contents

ADCP

Adcp/

The ADCP data set is broken up into files representing 24 hours of data collection. The files are named pingdata.xxx (xxx representing a day number). Note that these extensions do NOT represent Julian day numbers. Please refer to the file's creation date.

Some ADCP data is also transmitted to RVDAS. East and North vectors for ship's speed relative to the reference layer and ship's heading are archived in the navigational data section of RVDAS.

Calibration

Cal/

The tar files in the Cal directory contain images of calibration sheets for each of the following systems: Sound Velocity Probe, Meteorological System, and Underway System

Isobar Charts

Isobars/

Analysis of mean sea level pressure from the National Center for Environmental Prediction's Medium Range Forecast Model. Updated every 12 hours.

Data and Science Report

Report/

Copies of this report in MS Word, HTML, and text formats. The weekly science reports in text format may be included upon request of the Principal Investigator.

QC Plots

Postscript files of data stored each day on RVDAS for quality control analysis during the cruise. There are 3 types of files, named metXXX.ps, navXXX.ps, and oceanXXX.ps, where XXX is represents the Julian day. Met files are a summary of the data from the meteorological instruments, Nav files are a summary of navigational data, and Ocean files are a summary of the underway seawater and bathymetry data.

XBT

XBT/

During the cruise Expendable Bathythermographic (XBT) probes were used to obtain water column temperature profiles. The data files from these launches are included.

XCTD

XCTD/

During the cruise, Expendable Conductivity Temperature Depth (XCTD) probes were used to obtain water column conductivity and temperature profiles. The data files from these launches are included.

JGOFS Data Set

JGOF/

The JGOFS data set consists of a single file produced each day named jg<julian_day>.dat.gz where <julian_day> is the day the data was acquired. The ".gz" extension indicates that the individual files are compressed before archiving. The daily file consists of 22 separate columnar fields in text format, which are described below. The JGOFS data set is obtained primarily by applying calibrations to raw data and decimating to whole minute intervals. However, several fields are derived measurements from more than a single raw input. *Note: Null, unused, or unknown fields are filled with 9's in the JGOFS data.*

Additionally, 3 separate QC plots are generated daily by the ET using the JGOFS data set. These plots include TSG and Bathymetry data, meteorological data, and navigation data. The files are called ocean<julian_day>.ps, met<julian_day>.ps, and nav<julian_day>.ps respectively.

Field	Data	Units
01	GMT date	dd/mm/yy
02	GMT time	hh:mm:ss
03	PCOD latitude (negative is South)	Ddd.dddd
04	PCOD longitude (negative is West)	Ddd.dddd
05	Ships speed	Knots
06	GPS HDOP	-
07	Gyro Heading	Degrees (azimuth)
08	Course over ground	Degrees (azimuth)
09	Mast PAR	μEinsteins/meters^2 sec
10	Sea surface temperature	°C
11	Not used	-
12	Sea surface salinity	PSU
13	Sea depth (uncorrected, calc. sw sound vel. 1500 m/s)	meters
14	True wind speed (port windbird)	meters/sec
15	True wind direction (port windbird)	degrees (azimuth)
16	Ambient air temperature	°C
17	Relative humidity	%
18	Barometric pressure	mBars
19	Sea surface fluorometry	volts (0-5 FSO)
20	Not used	-
21	PSP	W/m^2
22	PIR	W/m^2

RVDAS

rvdas/

RVDAS (Research Vessel Data Acquisition System) was developed at Lamont-Doherty Earth Observatory of Columbia University and has been used on the R/V Maurice Ewing for several years. It was adapted for use on the Nathaniel B. Palmer and her sister ship, the R/V Laurence M. Gould.

Below you will find detailed information on the data included.

NOTE:

When we were at 68W and we started up the systems on the southbound leg, Poseidon would not log the TSG data. Several attempts were made to get the logging working properly but without success. The TSG logging on Poseidon only work if you started a Kermit session on the TSG port then start up the logger. However this caused corruption in the data files. Cyclone was logging the TSG data fine. So for the southbound leg you may want to compare the two data sets. On the Northbound leg Poseidon logged the TSG just fine. The time on Cyclone was off at the end of the cruise, it was 10 minutes and 33 seconds slower the Poseidon. Southbound leg JGOFs and QC plots were generated with the TSG data from Cyclone.

Be sure to read the "Significant Acquisition Events" section below for important information about data acquisition during this cruise.

Meteorological and Light Data

Measurement	File ID	Collect. Status	Rate	Instrument
Air Temperature	lmet	continuous	1 sec	R. M. young 41372VC
Relative Humidity	lmet	continuous	1 sec	R. M. young 41372VC
Wind Speed/Direction	lmet	continuous	1 sec	R. M. young 5106
PIR (LW radiation)	lmet	continuous	1 sec	Eppley PIR
PSP (SW radiation)	lmet	continuous	1 sec	Eppley PSP
Photosynthetically-Available Radiation	lmet	continuous	1 sec	BSI QSR-240
Barometer	lmet	continuous	1 sec	R. M. young 61201

Navigational Data

Measurement	File ID	Collect. Status	Rate	Instrument
Attitude GPS	lash	continuous	1 sec	Ashtec ADU-2
P-Code GPS	lpcd	continuous	1 sec	Trimble 20636-00SM
Gyro	lgyr	continuous	0.2 sec	Anschutz Gyro
Trimble GPS	tgps	continuous	1 sec	NT200

Geophysical Data

Measurement	File ID	Collect. Status	Rate	Instrument
Bathymetry	lknu	variable	Varies	Knudsen 320B/R

Oceanographic Data

Measurement	File ID	Collect. Status	Rate	Instrument
Salinity	ltsg	continuous	15 sec	SeaBird 21
Sea S Temperature	ltsg	continuous	15 sec	SeaBird 3-01/S
Fluorometry (analog)	ltsg	continuous	15 sec	Turner 10-AU-005
ADCP	ladc	continuous	1 sec	RD Instruments

Data File Names and Structures

RVDAS data is divided into two broad categories, ***Underway*** and ***Navigation***. The groups are abbreviated "uw" and "nav". Thus, these two tar files, lmguw.tar and lmgnav.tar exist under the top-level rvdas directory. The instruments are broken down as shown. Each data file is g-zipped to save space on the distribution. Not all data types are collected everyday or on every cruise.

RVDAS data files are named following the convention: [FileID].dDDD.

- The FileID is a 4-character code representing the system being logged, for example: lmet (for meteorology)
- DDD is the Julian day of the data collection

Underway Data	File ID
Meteorolical	lmet
Knudsen	lknu
Thermosalinograph	ltsg
ADCP	ladc
Sound Velocity Probe	lsvp

Navigation Data	File ID
Gyro Compass	lgyr
P-CODE GPS	lpcd
Ashtech ADU2 GPS	lash
Trimble NT2100 GPS	tgps
PCO2 System	lpco

Data is received by the RVDAS system via RS-232 serial connections. The data files that comprise the rvdas data set are described below. A time tag is added to each line of data received and the data is written to disk.

```
YY+DDD:HH:MM:SS.SSS [data stream from instrument]
```

Where, YY: two-digit year, DDD: Julian Day, HH: 2 digit hours, MM: 2 digit minutes SS.SSS: seconds. All times are UTC.

The delimiters used to separate fields in the raw data files are usually spaces and commas, but other delimiters are used (::, =, @) and occasionally there is no delimiter. Care should be taken when reprocessing the data that the fields separations are clearly understood. An example data

lknu

```
99+099:00:18:19.775 hf,305.2,lf,304.3
```

Field	Data	Units
1	RVDAS Time Tag	
2	hf – high frequency flag (12 kHz)	
3	high fequency depth	meters
4	lf – low frequency flag (3.5 kHz)	
5	low frequency depth	meters

lmet

```
02+314:23:59:50.067 01.2 047 028 01.3 063 042 0988.8 001.7 084 -000.2192 0000.9358 0025.5875
```

Field	Data	Units
1	RVDAS Time Tag	
2	Port Wind Speed	m/s
3	Port Wind Direction	deg
4	Port Wind Direction (standard deviation)	deg
5	Starboard Wind Speed	m/s
6	Starboard Wind Direction	deg
7	Starboard Wind Direction (standard deviation)	deg
8	Barometer	millibars
9	Temperature	°C
10	Relative humidity	%

Field	Data	Units
11	PSP (long wave radiometer)	Volts
12	PIR (short wave radiometer)	Volts
13	PAR (photo-synthetically available radiation, 400 - 700 nm)	Volts

ltsg

```
02+310:23:57:30.200        8542    -1.2580    34.1740    -1.2030      3.435      0.349  27.361205
```

Field	Data	Units
1	RVDAS Time Tag	
2	Scan number	
3	Internal water temperature	°C
4	Salinity	PSU
5	External water temperature	°C
6	Transmissometer signal	Volts
7	Fluorometer signal (analog)	Volts
8	Conductivity	mS/cm

lpco

```
02+319:23:59:13.748 2002319.99851    7154.27     26.49    1033.6     325.79      6.74     329.3
53.76    0   Equil
```

Field	Data	Units
1	RVDAS Time Tag	
2	Julian date file string	Julian
3	IR voltage reading	mV
4	Cell temperature	°C
5	Barometer	millibars
6	VCO2	mL
7	Equilibrator temperature	°C
8	PCO2	millibars
9	Gas flow	mL/min
10	Solenoid position ID	number
11	Measured gas	name

lsvp

```
00+348:01:59:52.128  1539.40
```

Field	Data	Units
1	RVDAS Time Tag	
2	Sound velocity	m/s

ladc

```
00+019:23:59:59.099 $PUHAW,UVH,-1.48,-0.51,250.6
```

Field	Data	Units
1	RVDAS Time Tag	
2	$PUHAW	

Field	Data	Units
3	UVH (E-W, N-S, Heading)	
4	Ship Speed relative to reference layer[1] velocity[2], East vector	knots
5	Ship Speed relative to reference layer[1] velocity[2], North vector	knots
6	Ship heading	degrees

[1]The reference layer is an average velocity measured in a number of depth "bins". On the LMG, the bins are eight meters deep and bins 3-10 define the reference layer. Hence, the reference layer is the water column from 16-80 meters beneath the ship.

[2]The speed ouput is water velocity relative to the ship's hull and is therefore opposite of the actual movement of the ship. For example, if the ship's heading is due north, the North/South reference layer velocity is likely to be negative (southerly).

lash

ATTD: Attitude Data

```
01+081:00:00:00.806 $PASHR,ATT,345605.0,165.03,+001.86,-01.96,0.0018,0.0173,0*22
```

Field	Data	Units
1	RVDAS Time Tag $PASHR	
2	ATT	
3	GPS Time sec. of the week	seconds
4	heading (rel. to true North)	degrees
5	pitch	degrees
6	roll	degrees
7	Measuremnet RMS error	meters
8	Baseline RMS error	meters
9	attitude reset flag	

```
01+081:00:00:00.966 $GPGGA,235952.00,6051.7937,S,06030.2175,W,1,08,01.0,+00068,M,,M,,*79
```

Field	Data	Units
1	RVDAS Time Tag $GPGGA	
2	UTC time at position	hhmmss.ss
3	Latitude	ddmm.mmm
4	North (N) or South (S)	
5	Longitude	ddmm.mmm
6	East (E) or West (W)	
7	GPS quality (1=GPS 2=DGPS)	
8	Number of GPS satellites used	
9	HDOP	
10	Antenna Height	meters
11	M for Meters	
12	Geoidal height	meters
13	M for meters	
14	age of diff. GPS data	sss
15	differential reference station ID	aaaa

lgyr

```
02+315:23:59:58.194 $PASVW,00.1,A*1D
02+315:23:59:58.414 $IIVHW,287.7,T,,M,,N,,K*71
02+315:23:59:58.616 $HEHDT,287.7,T*25
02+315:23:59:58.821 $HEROT,001.6,A*2C
```

```
02+315:23:59:58.984 $HCHDT,,T*07
```

HDT: True Heading

```
01+083:00:00:02.893 $HEHDT,246.3,T*2C
```

Field	Data	Units
1	RVDAS Time Tag $HEHDT	
2	Heading XXXXX = ddd.d	degrees
3	T flag for true heading, checksum	

ROT: Rate of Turn

```
01+083:00:00:03.093 $HEROT,-006.3,A*03
```

Field	Data	Units
1	RVDAS Time Tag $HEROT	
2	Rate of turn	degrees/min
3	Status: A = data valid, checksum	

tgps

GGA: Global Positioning Fix Data

```
00+040:00:00:00.985 $GPGGA,000003,6139.961,S,05949.422,W,1,6,001.64,-00036,M,00000,M,,
```

Field	Data	Units
1	RVDAS Time Tag $GPGGA	
2	Latitude in degrees with decimal minutes	ddmm.mmm
3	North (N) or South (S)	
4	Longitude in degrees with decimal minutes	ddmm.mmm
5	East (E) or West (W)	
6	GPS quality (1=GPS 2=DGPS)	
7	Number of GPS satellites used	
8	Horizontal dilution of precision (HDOP)	
9	Antenna height above/below mean-sea-level (geoid)	meters
10	Units for antenna height (M = Meters)	
11	Geoidal Separation[1]	
12	Units for Geoidal Separation (M = Meters)	meters
13	Age of differential GPS data, number of seconds since last SC104 Type 1 or 9	
14	Differental reference station ID	

[1]Geoidal Separation: the difference between the WGS-84 earth ellipsoid and mean-sea-level (geoid). A negative value represents mean-sea-level below ellipsoid.

GLL: Geographic Position – Latitiude/Logitude

```
00+040:00:00:00.065 $GPGLL,6139.96,S,05949.42,W,000002,A
```

Field	Data	Units
1	RVDAS Time Tag $GPGLL	
2	Latitude	ddmm.mmm
3	North (N) or South (S)	
4	Logitude	ddmm.mmm
5	East (E) or West (W)	
6	UTC of position	hhmmss.ss

Field	Data	Units
7	Status: A = Data Valid	

VTG: Track Made Good and Speed over Ground

```
00+040:00:00:00.213 $GPVTG,161,T,149,M,009.6,N,017.8,K
```

Field	Data	Units
1	RVDAS Time Tag $GPVTG	
2	Track, degrees true	degrees
3	T flag for True	
4	Track, degrees magnetic	degrees
5	M flag for Magnetic	
6	Speed over Ground	knots
7	N flag for Knots	
8	Speed over Ground	kmhr
9	K flag for km/hr	

VHW: Speed Through Water and Heading

```
00+040:00:00:00.212 $GPVHW,246,T,234,M,012.3,N,022.8,K
```

Field	Data	Units
1	RVDAS Time Tag $GPVHW	
2	Heading, degrees True	degrees
3	T flag for True	
4	Heading, degrees Magnetic	degrees
5	M flag for Magnetic	
6	Speed through water	knots
7	N flag for Knots	
8	Speed through water	km/hr
9	K flag for km/hr	

ZDA: Time and Date

```
00+040:00:00:00.285 $GPZDA,000002,09,02,2000,00,00
```

Field	Data	Units
1	RVDAS Time Tag $GPZDA	
2	UTC time	hhmmss.ss
3	Day: 01 – 31	dd
4	Month: 01 – 12	mm
5	Year	yyy
6	Local time zone description[1], 00 +/-13 hrs	
7	Local time zone minutes description, same sign as local hours	

[1]Zone description is the number of whole hours added to local time to obtain GMT, values are negative for East longitudes.

BWC: Bearing and Distance to Waypoint

```
00+040:00:00:00.865 $GPBWC,000003,6209.70,S,05824.00,W,127.2,T,115.3,M,050.1,N,014
```

Field	Data	Units
1	RVDAS Time Tag $GPBWC	

Field	Data	Units
2	UTC of bearing	hhmmss.ss
3	Destination waypoint latitude in degrees, decimal minutes	ddmm.mmm
4	Hemisphere Flag: N or S	
5	Destination waypoint longitude in degrees, decimal minutes	ddmm.mmm
6	Hemisphere Flag: E or W	
7	Bearing, degrees true	degrees
8	T flag for True	
9	Bearing, degrees magnetic	degrees
10	M flag for Magnetic	
11	Distance to waypoint in nautical miles	nm
12	N flag for Nautical Miles	
13	Waypoint ID	

lpcd

GGA: GPS Position Fix – Geoid/Ellipsoid

```
00+019:23:59:59.301 $GPGGA,235958.409,6849.6944,S,13712.8472,W,1,06,1.2,092.4,M,047.3,M,,*67
```

Field	Data	Units
1	RVDAS Time Tag $GPGGA	
2	UTC time at position	hhmmss.sss
3	Latitude	ddmm.mmm
4	North (N) or South (S)	
5	Longitude	ddmm.mmm
6	East (E) or West (W)	
7	GPS quality (1=GPS 2=DGPS 3=P-CODE)	
8	Number of GPS satellites used	
9	HDOP	
10	Antenna Height	meters
11	M for Meters	
12	Geoidal height	meters
13	M for meters	
14	Null field	
15	Checksum	

GLL: GPS Latitude/Longitude

```
00+019:23:59:59.381 $GPGLL,6849.6944,S,13712.8472,W,235958.409,A*35
```

Field	Data	Units
1	RVDAS Time Tag $GPGLL	
2	Latitude	degrees
3	North or South	
4	Longitude	degrees
5	East or West	
6	UTC of position	hhmmss.sss
7	staus of data (A = valid)	
8	Checksum	

VTG: GPS Track and Ground Speed

```
00+019:23:59:59.382 $GPVTG,238.7,T,182.3,M,001.8,N,003.3,K*41
```

Field	Data	Units
1	RVDAS Time Tag $GPVTG	
2	Heading	degrees
3	degrees True (T)	
4	Heading	degrees
5	degrees magnetic (M)	
6	Ship speed	knots
7	N = knots	
8	Speed	km/hr
9	Checksum	

LMG Sensors

Shipboard Sensors

Sensor	Description	Serial #	Cal. Date	Status
Port Anemometer	R.M. Young 105106	WM35061	06/26/03	collect
Stbd Anemometer	R.M. Young 105106	WM28392	06/26/03	collect
Barometer	R.M. Young 61201	BP01150	02/26/03	collect
Humidity/Wet Temp	R.M. Young 41372LC	06719	05/22/03	collect
Mast PAR	BSI QSR-240	6393	10/31/01	
Pyranometer	Eppley PSP	28933F3	02/19/03	collect
Pyrgeometer	Eppley PIR	28903F3	02/19/03	collect
TSG	SeaBird SBE21	1577	11/10/01	collect
TSG Remote Temp	SeaBird 3-01/S	1620	03/06/03	collect
Fluorometer	Turner 10-AU-005 Lamp: daylight 10-045, reference filter: 10-052, emission filter: 10-051, excitation filter: 10-050.	6592RTX		collect
Transmissometer	WET Labs 9707017	CST-168R	04/08/03	collect
P-Code GPS	Trimble 20636-00 (SM)	0220035265		CIV
Bathymetry	Knudsen 320B/R			collect

Acquisition and Processing Information

Processing Specifics

Refer to the instrmnt.cof file along with the specific instrument calibration sheets, both located in the Cal/ directory of the data distribution, for information on how the RVDAS data was collected and processed.

Errors and Events

This section lists all significant events and known problems with acquisition during this cruise including instrument failures, data acquisition system failures, and other factors affecting this data set.

Date (Julian)	Time (GMT)	Event	Location
265	18:27	Left Punta Arenas	Left Punta Arenas
266	09:45	Start logging the TSG, MET, Ashtech, Pcode, Trimble, Gyro, SVP, Sonar ← TSG logger not working	68W
266	10:07	ADCP on and logging to try and fix the TSG logging	68W
266	10:20	PCO2 on and logging to try and fix the TSG logging	68W
266	14:32	Stop logging on Poseidon & Cyclone to try and fix the TSG logging	
266	15:03	Shutdown Cyclone	
266	15:09	Shutdown Poseidon	
266	15:40	PCO2 IR box was not on, turned on	
266	15:37	Restart TSG to try and fix the TSG logging ← could not get TSG logging properly on Poseidon, see RVDAS section	
266	16:39	Reset Ashtech	
266	17:08	Reset Ashtech	
267	14:04	Turned off bottom tracking on ADCP, forgot to turn off when we enter the Drake	
267	15:32	Turned TSG back on – It was turned off by accident	
269	16:24	Reset Ashtech	
269	19:10	Shut off Sonar, ADCP, TSG, and PCO2	@ Palmer Station
273	12:51	TSG turned back on, but the seawater ← for testing/troubleshooting on the logger	
274	15:26	Sonar and ADCP back on and logging	Left Palmer Station
274	15:34	Seawater on	Left Palmer Station
274	15:41	Seawater back off ← to Ice	Left Palmer Station
274	15:43	PCO2 system on	Left Palmer Station
274	15:48	TSG on and logging	Left Palmer Station

274	15:58	PCO2 and TSG off ← due to seawater pumps off because of Ice	
274	17:05	Seawater pumps back on	
274	17:06	PCO2 system back on	
274	17:10	TSG back on	
274	23:40	Turned water off to fluorometer to test setting with fluorocene strip	
275	01:23	Set Fluorometer Full Scale to 5	
275	16:08	Reset Ashtech	
275	16:18	Reset Ashtech	
277	21:01	Turned off ADCP and TSG	@ 68W
277	21:04	Turned off PCO2 sampling and ran standards	@ 68W
277	21:05	Seawater off	@ 68 W
277	21:06	Stopped logging Sonar, Pcode, Trimble, Ashtech, Gyro, MET, and SVP	@ 68 W