LMG 1501

LTER

Cruise Data Report

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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 may affect how this data is processed such as instrument failures or other known problems with acquisition.

The data collected during this cruise is distributed on a CD-ROM written in ISO9660 with Joliet extensions. This data format has somewhat 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All of the data has been archived with the Unix “tar” command and/or compressed using Unix “gzip” compression.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 Windows, WinZip, a shareware utility included on this CD (remember, it is shareware) will open these files.

In some cases to adhere to the ISO9660 format the .tar extension was removed. When we tarred the files then gzip the tar archive the name of the file became *File*.tgz. This name does not follow the 8.3 naming convention of the ISO9660 format. On Windows and Mac Platforms Winzip and Stuffit Expander handles this just fine. When they expand the *File*.gz the expanded file becomes *File*.tar, which both software packages can handle. On Unix platforms gunzip expands *File*.tgz but it does not append the .tar extension. So you may not recognize the file as a tar archive, but OS does recognize it as a tar archive. If you use the file command it will return saying it is a tar file. The below tar command will un-archive the file just fine.

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 cvf 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
```

DVD Directory Structure

Disc 1:

ADCP:
ADCP.tar

Cal:
LTER_CTD/
MOCNESS/
TMC_CTD/
UW/

Imagery:
Imag.tar

Logsheet:
AIR.pdf
Drifters.pdf
H2O.pdf
LTER_CTD.pdf
XBT.pdf

Maps:
LMG1501.jpg

Mocness:
LMG1501_Configs/
LMG1501_data/

Ocean:
ctd.tar
xbt.tar

process:
JGOF.tar
PCO2.tar
PROC.tar
QC.tar

Report:
REPORT.docx
REPORT.pdf

rvdas:
nav/
uw/

Utility:
Acrobat/
Winzip/

Waypoint:
waypoint.txt

Disc 1 (continued):

Science:
C-019 Data/
C-020/
C-045/
Ducklow Rads/
eLog/
MartinsonMoorings/
Plans of the day/
PRR_data/
Schofield Rads/
SedimentTraps/
Weekly science sit rep reports/

Distribution Contents

ADCP

/ADCP/

This directory contains a tar file of gentoo's proc directory, which contains a database of the averaged ping data, Matlab m-files used in processing the data, and daily graphs of the currents. For more information contact Teri Chereskin at tchereskin@ucsd.edu .

Calibration

/Cal/

Refer to the InstCoef.txt file along with the specific instrument calibration sheets, both located in this directory, for information on how the RVDAS data was collected and processed.

Imagery

/Imagery/

This directory contains things such as ice imagery, isobar charts, sat imagery, wave and wind images, and weather reports.

Logsheets

/logsheet/

This directory contains scanned paper log sheets in PDF format for various science of opportunity or projects or cruise related science, including such things as XBT's, XCTD's, air sample log sheets, oxygen system maintenance logs, etc.

Maps

/Maps/

This directory maps and mapping data generated by the ship's MCIS and automated scripts, usually in JPEG or PostScript format, plus any maps provided for this purpose by the on-board science party.

MOCNESS

1-meter and 10-meter

Mocness/

The MOCNESS data resides in the MOC1.gz and MOC10.gz archive for the 1-meter and 10-meter respectively. The data set from each cast is made up of three files. The filenames consist of the station number and an extension: .pro .raw or .tab. The type of data in each file is listed below.

.pro	processed data in space delimited tabular format
.raw	raw cast data in ASCII text format
.tab	statistical summary in space-delimited tabular format

Processed filename *.pro

This file contains the processed data for each tow, written in ASCII to disk in a simple configuration, which consists of:

Rows 1-5	header information about sensors and the tow
Row 6	the column headings (discussed below): time pres echo temp theta sal sigma angle flow hzvel vtvel vol net fluor ptran oxycurrent oxytemp oxygen lat lon
Succeeding rows	data for each column heading with each value separated by 2 spaces.

time	Julian day, hours and minutes expressed as decimal
pres	depth (m)
temp	temperature degrees C
theta	potential temperature, formulae from Fofonoff and Millard 1983
sal	salinity ppt
sigma	potential density, formulae from Fofonoff and Millard 1983
angle	angle 0-90
flow	flow counts 0000-9999
hzvel	horizontal velocity (knots)
vtvel	vertical velocity (m/min)
vol	seawater volume filtered (m3)
net	net number
fluor	fluorescence (0-5 volts)
ptran	extinction coefficient (0-5 volts)
oxycurrent	0-5 volts
oxytemp	0-5 volts internal to the probe
oxygen	dissolved oxygen (ml/l)
lat	latitude decimal degrees
lon	longitude decimal degrees

Raw filename *.raw

This file contains the raw data from the underwater unit. These “*.raw” files can be used in the playback mode to re-process the data (see page 33 MOCNESS instructions), and also serve as the backup in case there are problems with the processed data file.

For each tow, data is written (as it appears in the acquisition window) in ASCII to disk in a simple configuration, which consists of:

Rows 1-5	header information about sensors and the tow
Succeeding rows	raw data string formatted thusly: #MN- N1 N2 AA FFFF PPPPP PTPT TTTTTT CCCCCC BBB $GPGLL

The fields are as follows and are discussed individually below.

N1	net count, counts of left response switch, 00-99
N2	net count, counts of right response switch, 00-99
AA	net angle in degrees, 00-99
FFFF	flow counts, 0000-9999. Reset to 0000 with every net response or increment net # button command
PPPPP	pressure value, converted to decibars by the deck computer
PTPT	a decimal number derived from the temperature sensor in the pressure sensor which is used to improve the pressure calibration
TTTTTT	averaged SeaBird temperature period. The frequency from the SeaBird temperature sensor is measured and processed in the NCU to generate the value TTTTTT, a 6-digit decimal number. This number is scaled as follows: (frequency of the temp. sensor)=K/(TTTTTT) where K=1,258,291,200. Software in the deck computer uses this frequency value along with the individual sensor's calibration file to calculate temperature.
CCCCCC	averaged SeaBird conductivity period, handled exactly like the temperature frequency and the same scaling factor should be used
BBB	battery voltage (divide value by 10)
$GPGLL	latitude and longitude in decimal degrees

Tab filename *.tab

The statistical summary for a given *.pro file. For each net, the following parameters are included:

pmin,pmax,pavg	minimum, maximum and average depth of net
tmin,tmax,tavg	minimum, maximum and average temperature of net
smin,smax,savg	minimum, maximum and average salinity of net
amin,amax,aavg	minimum, maximum and average angle of net
spmin,spmax,spavg	minimum, maximum and average horizontal velocity (kt) of net
armin,armax,aravg	minimum, maximum and average vertical velocity (m/sec) of net
#obs	total number of observations while net was open
vol	total seawater volume filtered for net

Captured screens, filenames *.bmp

This file is bitmap image of the acquisition software captured at any point during a MOCNESS "flight". The files on this CD reflect the acquisition window at the end of each "flight", immediately prior to ending acquisition.

Ocean (CTD, XBT and XCTD)

/Ocean/CTD

The ctd data was collected and processed on a computer running Windows XP, using Seasave Win32 – Version 7.20 and SBE Data Processing – Version 7.21

For more information and software visit the web site at www.seabird.com.

/Ocean/CTD/Configs/

This directory contains the Seabird .xmlcon config file. This file contains information of which sensors where used and what freq or volt the where connected to.

/Ocean/CTD/Scripts/

This directory contains the batch file and psa files that we used for post processing the data. The data was processed with the standard seabird processing method. This is just a preliminary processing which was done to verify that the sensors were functioning properly during the cruise. The raw data should be re-processed using the pre and post cruise sensor calibrations.

/Ocean/CTD/Raw

This directory contains the raw file collected at each CTD cast, which is represented by a set of four files containing a bottle-firing file (.bl), a configuration file (.xmlcon), a data file (.hex) and a header file (.hdr). Casts are named with the following g501CCC.ext, where g is for the LMG, 501 is the cruise 05-01, CCC is the cast number. For example; the raw files associated with the Cast 1are: g501001.bl, g501001.con, g501001.dat, g501001.hdr. The raw data files(*.hex) are binary files.

/Ocean/CTD/Graphs

This directory contains graphical plots of each CTD cast.

/Ocean/CTD/Process

This directory contains the processed data files for each CTD cast, the processing method used is briefly described in the above section *CTD/Scripts/*. Also see the above section *CTD/Data/raw* for a description of the file naming convention used. Each processed cast is represented here by a set of ten files:

GXXXCCC.xmlcon	A copy of the configuration file for the cast.
GXXXCCC.cnv	The converted file for the whole cast.
GXXXCCC.ros	The rosette file that contains the scan lines for each bottle trip.
GXXXCCC.btl	The bottle file that contains the avg, standard deviation, min, and max for a select set of variables for each bottled fired during the upcast.
dGXXXCCC.cnv	The converted file for the down cast.
dGXXXCCC.asc	An ASCII formatted file for the down cast without a header.
dGXXXCCC.hdr	The header for the down cast.
uGXXXCCC.cnv	The converted file for the up cast.
uGXXXCCC.asc	An ASCII formatted file for the up cast without a header.
uGXXXCCC.hdr	The header for the up cast.

/Ocean/XBT

Contains a zip archive of XBT data generated for the Drake Transect by NOAA standard “AMVERSEAS” software. Non-Drake transect data may also be included, which will a combination of binary and ascii files generated by standard Sippican MK-21 software. The dataset includes the following files:

dat.zip The probe drop schedule and other configuration files.

efiles.zip The edited data files.

log.zip The log files for drop and GPS positioning.

nav.zip The navigation files.

sfiles.zip The raw data files.

*.pdf Scanned images of the paper log sheets.

/Ocean/XCTD

Expendable Conductivity, Temperature, and Depth (XCTD) digital probes were used to obtain water column temperature and Salinity profiles. The two files were created for each drop .RDF files contain the raw data, and the .EDF contain the exported ascii data.

Data and Science Report

/Report/

Copies of this report in MS Word, pdf, and text formats.

Science

/Science/

This directory, if populated, contains data specified by the on-board science party.

WAYPOINTS

/waypoint/

Contains the waypoint file used for the cruise; this is read by the DAS system and the selected waypoint is displayed on the CCTV system.

QC Plots

/process/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.

JGOFS Data Set

/Process/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	μg/l
20	Transmissometer	Volts (0-5)
21	PSP	W/m^2
22	PIR	W/m^2

pCO2-merged Data Set

/Process/PCO2/

```
00+346:23:58:20.672 2000346.9991 2398.4 1008.4 0.01 45.4 350.3 342.6 15.77 Equil -43.6826
173.1997 15.51 33.90 0.33 5.28 9.05 1007.57 40.0 14.87 182.44 -1
```

Field	Data	Units
1	RVDAS time tag	
2	pCO_2 time tag (decimal is fractional time of day)	yyyyddd.ttt
3	Raw voltage (IR)	mV
4	Cell temperature	°C
5	Barometer	MBar
6	Flow rate	ml / min
7	Concentration	ppm
8	pCO_2 pressure	microAtm
9	Equilibrated temperature	°C
10	Sea Water Temp	1 or 2 digits
11	Valve position	°C
12	Flow source (Equil = pCO_2 measurement)	text
13	RVDAS latitude	degrees
14	RVDAS longitude	degrees
15	TSG external temperature	°C
16	TSG 1 salinity	PSU
17	Fluorometer	V
18	RVDAS true wind speed	m/s
19	RVDAS true wind direction	degrees
20	Barometric Pressure	mBars
21	Uncontaminated seawater pump flow rate	l/min
22	Speed over ground	knots
23	Course made good	degrees
24	Oxygen	µM
25	TSG 2 internal temperature	°C
26	TSG 2 salinity	PSU
27	TSG 1 internal temperature	°C
28	H2O Input Source	-1 stern thrustor 0 moonpool

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. 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	lmwx	continuous	1 sec	R. M. young 41372VC
Relative Humidity	lmwx	continuous	1 sec	R. M. young 41372VC
Wind Speed/Direction	lmwx	continuous	1 sec	Gill Ultrasonic
PAR, (Photosynthetically-Available Radiation)	lmwx	continuous	1 sec	BSI QSR-240
Barometer	lmwx	continuous	1 sec	R. M. young 61201
GUV	lguv	continuous	1 sec	GUV2511
Port Ultrasonic Wind Speed/Direction	lmwx	continuous	1 sec	Gill Wind Observer II
PIR (LW radiation)	lmwx	continuous	1 sec	Eppley PIR
PSP (SW radiation)	lmwx	continuous	1 sec	Eppley PSP
Oxygen	lgo2	continuous	1 min	UCAR Oxygen system

Navigational Data

Measurement	File ID	Collect. Status	Rate	Instrument
Gyro	lgyr	continuous	0.2 sec	Meridian Bridgemate Gyro
Garmin GPS	lgar	continuous	1 sec	Garmin 17
Seapath GPS	Lsep	Continuous	1 sec	Seapath 330

Geophysical Data

Measurement	File ID	Collect. Status	Rate	Instrument
Bathymetry	lknu	variable	Varies	Knudsen Chirp 3260
Net Depth Sensor	lnds	variable	~1/3 sec	Omega PX-605
DUSH 11 Winch	lwn1	variable	varies	Markey DUSH 11
DUSH 5 Winch	lwn1	variable	varies	Markey DUSH 5
DUSH 4 Winch	lwn1	variable	varies	Markey DUSH 4
COM10 Winch	lwn1	variable	varies	Markey COM10

Oceanographic Data

Measurement	File ID	Collect. Status	Rate	Instrument
Salinity	utsg	continuous	1 sec	SeaBird 45
Sea Surface Temperature	Lrtm	continuous	1 sec	SeaBird 38
Fluorometry (digital)	ldfl	continuous	1 sec	Wetlab ECO
ADCP, Speed Log	ladc	continuous	1 sec	RD Instruments
Oxygen	loxy	continuous	1 sec	
PCO2	lpco2	continuous	2.5 min	

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: LMG[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
Meteorological - Cambell	lmwx
Knudsen	lknu
microTSG	utsg
Digital Remote Temperature	lrtm
Fluorometer – Wetlab ECO	ldfl
ADCP	ladc
Sound Velocity Probe	lsvp
GUV & PUV	lguv
PCO2 System	lpco
Oxygen	loxy
Wet Wall Flows	lsea
Winches: Dush4,5,&11	lwn1
Net Depth Sensor	lnds

Navigation Data	File ID
Gyro Compass	lgyr
Garmin 17 GPS	lgar
Seapath 330 GPS	lsep

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 field separations are clearly understood. An example data

lknu – Knudsen Chirp 3260 Sonar

```
14+002:19:07:04.648 3.5kHz,4000.92,1,12.0kHz,4001.12,1,1500,-57.343073,-63.750720
```

Field	Data	Units
1	RVDAS Time Tag	
2	3.5kHz – low frequency header	
3	LF - depth to surface	meters
4	LF – Depth Valid Flag	
5	12.0kHz – high frequency header	
6	HF - depth to surface	meters
7	HF – Depth Valid Flag	
8	Sound speed velocity	m/s
9	Latitude	Dec degrees
10	Longitude	Dec degrees

lnds – Net Depth Sensor

```
99+099:00:18:19.775 V01 00199.8
```

Field	Data	Units
1	RVDAS Time Tag	
2	V01 – Sensor 1	label
3	Depth	meters

lwn1 - Winches

```
08+033:11:27:50.673 RD,DUSH-5,00111.63,00000000,-0000012,1938
```

Field	Data	Units
1	RVDAS Time Tag	
2	Record Identifier, RD=Remote Data	
3	Winch Indentifier, DUSH-X where X is 4, 5, or 11	
4	Tension	lbs
5	Speed	Meters/minute
6	Payout	meters
7	Checksum	

lmwx - Campbell Meteorological DAS

```
08+034:13:52:14.216 PUS,A,356,002.15,M,+332.28,+000.97,60,08
```

Field	Data	Units
1	RVDAS Time Tag	
2	PUS tag – Port UltraSonic Anemometer	
3	Unit Identification, A-Z	
4	Port Wind Direction, degrees relative to Bow	deg
5	Port Wind Speed	m/s
6	Units, M=meters per second	
7	Sound Speed	m/s
8	Sonic Temperature	°C
9	Status, 0=ok, 60=Heating Enabled & ok, Other value mean a fault	
10	Check Sum	

```
08+034:13:52:14.216 SUS,A,356,002.15,M,+332.28,+000.97,60,08
```

Field	Data	Units
1	RVDAS Time Tag	
2	SUS tag – Starboard UltraSonic Anemometer	
3	Unit Identification, A-Z	
4	Port Wind Direction, degrees relative to Bow	deg
5	Port Wind Speed	m/s
6	Units, M=meters per second	
7	Sound Speed	m/s
8	Sonic Temperature	°C
9	Status, 0=ok, 60=Heating Enabled & ok, Other value mean a fault	
10	Check Sum	

```
08+034:13:52:14.454 MET,12.22322,44.25706,-75,-25,-363.6365,2.332982,-0.08215196,278.6845,
279.2192,854.6198
```

Field	Data	Units
1	RVDAS Time Tag	
2	MET tag	
3	Power Supply Voltage	Volts
4	Enclosure Relative Humidity	%
5	Air Temp	ºC
6	Air Relative Humidity	%
7	PAR	mVolts
8	PSP Thermopile	mVolts
9	PIR Thermopile	mVolts
10	PIR Case Temperature	°K
11	PIR Dome Temperature	°K
12	Barometer	mBars

Lsea – wet wall flows, transmissometer

```
12+004:12:01:04.438 WetLab_1,14.1,XMISS,3.098,V,0.000,0.000,0.000,-928.535,-
220.566,0.000,0.000,T,NAN,NAN,NAN,NAN,P,0,0,F,47.91811,0,6.815308,0,0,0,0,0,I,1,1,1,1
```

Field	Data	Units
01	RVDAS Time Tag	
02	WetLab_1	Text
03	Internal Temperature	°C
04	XMISS	Text
05	Transmissometer	V
06	V	Text
07	Double Ended Voltage 1	V
08	Double Ended Voltage 2	V
09	Double Ended Voltage 3	V
10	Voltage 1	V
11	Voltage 2	V
12	Voltage 3	V
13	Voltage 4	V
14	T	Text
15	Temperature 1	°C
16	Temperature 2	°C
17	Temperature 3	°C
18	Temperature 4	°C
19	P	Text
20	Pulse Counter 1	Number
21	Pulse Counter 2	Number
22	F	Text
23	Flow Counter 1	Number
24	Flow Counter 2	Number
25	Flow Counter 3	Number
26	Flow Counter 4	Number
27	Flow Counter 5	Number
28	Flow Counter 6	Number
29	Flow Counter 7	Number
30	Flow Counter 8	Number
31	I	Text
32	Digital Input 1	Number
33	Digital Input 2	Number
34	Digital Input 3	Number

Field	Data	Units
35	Digital Input 4	Number

utsg – microTSG, Thermosalinograph

For further information on this data, check www.seabird.com for SBE 45 MicroTSG Thermosalinograph

```
08+037:13:45:57.596   2.6470,  3.03853,  33.8129, 1459.351
```

Field	Data	Units
1	RVDAS Time Tag	
2	Internal water temperature	°C
3	Conductivity	S/m
4	Salinity	psu
5	Sound Velocity	m/s

lrtm – digital Remote Temperature

For further information on this data, check on www.seabird.com on SBE38 Digital Thermometer

08+037:13:47:17.841 2.2527

Field	Data	Units
1	RVDAS Time Tag	
2	External water temperature	°C

ldfl – Fluorometer, Wetlab ECO

```
08+037:13:55:08.434 99/99/99    99:99:99        0.00    2585    73      543
```

Field	Data	Units
1	RVDAS Time Tag	
2	Fluorometer Date	mm/dd/yy
3	Fluorometer Time	hh:mm:ss
4	Chlorophyll Signal	µg/l
5	Reference	λq
6	Counts – Chlorophyll Signal	Count
7	Thermistor	

lgo2 – Oxygen System

For further information on this data, please contact Britt Stephens at stephens@ucar.edu

```
12+301:22:35:30.558 81300.8 16.0 32.0 000.0 005.0 1.2589631 1.2379622 744.549 111.853 131.642 -
2.089 -2.448 723.594 002.50 086.43 099.74 002.77 000.97 050.65 0.000 001.19 065.59 039.48
1966.097 01.345 37.0171 37.8433 000.0 000.0 20.66 20.41 -92.0 28.66 37.44 42.33 37.80 47.95 0.0
01.88 0.0001711 0.0001712 0.0000747 0.0000725 02.657 02.678 -1 0.0000895 -043.94
```

Field	Data	Units
1	RVDAS Time Tag	
2	jsecoday - Seconds since midnight	
3	jselflag - 8 bit decimal value indicated selected gases	
4	jprgflag - 8 bit decimal value indicated purged gases	
5	jmfcflag - 8 bit decimal value indicated mass-flow controller states	
6	jgenflag - 8 bit decimal value indicated other parameters	
7	jfcv1 - voltage on Fuel Cell #1	
8	jfcv2 - voltage on Fuel Cell #2	
9	jpfcell - pressure in torr at fuel cells	

10	jlico2a - CO2 in ppm in Li7000 Cell A	
11	jlico2b - CO2 in ppm in Li7000 Cell B [CO2 MEASUREMENT]	
12	jlih2oa - H2O in ppt in Li7000 Cell A	
13	jlih2ob - H2O in ppt in Li7000 Cell B	
14	jlipb - pressure in torr at Li7000 Cell B	
15	flmfcset - mass-flow controller set voltage	
16	jfll1 - flow in sccm on Inlet Line #1	
17	jfll2 - flow in sccm on Inlet Line #2	
18	jfllt - flow in sccm on Long-Term reference cylinder	
19	jflcal - flow in sccm on selected Calibration cylinder	
20	jflwta - flow in sccm on selected Working Tank Cylinder	
21	jvsoset - purge line voltage-sensitive orifice set voltage	
22	jflpurge - flow in sccm on purge line	
23	jflwtb - flow in sccm on Working Tank line through sensors	
24	jflsp - flow in sccm on Span line through sensors	
25	jpfridge - pressure in torr inside fridge trap	
26	jtfridge - temperature in C inside fridge trap	
27	jtmpt - fuel-cell control temperature (thermistor) in C for MPT10000	
28	jtfcell - fuel-cell thermistor temperature in C	
29	jtach1 - rmp of fan inside Line #1 Inlet	
30	jtach2 - rmp of fan inside Line #2 Inlet	
31	jtcyl1 - temperature in C from cylinder box RTD #1	
32	jtcyl2 - temperature in C from cylinder box RTD #2	
33	jtchill - temperature in C from chiller RTD	
34	jtamb - temperature in C RTD near Analyzer Box electronics	
35	jtomega - Analyzer Box control temperature (RTD) for Omega CNi2332	
36	jtu4ch - temperature in C inside USB4CH 24-bit A/D box	
37	jtfcrtd - fuel-cell RTD temperature in C	
38	jtirga - temperature in C inside Li7000	
39	jliflags - Li7000 status flag	
40	jlirhsrc - Li7000 source/detector relative humidity	
41	jsdfcv1 - standard deviation of 1-Hz Fuel Cell #1 voltage	
42	jsdfcv2 - standard deviation of 1-Hz Fuel Cell #2 voltage	
43	jslfcv1 - slope of 1-Hz Fuel Cell #1 voltage	
44	jslfcv2 - slope of 1-Hz Fuel Cell #2 voltage	
45	jsdco2a - standard deviation of 1-Hz Li7000 Cell A CO2 in ppm	
46	jsdco2b - standard deviation of 1-Hz Li7000 Cell B CO2 in ppm	
47	posneg - flag indicating position of fuel-cell changeover valve	
48	jogdeltadiff - amplitude of 3-jog O2 difference-signal [O2 MEASUREMENT]	

loxy – Oxygen (Part of PCO2 system, separate from Oxygen System)

For further information on this data, contact Tim Newberger at ***tim.newberger@noaa.gov***

```
04+117:23:57:23.504 MEASUREMENT         3830     380  Oxygen:           309.95      Saturation:
83.48   Temperature:       -1.35      DPhase:            33.41      BPhase:            32.22
        RPhase:             0.00      BAmp:      262.09      BPot:      163.00      RAmp:
0.00    RawTem.:          694.92
```

Field	Data	Units
1	RVDAS Time Tag	
2-4	Measurement ID, Model Number, Serial Number	alphanumeric
5	Oxygen heading	text
6	Oxygen Reading	Raw numeric
7	Saturation heading	text
8	Saturation Reading	Raw numeric
9	Temperature heading	text
10	Water Temperature	ºC
11	Dphase heading	text
12	Dphase	Raw numeric
13	Bphase heading	text
14	BPhase	Raw numeric
15	Rphase heading	text
16	Rphase	Raw numeric
17	Bamp heading	text
18	Bamp	Raw numeric
19	Bpot heading	text
20	Bpot	Raw numeric
21	Ramp heading	text
22	Ramp	Raw numeric
23	RawTem heading	text
24	RawTemp	Raw numeric

lpco – PCO2 system

For further information on this data, contact Tim Newberger at ***tim.newberger@noaa.gov***

```
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	Gas flow	mL/min
7	VCO2 dry value	PPM
8	PCO2 wet/Delta value	PPM
9	Equilibrator Temperature from RTD	°C
10	Equilibrator Temperature from SBE-38	°C
11	Solenoid position ID	number
12	Measured gas	name

Lguv – Biospherical GUV

```
08+037:14:17:59.211 020608 141758 -.000099 1.307E0 7.24E0 1.316E1 2.609E1 3.285E1 3.505E1 8.075E-
2 38.993 17.985
```

GUV only

Field	Data	Units
1	RVDAS Time Tag	
2	GUV Computer Date	mmddyy
3	GUV Computer Time	hhmmss
4	Ed0Gnd - GUV	Volts
5	Ed0305 - GUV	$\mu W/cm^2nm$
6	Ed0313 - GUV	$\mu W/cm^2nm$
7	Ed0320 - GUV	$\mu W/cm^2nm$
8	Ed0340 - GUV	$\mu W/cm^2nm$
9	Ed0380 - GUV	$\mu W/cm^2nm$
10	Ed0395 - GUV	$\mu W/cm^2nm$
11	Ed0PAR - GUV	$\mu E/cm^2sec$
12	Ed0Temp - GUV	°C
13	Ed0VIn	Volts

GUV and PUV

Field	Data	Units
1	RVDAS Time Tag	
2	GUV Computer Date	mmddyy
3	GUV Computer Time	hhmmss
4	EdZGnd -PUV	Volts
5	EdZ305 -PUV	$\mu W/cm^2nm$
6	EdZ313 -PUV	$\mu W/cm^2nm$
7	EdZ320 -PUV	$\mu W/cm^2nm$
8	EdZ395 -PUV	$\mu W/cm^2nm$
9	EdZ340 -PUV	$\mu W/cm^2nm$
10	EdZPAR -PUV	$\mu E/cm^2sec$
11	LuZChl -PUV	$\mu E/srm^2sec$
12	EdZ380 -PUV	$\mu W/cm^2nm$
13	WTemp -PUV	°C
14	Depth -PUV	m
15	EdZTemp -PUV	°C
16	LuZTemp -PUV	°C
17	Tilt -PUV	Degrees
18	Roll -PUV	Degrees
19	Ed0Gnd - GUV	Volts
20	Ed0305 - GUV	$\mu W/cm^2nm$
21	Ed0313 - GUV	$\mu W/cm^2nm$
22	Ed0320 - GUV	$\mu W/cm^2nm$
23	Ed0340 - GUV	$\mu W/cm^2nm$
24	Ed0380 - GUV	$\mu W/cm^2nm$
25	Ed0395 - GUV	$\mu W/cm^2nm$
26	Ed0PAR - GUV	$\mu E/cm^2sec$
27	Ed0Temp - GUV	°C
28	Ed0VIn	Volts

lsvp - Sound Velocity Probe in ADCP Transducer Well

NOTE: This value does not represent or reflect the sound speed in the ocean, and is for internal use by the ADCP.

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

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

ladc – ADCP Speed Log

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

Field	Data	Units
1	RVDAS Time Tag	
2	$PUHAW	
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 typically 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).

lgyr - Gyro

```
02+315:23:59:58.616 $HEHDT,287.7,T*25
```

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	

lsep – Seapath 330 GPS

INZDA: Time and Date Data

```
10+351:23:59:58.142 $INZDA,235958.08,17,12,2010,,*78
```

Field	Data	Units
1	RVDAS Time Tag	
2	$INZDA Tag	
3	time	hhmmss.ss
3	day	dd
4	month	mm
5	year	yyyy
6	(blank)	
7	Check sum	hexadecimal

INGGA: Global Positioning Fix Data

10+351:23:59:58.142 $INGGA,235958.07,6118.168460,S,06008.089527,W,1,12,0.7,22.57,M,17.79,M,,*46

Field	Data	Units
1	RVDAS Time Tag	
2	$INGGA Tag	
3	Time (UTC)	hhmmss.ss
3	Latitude in degrees with decimal minutes	ddmm.mmm
4	{N|S} (latitude is north or south)	
5	Longitude in degrees with decimal minutes	ddmm.mmm
6	{E|W} (longitude is east of west)	
7	GPS quality indicator: 0 = invalid position, 1 = GPS SPS used, 2 = DGPS used, 3 = GPS PPS used, 4 = GPS RTK used, 5 = GPS float RTK used, 6 = dead reckoning	
8	Number of Satellites in use (00-99)	
9	HDOP	
10	Height above ellipsoid in meters	m.mm
11	M	
12	Age of DGPS corrections in seconds	ss.ss
13	M	
14	(blank)	
15	*Check sum	hexadecimal

INRMC: Recommended Minimum Specific GNSS Data

10+351:23:59:58.200 $INRMC,235958.07,A,6118.168460,S,06008.089527,W,12.8,331.22,171210,11.3,E,A*1C

Field	Data	Units
1	RVDAS Time Tag	
2	$INRMC Tag	
3	UTC of position	hhmmss.ss
4	Status A = Data Valid, V = Navigation Receiver Warning	
5	Latitude in degrees with decimal minutes	ddmm.mmm
6	North (N) or South (S)	
7	Longitude in degrees with decimal minutes	ddmm.mmm
8	East (E) or West (W)	
9	Speed Over Ground, knots	knots
10	Course Over Ground, degrees True	degrees
11	Date	ddmmyy
12	Magnetic Variation, degrees E/W	degrees
13	Mode Indicator E= Estimated Mode	
14	*Check sum	

INVTG: Speed Over Ground, Course Over Ground

14+025:23:59:59.100 $INVTG,32.69,T,,M,10.6,N,19.6,K,A*1A

Field	Data	Units
1	RVDAS Time Tag	
2	$INVTG Tag	
3	Course over ground, degrees true	d.dd
4	T	
5	,	
6	M	
7	Speed over ground in Knots	k.k
8	N	
9	,	
10	K	
11	Mode	

Field	Data	Units
12	Checksum	

PSXN,20: Data Quality

10+351:23:59:58.200 $PSXN,20,1,2,0,0*38

Field	Data	Units
1	RVDAS Time Tag	
2	$PSXN Tag	
3	20 (PSXN identifier)	
3	Horizontal position and velocity quality: 0 = normal, 1 = reduced performance, 2 = invalid data	
4	Height and vertical velocity quality: 0 = normal, 1 = reduced performance, 2 = invalid data	
5	Heading quality: 0 = normal, 1 = reduced performance, 2 = invalid data	
6	Roll and pitch quality: 0 = normal, 1 = reduced performance, 2 = invalid data	
7	*Check sum	hexadecimal

PSXN,23: Roll, Pitch, Heading and Heave

10+351:23:59:58.213 $PSXN,23,0.02,-0.76,330.56,*0B

Field	Data	Units
1	RVDAS Time Tag	
2	$PSXN Tag	
3	23 (PSXN identifier)	
3	Roll in degrees. Positive with port side up.	d.dd
4	Pitch in degrees. Positive with bow up.	d.dd
5	Heading in degrees true	d.dd
6	Heave in meters. Positive is down	m.mm
7	*Check sum	hexadecimal

lgar - Garmin GPS

GGA: Global Positioning Fix Data

08+034:12:26:06.131 $GPGGA,122607,6446.4733,S,06403.4455,W,1,11,0.9,-193.4,M,9.7,M,,*5A

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

```
08+034:12:26:06.211 $GPGLL,6446.4733,S,06403.4455,W,122607,A
```

Field	Data	Units
1	RVDAS Time Tag	
2	$GPGLL Tag	
3	Latitude	ddmm.mmm
4	North (N) or South (S)	
5	Longitude	ddmm.mmm
6	East (E) or West (W)	
7	UTC of position	hhmmss.ss
8	Status: A = Data Valid, V =Data Not Valid	

VTG: Track Made Good and Speed over Ground

```
08+034:12:26:06.211 $GPVTG,167,T,151,M,000.0,N,0000.0,K
```

Field	Data	Units
1	RVDAS Time Tag	
2	$GPVTG Tag	
3	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	

LMG Sensors

Shipboard Sensors

Sensor	Description	Serial #	Cal. Date	Status
Port Anemometer	Gill Ultrasonic Wind Observer II	1246001-WC45	N/A	Collected
Starboard Anemometer	Gill Ultrasonic Wind Observer II	1246002-WC45	N/A	Collected
Barometer	R.M. Young 61201	BP00873	12-Jun-2014	Collected
Humidity/Wet Temp	RM Young 41372LC	06133	07-Dec-2012	Collected
PAR for Mast	Biosph. Inst. QSR-240P	6393	1-Oct-2012	Collected
PIR	Eppley PIR	28903F3	14-Dec-2012	Collected
PSP	Eppley PSP	28933F3	20-Dec-2012	Collected
GUV (Mast)	Biosph. Inst. GUV-2511	5126	28-Jan-2013	Collected
Transmissometer	WET Labs C-Star 25 cm deep	CST-553DR	01-Oct-2012	Collected
MicroTSG (Primary)	Sea-Bird 45	243	05-Jan-2013	Collected
MicroTSG (Secondary)	Sea-Bird 45	390	09-Apr-2013	Collected
Digital Remote Temp	Sea-Bird 38	390	15-Nov-2012	Collected
Fluorometer	WET Labs ECO-FL	FLRTD-380	23-Aug-12	Collected

LTER CTD Sensors

Sensor	Description	Serial #	Cal. Date	Status
CTD Fish	Seabird SBE9Plus	0377	19-Apr-2013	Collected
Primary Temperature	Seabird SBE3	1529	20-Dec-2012	Collected
Secondary Temperature	Seabird SBE3	5025	30-Apr-2013	Collected
Primary Conductivity	Seabird SBE4	2247	01-Apr-2014	Collected
Secondary Conductivity	Seabird SBE4	2047	30-Apr-2013	Collected
Primary Dissolved Oxygen	Seabird SBE43	196	05-Apr-2014	Collected
Secondary Dissolved Oxygen	Seabird SBE43	190	05-Apr-2014	Collected
Fluorometer	Wet Labs ECO	FLRTD-867	19-Apr-2013	Collected
PAR	Biosph. Inst. QSP-2300	4561	23-Apr-2014	Collected
Transmissometer	Wet Labs C-Star	CST-406DR	12-Mar-2013	Collected

Trace Metal CTD Sensors

Sensor	Description	Serial #	Cal. Date	Status
CTD Fish	Seabird SBE9Plus	0328	21-May-2014	Collected
Primary Temperature	Seabird SBE3	5097	13-May-2014	Collected
Secondary Temperature	Seabird SBE3	5034	23-Apr-2014	Collected
Primary Conductivity	Seabird SBE4	4067	16-Apr-2014	Collected
Secondary Conductivity	Seabird SBE4	2293	04-Apr-2014	Collected
Primary Dissolved Oxygen	Seabird SBE43	161	09-Oct-2014	Collected
Secondary Dissolved Oxygen	Seabird SBE43	200	08-Apr-2014	Collected
Fluorometer	Wet Labs ECO	FLRTD-398	01-Oct-2013	Collected
Transmissometer	Wet Labs C-Star	CST-891DR	18-Jun-2013	Collected

Mocness Sensors

Sensor	Description	Serial #	Cal. Date	Status
Temperature	Seabird SBE3	2637	14-May-2013	Collected
Conductivity	Seabird SBE4	2065	11-Apr-2014	Collected
Pressure Sensor	Mocness pressure housing	177	19-Nov-2010	

Fluorometer Calibration Changes

Customer Alert: July, 2011

CHLa Scale Factors Shift

WET Labs calibration testing has revealed that our CHLa solid proxy used to calibrate our ECO and Wetstar fluorometers allows a large amount of instrument to instrument variability. Also, we have differences in scaling between Wetstar CHLa fluorometers and ECO CHLa Fluorometers because of differences in the solid proxy used to characterize these instruments. A new methodology using a liquid proxy has been implemented to assure stable calibrations between instruments and to match up the ECO FL and Wetstar FL corrected data outputs.

Instruments affected:

All CHLa ECO fluorometers built or calibrated before January 2011.

All CHLa Wetstar fluorometers built or calibrated before July 2011.

WET Labs' Actions:

New Instruments:

WET Labs has instituted a new calibration standard solution preparation methodology. All new ECO/Wetstar CHLa fluorometers delivered from this date forward will have range characteristics as per current specifications and scale factors**.**

Instruments returned for service and calibration:

Instruments returned for service and calibration will be calibrated using the new methodology. We are tuning all service instruments to this new liquid proxy to decrease instrument to instrument variability.

In some cases, we will not be able to achieve the previously stated range of an instrument. In these cases, we will strive for the highest resolution with the highest signal to noise ratio possible.

WET Labs service technicians will incorporate these improvements during service when practical. WET Labs' term for this service is 'retuning.' Accordingly, a serviced instrument may well have a better performance after retuning than when it was first built.

For instruments that are retuned, benefiting in either resolution or signal to noise ratio, WETLabs can provide pre calibration data to allow you to link your data sets prior to service with your data sets after the instrument is returned to you.

Recommended Customer Actions:

If you calibrate your instruments then you do not need to take any action. Continue to use your calibration.

If you report scaled or raw data, you should adjust your reported values.

For instruments returned for service, you will use the ratio between the previous scale factor and pre-service scale factor. This ratio will cover both the change in the methodology and any change in your instrument between the previous calibration and this servicing.

Use the post-service scale factor going forward.

Acquisition and Processing Information

Processing Specifics

Refer to the InstCoef.txt 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.

Significant Notes

Icing impacted collection of seawater data during first several hours after departure from Palmer Station on day 265. Data end users are encouraged to visually evaluate the data prior to use.

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.
(i.e, The PCO2 system was turned off for the troubleshooting and repairs of the equilibrator pump.)

Day Of Year	Time (GMT)	Event	Location
364	07:55	Data Logging ON	@68W
001		GUV instrument broken… no data for rest of cruise ☹	
003	11:03	Data Logging OFF	Arrive PAL
005	11:55	Data Logging ON	Depart PAL
017	19:14	Data Logging OFF	Arrive Rothera
018	12:56	Data Logging ON	Depart Rothera
033	10:39	Data Logging OFF	Arrive PAL
034	13:13	Data Logging ON	Depart PAL
038	19:49	Data Logging OFF	@68W