# LMG0301 - 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 which 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 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All of the data has been archived with the Unix "tar" command and/or compressed using Unix "gzip" compression.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.

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*.tar.gz. This name does not follow the 8.3 naming convention of the ISO9660 format. So the file was renamed without .tar making the file name **File**.gz. 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 platform gunzip expands *File*.gz 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.***

***NOTE: The time sync software that keep the RVDAS computer's time synchronized with the gps was not working correctly. The time on RVDAS drifted throughout the cruise, the time was manually readjusted periodically. See the Acquisition Problems and Events section for time corrections and discrepancies.***

***NOTE: The Pcode GPS stop working at the beginning of the cruise. So the civilian Trimble NT200 GPS was feed into all the systems that before used the Pcode. So the RVDAS Pcode log file are actually the Trimble NT200.***

## 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
```

# CD Directory Structure

**Disk1/ADCP/**
- Pingdata
- Gentoo

**Disk1/CAL/**
- SVP_CALS.tar
- UW_CALS.tar
- CTD_CALS.tar
- Instrmnt.cof

**Disk1/CTD/**
- Readme.txt
- **Data/graphs/**graphs.gz
  - **process/**process.gz
  - **raw/**raw.gz
- **PScripts/**PScripts.tar
- **Seacat/**readme.txt
  - **graphs/**graphs.gz
  - **process/**process.gz
  - **raw/**raw.gz
  - **pscripts/**pscripts.tar
- **Setup**/*.jpg
  - Config.*
  - **CONFiles/***.con

**Disk1/EVENTLOG/**
- eventlog.*

**Disk1/GRIDSCRPT/**
- GRIDSCRPT.gz

**Disk1/GUV/**
- GUV_CSV.ZIP
- GUV_LOG.ZIP

**Disk1/ISOBARS**/
- Isobars.tar

**Disk1/JGOF**/
- Lmgjgof.tar
- Lmgqc.tar

**Disk1/MAP**/
- Lter.jpg
- Lter.ps
- Track.txt

**Disk1/PCO2/**
- Lmgpco2.tar

**Disk1/QC_PLOTS**/
- Lmgqc.tar

**Disk1/REPORT/**
- Report.doc
- Report.html
- Report.txt

**Disk2/RVDAS**/
- Lmguw.tar
- Lmgnav.tar

**Disk1/SALTS/**
- Salts.*

**Disk1/UTILITY/**
- Winzip
- Stuffit Expander

**Disk1/WAYPTS/**
- waypoint.txt

**Disk1/WEEKLY/**
- weekly#.txt

**Disk1/XBT-XCTD/**
- **LTER/**XCTDData.gz
  - XCTDDeep.gz
  - XCTDLOG#.jpg
- **SBCross/**DAT.ZIP
  - EDF.ZIP
  - RDF.ZIP
  - SFILES.ZIP
  - LOG.ZIP
  - NAV.ZIP
  - XBTLOG.ZIP

# Distribution Contents

## ADCP

Disk1/Adcp/

The ADCP DAS data files are named pingdata.xxx (xxx representing a file number). Note that these extensions do NOT represent Julian day numbers. Please refer to the file's creation date. The ADCP DAS computer creates a new pingdata file when the current one reaches a size of 320K. The ping files logged on Gentoo, the Linux processing computer, however are created new each day.

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.

There was one problem that occurred with the ADCP. When we left Palmer Station at the end of the cruise, we started the ADCP DAS collection again. For some unknown reason it started writing to pingdata.023 instead of pingdata.028. We were unsure if it was overwriting the file or just appending. So we moved the pingdata files with extensions 000-027 and started over with a new set of pingdata files beginning with pingdata.000. The first set of data is in the ADCP/LEG1/ directory and the second set is in the ADCP/LEG2 directory.

## Calibration

Disk1/Cal/

The tar files in the Cal directory contain images of calibration sheets for each of the following systems: Sound Velocity Probe(SVP_CALS.TAR), Meteorological System(MET_CALS.TAR), Underway System(UW_CALS.TAR), and CTD(CTD_CALS.TAR).

## CTD

Disk1/CTD/

The ctd data was collected and processed on a windows 98 computer, using Seasave Win32 – Version 5.25a and SBE Data Processing – Version 5.21.

See the Readme.txt file for cast notes.

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

### *disk1/CTD/Setup/*

In the Setup directory there is a Config file in html, excel, and text form which contain information of which sensors where used and what freq or volt the where connected to. The file also contains a table with the vertical distance in meters from the pressure port that each sensor was mount. The distances are positive as pressure increases. The sensor connections are also shown in the two diagrams of the fish's end caps: Freq.jpg and Volt.jpg. Also in this directory are jpeg images of the CTD rosette. They also show how the Rothera seacat was mounted, which was done for one cast for calibration. We used three different con files through out the cruise, which are in this directory. Lmg0301.con was used for cast 1 to 16, event 007 to 122. The oxygen sensor failed so we had to replace it, so lmg0301a.con was created with updated cals for this new sensor. It was used for cast 17 to 60, event 137 to 525. We then decided to add the SPAR to the CTD data set, so a third con file was created with the new cals added, lmg0301b.con. It was used for the remaining casts 61 to 93, event 534 to 729.

### *disk1/CTD/Pscripts/*

This directory contains the Pscript.tar archive, which contains the batch file and psu 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.

## *disk1/CTD/Data/raw*

The raw.gz file is a tar archive file that has been compressed with gzip, for more information on this see the above *Introduction* section. This archive contains the raw file collect at each CTD cast, which is represented by a set of four files containing a bottle-firing file (.bl), a configuration file (.con), a data file (.dat) and a header file (.hdr). Casts are named with the following g301EEE.ext, where g is for the LMG, 301 is the cruise 0301, EEE is the event number, and ext is the extention (bl, con, dat, hdr). For example; the raw files associated with the event 007 on this cruise are: g0301007.bl, g0301007.con, g0301007.dat, g0301007.hdr. The raw data files(*.dat) are binary files.

## *disk1/CTD/Data/process*

The process.gz file is a tar archive file that has been compressed with gzip. For more information on this see the above *Introduction* section. This archive contains the processed data files for each CTD cast, the processing method used is briefly described in the above section *CTD/Pscripts/*. 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:

| | |
|---|---|
| g301EEE.con | A copy of the configuration file for the cast. |
| g301EEE.cnv | The converted file for the whole cast. |
| g301EEE.ros | The rosette file that contains the scan lines for each bottle trip. |
| g301EEE.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. |
| dg301EEE.cnv | The converted file for the down cast. |
| dg301EEE.asc | An ASCII formatted file for the down cast without a header. |
| dg301EEE.hdr | The header for the down cast. |
| ug301EEE.cnv | The converted file for the up cast. |
| ug301EEE.asc | An ASCII formatted file for the up cast without a header. |
| ug301EEE.hdr | The header for the up cast. |

## *disk1/CTD/Data/graphs*

The graph.gz file is a tar archive file that has been compressed with gzip, for more information on this see the above *Introduction* section. This archive contains three postscript files for each cast, which are plots of the processed CTD data. The graphs were generated with a CShell script written by Fred Stuart, which uses the GMT, General Mapping Tool, software package. The file naming convention is TTT.LMG0301.EEE.ps where TTT represents the graph type( Pri, Sec, Other) and EEE is the event number for the cast. The Pri graph type is a plot of the primary sensors, the Sec graph type is a plot of the secondary sensors, and the Other graph type is a plot of all the other sensor on the CTD. These files were use to compare the data from cast to cast to make sure that all the sensors were working properly.

## *disk1/CTD/Data/seacat*

The data in this directory was collected using the Palmer Station seacat from a zodiac. The cast were done on the Foraging Grid near Palmer Station, see the readme.txt in this directory for more information on the Foraging grid location. The subdirectories here are the same as describe in the above CTD sections, except for the naming convention see the readme.txt file to correspond the file name to an event number, latitude, and longitude.

## Salts

disk1/SALT/

Salts were collected during the southbound Drake crossing of LMG03-01 as per the standard routine established by Janet Sprintall, using the ship's underway system. Additional samples were taken during the cruise to calibrate the CTD. Approximately six cruise samples were collected once per day from the rosette niskin bottles. Most water was sampled from the mixed regions (typically the bottom several bottles, though we did have a few surface mixed layers).

Samples were analyzed every couple of days, allowing room temperature to be reached and for multiple samples to be run at the same time for conservation of standard seawater and technician sanity.

The salinity was determined from use of equation 1 and the AutoSal's "2 x conductivity ratios". Readings were taken until three replicates within +/-0.00005 were attained. The salinity was then determined from the mean of these three replicates (as shown in the electronic data sheets).

$$\Delta S = \frac{(t-15)}{1+k(t-15)}(b_0 + b_1 R_t^{1/2} + b_2 R_t + b_3 R_t^{3/2} + b_4 R_t^2 + b_5 R_t^{5/2})$$

$$S(psu) = a_0 + a_1 R_t^{1/2} + a_2 R_t + a_3 R_t^{3/2} + a_4 R_t^2 + a_5 R_t^{5/2} + \Delta S$$

**Equation 1.** $a_0$ = 0.0080, $b_0$ = 0.000; $a_1$ = -0.1692, $b_1$ = -0.0056; $a_2$ = 25.3851, $b_2$ = -0.0066; $a_3$ = 14.0941, $b_3$ = -0.0375; $a_4$ = -7.0261, $b_4$ = 0.0636; $a_5$ = 2.7081, $b_5$ = -0.0144

k = 0.0162; t = bath temperature in C; $R_t$ = Conductivity ratio

For calibration/processing, the salts spreadsheet includes the salinity values from primary and secondary sensor on the CTD, and each of these values subtracted from the salinity determined via the AutoSal. The final column also lists the values of the two CTD salinities subtracted from each other.

All cruise salts from the CTD were collected and analyzed by the Marine Science Technician, Jordan Watson. The machine appeared to function well. The Guildline AutoSal protocol suggests that during the DI rinses in between samples, a conductivity reading of less than 0.00050 be attained before continuing to the next sample. However, after the first several runs, I switched this number to 0.00020 as my personal guideline and seemed to achieve greater precision with a fewer number of required replicates, at the expense of extra DI rinses instead of extra sample rinses. I believe that this took extra time, but achieved better results.

## Cruise Track

disk1/MAP/

PostScript cruise track plots have been produced for this cruise, in two sizes lter8in.ps and lter18in.ps. The lter8in.ps is 8.5"x11" and the lter18in.ps is 18"x24". The lter8in.ps has been converted to a jpeg format also. Additionally, the cruise track file track.asc is also included and contains the latitude and longitude in one-minute intervals.

## PUV – GUV

disk1/PUV-GUV/

The GUV files are in both binary and ASCII format they have been zipped using pkzip and called GUV_LOG.ZIP and GUV_CSV.ZIP respectively.

The GUV log files were converted to CSV (Comma Separated Value) format using the Biospherical Instruments' PUVLOG program.

The columnar format of the CSV file is listed below:

| Field | GUV Data |
|---|---|
| 1 | Record Number |
| 2 | Time |
| 3 | 308 S |
| 4 | 320 S |
| 5 | 340 S |
| 6 | 380 S |
| 7 | PAR S |
| 8 | INT308 S |
| 9 | INT320 S |
| 10 | INT340 S |
| 11 | INT380 S |
| 12 | INTPAR S |

## Isobar Charts

disk1/Isobars/isobar.tar

The isobar.tar file contains GIF image file. These file are an analysis of mean sea level pressure from the National Center for Environmental Prediction's Medium Range Forecast Model. They are updated every 6 hours. Naming the convention is as follows yyjjj.hh.gif where yy is the year, jjj is the day number, and hh is the hour.

## Data and Science Report

disk1/Report/

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

## Weekly

disk1/Weekly/

Copies of weekly activity reports from the Chief Scientist, Robin Ross.

## QC Plots

Disk1/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.

## SouthBound Drake Crossing

### *XBT*

disk1/XBT-XCTD/SBCross/XBT

During the Southbound crossing Expendable Bathythermographic (XBT) probes were used to obtain water column temperature profiles. These XBT were launched from the auto-launcher off the port aft quarter of the ship. The data files from these launches are included here in the SFILES.ZIP. The NAV.ZIP file contains the navigation files. The LOG.ZIP contains log files generated by the auto-xbt software. The DAT.ZIP file contains the configuration file used and generated by the auto-xbt software. The handwritten logs take during the transect were scanned in and saved as .jpg files (XBTlog1.jpg, XBTlog2.jpg, XBTlog3.jpg). For more information contact Glenn Pezzoli, project coordinator, at gpezzoli@ucsd.edu.

### *XCTD*

disk1/XBT-XCTD/SBCross/XCTD

During the Southbound crossing, Expendable Conductivity Temperature Depth (XCTD) probes were used to obtain water column conductivity and temperature profiles. These XCTD were the analog type, and where manually launch from tube 1 of auto-launcher. The data files from these launches are included both in binary (RDF.ZIP) and ascii (EDF.ZIP) format. The logsheet (XCTDLog) has been saved as three different formats excel spreadsheet, HTML, and text file.

## XCTD

disk1/XBT-XCTD/LTER

During the cruise, at various stations, Expendable Conductivity Temperature Depth (XCTD) probes were used to obtain water column conductivity and temperature profiles. Analog and digital XCTD were used. The analog probe can goto depth of 1850m and the digital to 1100m, so the analog probes were use at stations deeper than 1100 meters. The XCTDData.gz file contains both the binary and ASCII file for each digital XCTD drop. The XCTDDeep.gz file contains both the binary and ASCII file for each analog XCTD drop. The log sheets were scanned in as jpegs as XCTDLog#.jpg where # is a integer corresponding to the log sheet page number.

## JGOFS Data Set

disk1/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 | $\mu$Einsteins/meters$^2$ sec |

| Field | Data | Units |
|---|---|---|
| 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

disk2/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.

***NOTE: The Pcode GPS stop working at the beginning of the cruise. So the civilian Trimble NT200 GPS was feed into all the systems that before used the Pcode. So the RVDAS Pcode log file are actually the Trimble NT200.***

### *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 | Not collected | 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: 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 |
|---|---|
| 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 | S/cm |

## lpco

***NOTE:*** ***The Pcode GPS stop working at the beginning of the cruise. So the civilian Trimble NT200 GPS was feed into all the systems that before used the Pcode. So the RVDAS Pcode log file are actually the Trimble NT200.***

```
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 |

## svp1

```
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 | |
| 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 | Measurement 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 |

| Field | Data | Units |
|---|---|---|
| 5 | East (E) or West (W) | |
| 6 | UTC of position | hhmmss.ss |
| 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 | |
| 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 | 07/28/02 | collected |
| Stbd Anemometer | R.M. Young 105106 | WM28393 | 07/28/02 | collected |
| Barometer | R.M. Young 61201 | BP00873 | 08/15/01 | collected |
| Humidity/Wet Temp | R.M. Young 41372VC | 6133 | 09/13/02 | collected |
| Mast PAR | BSI QSR-240 | 6394 | 06/05/01 | collected |
| Pyranometer | Eppley PSP | 31701F3 | 09/18/02 | collected |
| Pyrgeometer | Eppley PIR | 32031F3 | 09/18/02 | collected |
| GUV | Biospherical GUV-511 | 9228 | 11/03/01 | collected |
| TSG | SeaBird SBE21 | 1789 | 08/02/02 | collected |
| TSG Remote Temp | SeaBird 3-01/S | 1619 | 09/13/02 | collected |
| Fluorometer | Turner 10-AU-005 Lamp: daylight 10-045, reference filter: 10-052, emission filter: 10-051, excitation filter: 10-050. | 6046RTD | n/a | collected |
| Transmissometer | WET Labs 9707017 | CST-424R | 07/31/02 | collected |
| P-Code GPS | Trimble 20636-00 (SM) | 220035269 | n/a | Not Collected |
| Bathymetry | Knudsen 320B/R | | n/a | collect |

## CTD Sensors

| Sensor | Description | Serial # | Cal. Date |
|---|---|---|---|
| CTD Fish | Sea-Bird 9Plus-3400m | 091480 | 29-Jun-01 |
| CTD Deck Unit | Sea-Bird 11Plus | 288 | n/a |
| Prim. Temp. Sensor | Sea-Bird 3-02/F | 2470 | 25-Jun-02 |
| Sec. Temp. Sensor | Sea-Bird 3-02/F | 2444 | 22-Jun-02 |
| Prim. Cond. Sensor | Sea-Bird 4-02/0 | 2065 | 25-Jun-02 |
| Sec. Cond. Sensor | Sea-Bird 4C | 2047 | 25-Jun-02 |
| Diss. Oxygen Sensor | Sea-Bird 13-02-B | 0182 | 5-Nov-02 |
| Fluorometer | Chelsea model Mk III Aquatracka | 088015 | 8-Aug-02 |
| Transmissometer | | CST-553DR | 2-Feb-02 |
| PAR | | 4470 | 19-Jul-02 |

# 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 |
|---|---|---|---|
| 001 | 02:11 | Turned on TSG | 68 West |
| 001 | 02:49 | Turned on PCO2 | 68 West |
| 001 | 03:18 | SVP logging started | 68 West |
| 001 | 03:34 | Turned on ADCP | 68 West |
| 003 | 12:07 | Started GUV logging (internal temperature was set to 25degC) | Drake Passage |
| 003 | 22:33 | ADCP DAS and Deck Box turned off to test for interference with the BioSonics towed sonar | |
| 003 | 22:31 | ADCP DAS and Deck Box turned back on | |
| 003 | 22:40 | Increase the GUV sensor temperature to 40degC | |
| 003 | 11:19 | Turned off Seawater flow, PCO2, and TSG | Arrived @ Palmer Station |
| 003 | 11:31 | Turned off ADCP and Sonar | Arrived @ Palmer Station |
| 005 | 14:00 | Corrected the Calibration data enter into the GUV. Began a new log. | @ Palmer Station |
| 005 | 22:30 | Turned on Sonar and ADCP | Leaving Palmer Station |
| 005 | 22:58 | Turned on Seawater and TSG | Leaving Palmer Station |
| 005 | 23:23 | PCO2 system on and logging | Leaving Palmer Station |
| 007 | 12:33 | Increased Seawater pressure from 3.6 to 4.6 | |
| 007 | 12:50 | Noticed RVDAS was not logging the PCO2 | |
| 007 | 01:08 | PCO2 logging again, PCMCIA conntector was disconnected | |
| 007 | 22:15 | Reset Ashtech GPS | |
| 009 | 01:50 | Changed N2 tank on the PCO2 to one of the larger cylinders in the Baltic Room. Also check system for leaks, none found | |
| 009 | 18:17:24 | RVDAS time was off by 00:01:06 minutes from the gps time. Set to 18:18:30 | |
| 009 | 21:37 | Reset Ashtech GPS | |
| 017 | 15:53 | TSG Turned Back, Off due to loss of ship power. Not on UPS circuit | |
| 017 | 18:34 | Shutdown RVDAS and loggers. | |

| | | | |
|---|---|---|---|
| | | To troubleshoot the Time sync problem on RVDAS | |
| 017 | 18:54 | RVDAS backup and logging. Share memory not being written to, effecting CCTV displays, but not the data logging. Time sync still not working | In Transit between stations |
| 017 | 20:09 | Reset Ashtech GPS | In Transit between stations |
| 017 | 21:27 | Shutdown RVDAS and loggers. For to fix shared memory problems | In Transit between stations |
| 017 | 22:26 | RVDAS backup and logging. Shared memory working again, but time sync still not working. | In Transit between stations |
| 018 | 03:53 | Shutdown RVDAS and loggers. To test shared memory issue. | In Transit between stations |
| 018 | 21:40 | Cleaned Mast Sensors | |
| 018 | 04:16:55 | RVDAS time was off by 00:01:05 minutes from the gps time. Set to 04:18:00 | |
| 021 | 21:09 | Reset Ashtech GPS | |
| 022 | 18:57 | Connected Mast SPAR to the CTD Deck Box | |
| 023 | 01:39 | Reset Ashtech GPS | |
| 024 | 14:37 | Reset Ashtech GPS | |
| 025 | 02:15 | Changed N2 tank on the PCO2 using another one of the larger cylinders in the Baltic Room. | |
| 025 | ~10:00 | Did not dock, just pull up to pier | Arrived @ Rothera |
| 025 | ~11:15 | | Left Rothera |
| 025 | 21:18 | Docked at pier, Turned off Sonar | Arrived @ Rothera |
| 026 | ~10:30 | Turned on Sonar | Left Rothera |
| 028 | 02:11:44 | RVDAS time was off by 00:01:16 minutes from the gps time. Set to 02:13:00 | |
| 028 | 03:43 | Shutdown RVDAS and loggers. To test shared memory and time sync issue. | |
| 028 | 20:28 | Reset Ashtech GPS | |
| 029 | 05:52 | Reset Ashtech GPS | |
| 030 | 10:19 | Reset Ashtech GPS | |
| 033 | 19:25 | Shutdown Seawater, PCO2, and TSG | Arrived @ Palmer Station |
| 033 | 19:48 | Shutdown Sonar, and ADCP | Arrived @ Palmer Station |
| 034 | ??? | GUV Turned off | @ Palmer Station |
| 035 | 12:22 | Turned on Sonar, and ADCP | Left Palmer Station |
| 035 | 12:39 | Turned on TSG | Left Palmer Station |
| 035 | 12:48 | PCO2 on and logging | Left Palmer Station |
| 035 | 14:03:26 | RVDAS time was off by 00:01:04 minutes from the gps time. Set to 14:04:30 | |
| 036 | ~12:52 | Notice ADCP current pingdata file was wrong. Writing to past pingdata file. See ADCP Section. | |
| 038 | ~03:00 | Seawater pressure was found high 8.5, lowered to 5.5 | |

| | | | |
|---|---|---|---|
| 038 | 19:07 | Turned off ADCP logging | 68 West |
| 038 | 19:11 | Turned off Seawater, TSG, PCO2 | 68 West |
| 038 | 20:20 | Stop Data logging on RVDAS | 68 West |
| 039 | 12:00:14 | RVDAS time was off by 00:00:30 seconds from the gps time. The GPS time was 12:00:44 | Punta Arenas |