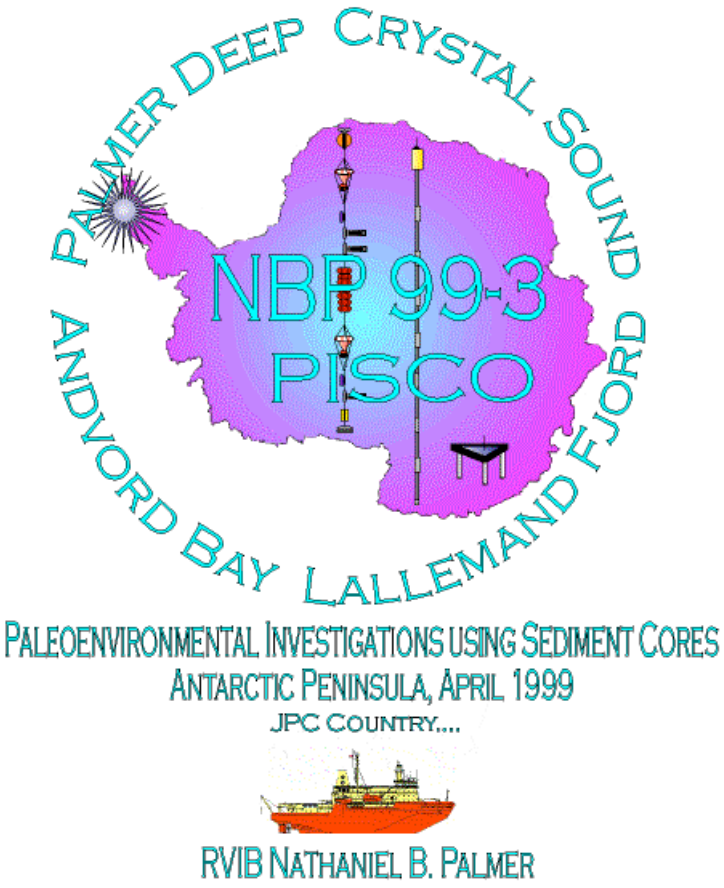
NBP9903: Domack/Leventer Cruise

Shipboard Data Acquisition System Report



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Introduction

The NBP data acquisition systems continuously log data from several instruments throughout the cruise. This document describes the format of that data and its location on the distribution CD. 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.

The data is contained in a unix tar archive called NBP9903.tar. All of the data has been compressed using unix "gzip" compression or standard unix compression. Gzipped files have a ".gz" extension and unix compressed files have a ".Z" extension. Tools are available on all platforms for uncompressing and de-archiving these formats. On Macintosh, Stuffit Deluxe 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. NBP9903.tar was created on an SGI 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
```

The directories in the archive are structured in the following manner:

TSGcal (TSG Calibration file)
adcp:
- adcp/pingdata files
- adcp/loglist.cnf
- adcp/exit.cnf
- adcp/start.cnf
- adcp/u34.cnf
- adcp/ue4_f1.def

ctd:
- ctd/*.con files
- ctd/*.bl files
- ctd/*.dat files
- ctd/*.hdr files
- ctd/process/*.btl files
- ctd/process/*.con files
- ctd/process/*.cnv files
- ctd/process/*.ros files
- ctd/process/*.asc files
- ctd/process/*.xls (Excel spreadsheets)

geopdata:
- geopdata/ASH:
- geopdata/BAT:
- geopdata/GRV:
- geopdata/JGOF:
- geopdata/MAG:
- geopdata/NGL:
- geopdata/PCD:
- geopdata/PROC:
- geopdata/SB:
- geopdata/SIM:
- geopdata/TSG:

ocean:
- ocean/tsgfl files

rtdas:
- rtdas/DATA:
  - rtdas/DATA/ASH:
  - rtdas/DATA/BAR:
  - rtdas/DATA/BAT:
  - rtdas/DATA/FLR:
  - rtdas/DATA/GRV:
  - rtdas/DATA/GYR:
  - rtdas/DATA/MAG:
  - rtdas/DATA/MET:
  - rtdas/DATA/NGL:
  - rtdas/DATA/PCD:
  - rtdas/DATA/SIM:
  - rtdas/DATA/TSG:
- rtdas/REPORT:
  - rtdas/REPORT/MET_REP:
  - rtdas/REPORT/MET_REP2:

rvdas:
- rvdas/nav:
- rvdas/uw:

xbt:
- xbt/xbt files

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.

CTD

Individual CTD casts are 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 numbered according to the cruise id (9903) followed by the number of the cast. For example; the raw files associated with the third cast on this cruise are: 9903003.bl, 9903003.con, 9903003.dat, 9903003.hdr. The configuration and data files are in binary format. The SeaSoft package included on this CD may be used to convert these files to text if necessary.

SeaBird's SeaSoft software used to acquire the data is included in the CTD data distribution in the "Seasoft" directory. SeaSoft is a DOS-based software package, but can be run in a DOS window under the Windows9X operating systems for cast playback and data analysis. The software package used to process this data (version 4.234) is included on this CD in the directory **Seasoft**. The configuration files and processing scripts (written by Suzanne O'Hara for the standard processing of the SBE 9/11*plus*) are also included in the **Seasoft** directory under **cfg9903**. A directory called **ctd-plots** contains all of the PostScript plots produced for the separate CTD report. These plots were created using GMT.

File extension definitions:*

ASC	The data portion of a .CNV converted data file written in ASCII by ASCIIOUT, or files written by TERM37.
BL	Created by SEASAVE when a bottle fire confirmation is received. Contains bottle sequence number, position, date, time, beginning and ending scan numbers.
BTL	Created by ROSSUM. This is a summary of the data in a .ROS file.
BSR	Bottle scan range file, used by DATCNV to create a .ROS file.
CFG	Used by SEASOFT modules to store the input filename, input data path, output data path, and other miscellaneous module specific parameters.
CTR	Density contour file generated by CONTOUR.
CNV	'Converted' engineering unit data file. An ASCII header precedes the data.
CON	Contains instrument configuration and calibration coefficients, used by SEACON, SEASAVE, and DATCNV
DAT	Raw binary data, optionally with header information (SBE 9/11, 11X, 9/11*plus*, and data files created with previous versions of SEASOFT).
DSP	Used by SEASAVE to store data acquisition and display parameters.
HDR	1) Header portion of a .CNV converted data file written by ASCIIOUT. 2) Header recorded when acquiring real time data or uploading archived data.
HEX	Raw HEX data with header information (SBE 16, 17, 19, 21, and 25)
MRK	Marker file created by SEASAVE during real time data acquisition.
PLT	Used by SEAPLOT to store display parameters
ROS	Scans marked with the bottle fire confirmation bit, or defined by a .BSR file, written by DATCNV.

*Note: This is a complete list of all file extensions. This data set may not contain ALL of the above extension files.

SEASOFT modules search the current directory for DSP, PLT, and CFG files.
SEASOFT modules search the 'input data path' for CON, HEX, DAT, and CNV files. One exception is SEACON which searches the current directory for CON files.

For more information and updated software visit the web site at www.seabird.com, or contact:

Sea-Bird Electronics
1808 - 136th Place NE

Bellevue, WA 98005
(206) 643-9866
seabird@seabird.com

Cruise Track

Two PostScript cruise track files have been produced for this cruise: NBP9903.ps, and Small_NBP9903.ps. NBP9903.ps is poster-sized (36" x 40") and Small_NBP9903.ps is standard US Letter sized (8.5" x 11"). A GMT cruise track file (NBP99-3.trk) is also included, which contains the longitude and latitude at one-minute intervals extracted from the NBP9903.gmt file.

NBP Geophysical Data Products (MGD77 / JGOFS)

Path: NBP9903.mgd
NBP9903.gmt
NBP9903.tar [geopdata/JGOF]
NBP9903.tar [geopdata/PROC]

Two data products are created on each cruise of the NBP: JGOFS and MGD77. The JGOFS data set consists of a single file produced each day named jgDDD.dat.gz where DDD is the Julian day the data was acquired. The ".gz" extension indicates that the individual files are compressed before archiving. The daily file consists of 20 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 one raw input. For example, Course Made Good (CMG) and Speed Over Ground (SOG) are calculated from gyro and GPS inputs by the NGL software package. Similarly, the wind direction field is the vector sum of the separate X and Y inputs received from the wind instrument. The JGOFS data set was used to produce the daily data plots during the cruise.

Note: Null, unused, or unknown fields are filled with 9's in the JGOFS data.
Note: TSG data is processed by RVDAS.

The fields consist of the following values:

Field	Data	Units
01	GMT date	(dd/mm/yy)
02	GMT time	(hh:mm:ss)
03	NGL latitude	(-dd.dddd)
04	NGL longitude	(-ddd.dddd)
05	SOG (speed over ground)	Knots
06	GPS HDOP	-
07	Gyro Heading	Degrees
08	CMG (course made good)	Degrees
09	mast PAR	Microeinsteins/meter/sec^2
10	sea surface temperature	degrees C
11	sea surface conductivity	siemens/meter
12	sea surface salinity	PSU
13	sea depth (uncorrected)	meters (calculated using 1500 m/s)
14	true wind speed	meters/sec (STARBOARD ONLY)
15	true wind direction	degrees (STARBOARD ONLY)
16	ambient air temperature	degrees C
17	relative humidity	Percent
18	barometric pressure	Millibars
19	sea surface fluorometry	volts (0-5 FSO)
20	not used	-

The MGD77 data set is contained in a single file for the entire cruise named NBP9903.mgd, There is also a file named NBP9903.gmt. This file is the output of the mgd77togmt utility using NBP9903.mgd as input. The "gmt" file can be useful for plotting and other purposes. The directory /geopdata/PROC contains a file

from each day of data acquisition named: Dddd.fnl.gz, where ddd is the Julian day. These files contain all the data used to produce the "mgd" file, but in a space-delimited columnar format that may be more accessible for some purposes. In addition, these files contain data on one-second intervals rather than one minute and are individually "gzipped" to save space. Below is a detailed description of the MGD77 data set format.

Format Conventions:

All decimal points are implied. Leading zeros and blanks are equivalent.
Unknown or unused fields are to be filled with 9's (DO NOT BLANK FILL).
All "corrections", such as time zone, diurnal magnetics, and Eotvos, are understood to be added (e.g., time-zone correction is the number of hours, which must be added to the recorded time to determine GMT).

Columns	Length	Type	Description
1	1	int	DATA RECORD TYPE Set to "3" for data record.
2-9	8	char	SURVEY IDENTIFIER Identifier supplied by the contributing organization, else given NGDC in a manner that represents the data. Identical to hat in the header record.
10-14	5	int	TIME-ZONE CORRECTION In hundredths of hours. Corrects time (in characters 13-27) to GMT when added: equals zero when time is GMT.
15-16	2	int	YEAR 2 digit year
17-18	2	int	MONTH (e.g. May is represented as 05)
19-20	2	int	DAY Day of month
21-22	2	int	HOUR
23-27	5	real	MINUTES X 1000
28-35	8	real	LATITUDE X 100000 + = North; - = South. Between –9000000 and 9000000
36-44	real	real	LONGITUDE X 100000 + = East; - = West. Between –18000000 and 18000000
45	1	int	POSITION TYPE CODE Indicates how lat/long was obtained: 1 = Observed fix 3 = Interpolated 9 = Unspecified
46-51	6	real	BATHYMETRY, 2- WAY TRAVELTIME In ten-thousandths of seconds. Corrected for transducer depth and other such corrections, especially in shallow water
52-57	6	real	BATHYMETRY, CORRECTED DEPTH In tenths of meters.
58-59	2	int	BATHYMETRIC CORRECTION CODE This code details the procedure used for determining the sound velocity correction to depth
60	1	int	BATHYMETRIC TYPE CODE Indicates how the data record's bathymetric value was obtained: 1 = Observed 3 = Interpolated (Header Seq. 12) 9 = Unspecified
61-66	6	real	MAGNETICS TOTAL FIELD, 1ST SENSOR In tenths of nanoteslas (gammas). Use this field for single sensor.
67-72	6	real	MAGNETICS TOTAL FIELD, 2ND SENSOR

Columns	Length	Type	Description
			In tenths of nanoteslas (gammas). For trailing sensor.
73-78	6	real	MAGNETICS RESIDUAL FIELD In tenths of nanoteslas (gammas). The reference field used is in Header Seq. 13.
79	1	int	SENSOR FOR RESIDUAL FIELD 1 = 1st or leading sensor 2 = 2nd or trailing sensor 9 = Unspecified
80-84	5	real	MAGNETICS DIURNAL CORRECTION In tenths of nanoteslas (gammas). (In nanoteslas) if 9-filled (i.e., set to "+9999"), total and residual fields are assumed to be uncorrected; if used, total and residuals are assumed to have been already corrected.
85-90	6	F6.0	DEPTH OR ALTITUDE OF MAGNETICS SENSOR In meters. + = Below sea level 3 = Above sea level
91-9	7	real	OBSERVED GRAVITY In tenths of milligals. Corrected for Eotvos, drift, and tares.
98-10	6	real	EOTVOS CORRECTION In tenths of milligals. E = 7.5 V cos phi sin alpha + 0.0042 V*V
104-108	5	real	FREE-AIR ANOMALY In tenths of milligals. Free-air Anomaly = G(observed) – G(theoretical)
109-113	5	char	SEISMIC LINE NUMBER Used for cross-referencing with seismic data.
114-119	6	char	SEISMIC SHOT-POINT NUMBER
120	1	int	QUALITY CODE FOR NAVIGATION 5 – Suspected, by the originating institution 6 – Suspected, by the data center 9 – No identifiable problem found (NOTE – Institution will most frequently 9-fill this field; however, should they wish to code a "5", the data center will not contradict. The data center's quality control program, which performs (among other checks) a vectorial analysis of the navigation, is available in a printout form upon request.)

RVDAS and RTDAS Data Acquisition Systems

Why are there two data sets? What is RVDAS and how does it differ from RTDAS?

RTDAS (Real Time Data Acquisition System) has been used on the NBP since 1992. It was developed in the early 90's by EG&G specifically for the Nathaniel B. Palmer. It is a complex system made up of no less than 5 separate computers.

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 is a simpler, more robust system that performs less internal processing on the data sets. It was adapted for use on the Nathaniel B. Palmer and her sister ship, the R/V Laurence M. Gould and is now in the final stages of testing on these ships. Soon, it will replace RTDAS entirely.

RVDAS and RTDAS log exactly the same set of inputs. Hence, the raw data sets are theoretically identical. However, some internal processing is performed by the RTDAS system, therefore slight differences may be noted. The daily data processing scripts use the RVDAS data set. Both the raw and processed data sets from RVDAS are included in the data distribution. The RTDAS raw data set is provided for redundancy. In the case where processed data is logged from RTDAS, the raw data is also available. Below you will find detailed information on the data included in these sets. Be sure to read the "Significant Acquisition Events" section below for important information about data acquisition during this cruise.

RVDAS Raw Data Set

Path: rvdas/uw
rvdas/nav

File Naming Conventions

The RVDAS logged data file-naming convention differs from that of RTDAS. There is only one file type with RVDAS: raw data. Data arriving at RVDAS is time-stamped and written to disk. Other processes carry out all processing for analysis or display.

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

- The CruiseID is the numeric name of the cruise, for example: NBP9903.
- The ChannelID is a 4-character code representing the instrument of system being logged, for example: met1 (for meteorology)
- DDD is the Julian day during which the data is logged.

Unlike RTDAS, RVDAS only writes one file per day regardless of how many times logging is started or stopped.

File Structure and Channel ID's

RVDAS data is divided into two broad categories, ***Underway*** and ***Navigation***. The groups are abbreviated "uw" and "nav". Thus, these two subdirectories 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 CD.

Underway (/rvdas/uw)

- Barometer – bar1
- Bathy 2000 – bat1
- Meteorological – met1
- Flourometer – flr1
- Gravimeter – grv1
- Magnetometer – mag1
- Meteorological – met1
- Simrad – sim1

- Thermosalinograph – tsg1
- Winch – wnc1

Navigation (/rvdas/nav)

- Ashtech GPS – 3df1
- Trimble P-Code GPS – PCOD
- Gyrocompass – gyr1
- Furuno GPS – gp02
- NGL – ngl1

Time Stamps

All RVDAS data is time stamped in the following manner before it is written to disk.

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

Where,

- YY: two-digit year
- DDD: Julian Day
- HH: two digit GMT hours
- MM: two digit GMT minutes
- SS.SSS: seconds, with millisecond resolution, GMT

RTDAS Raw Data Set

Available sensors supported and logged through the Real Time Data Acquisition System (RTDAS) consisted of the following:

Instruments

Meteorological and Light Data

- Ambient Air Temperature
- Relative Humidity
- Wind Speed (starboard and port instruments)
- Wind Direction vectors (starboard and port instruments)
- PIR & PSP (Long-wave and Short-wave Light Spectrum)
- PAR (Photo-Active Radiation)

Barometer

- Barometric Pressure measured in millibars

GPS (Global Positioning System) Navigational Data

- Ashtec GPS (NMEA and PBEN), Model: XII
- PBEN – Standard PBEN Format from Ashtech receiver RAW string
- ATT – Pitch and Roll NMEA Format String from Ashtech RAW string

Trimble Centurion GPS, Model: 20636-00 SM

- P-code receiver GPS.
- NMEA Output: GLL, GGA, and VTG

Yokogawa Gyro

- Gyro heading from ship's navigation system.

Lacoste & Rhomberg Gravity Meter System (version 1.10)

- Gravity

NGL – Processed Navigational Data

NGL is a navigation software package that takes inputs from the Ashtec and Trimble GPS's and the Yokogawa Gyro. Using this information, it calculates Speed over Ground (SOG) and Course Made Good (CMG). The output string has the following fields.

- Latitude
- Longitude
- Heading
- Speed over ground
- Course made good

Ocean Data Equipment Corporation Bathy 2000 Sonar

- Depth only, logged continuously

Simrad EK500 Sonar

- Depth only, ceiling is 2500 meters, used sporadically throughout this cruise.

Sea-Bird Model 21 Thermosalinograph, including Turner Fluorometry

- Sea-Bird Underway Temperature, Conductivity, and Salinity data
- Remote (sea water intake) Temperature

- RAW data string in SeaBird hexadecimal format, includes fluorometry from Turner 10-AU instrument.

All of the sources listed above are connected to RT-DAS via RS-232 serial interface and configured as individual channels for data logging. Data from sensor inputs can be logged to disk in two different formats, either RAW or PROCESSED. RAW data files consist of a time stamp and the RAW RS-232 data string. No data manipulation is performed on these files.

Processed data files consist of a time stamp, and parsed data fields when applicable. PROCESSED fields also provide for limited mathematical calculations of the individual field or data sets. These calculations are primarily used for applying calibration coefficients and performing conversions, such as hexadecimal to decimal. These processed files should not be confused with the JGOFS and MGD77 processed data sets.

File Naming Conventions

All files are logged to disk on the RTDAS system follow the same naming convention. Each RTDAS channel consists of a three-letter name abbreviation. As an example, the naming scheme for the MET (meteorological) data stream is shown below. If a logging process is interrupted for any reason, RTDAS will begin writing new log files. The sequential data file number will be incremented by 1 when this occurs.

Raw data:	MET?????.R##
Processed data:	MET?????.D##

MET	Channel name, e.g. meteorological data
??????	Three digit Julian date & two-digit year (ex. 00199)
R	Raw data indicator
D	Processed data indicator.
##	Sequential number of the data file. (Usually 00.)

Field Formats

Below are the field formats for all channels logged on this cruise. Not all channels are logged in both raw and processed formats.

ASH Channel – raw data – PBEN String

Field	Parameter
1	Data
2	GMT time (hhmm)
3	Header Strings
4	Receive Time (GPS seconds of the week)
5	Station Position ECEF – X
6	Station Position ECEF – Y
7	Station Position ECEF – Z
8	Latitude
9	Longitude
10	Altitude
11	Velocity in ECEF – X
12	Velocity in ECEF – Y
13	Velocity in ECEF – Z
14	Site Name
15	PDOP
16	HDOP
17	TDOP

ASH Channel – raw data – ATT string

Field	Parameter

1	Date
2	Time (HHMM)
3	Header string
4	Receive time (GPS seconds of the week)
5	Heading in degrees
6	Pitch in degrees
7	Roll in degrees
8	Measure RMES (MRMS) in meters
9	Baseline RMS (MRMS) error in meters
10	Attitude reset flag

Note: Ignore single character fields between "data" fields.

BAR Channel – Processed data

Field	Parameter
1	Parameter
2	Epoch seconds
3	Milliseconds
4	Barometric pressure

Note: Ignore single character fields between "data" fields

BAT Channel – Raw Data

Field	Parameter
1	Date mm/dd/yy
2	Time hh:mm:ss
3	Digitized depth in meters to 5 significant digits to the left of the fixed decimal point and 1 digit to the right. I = invalid or lost bottom, V = valid or digitized bottom.
4	Empty field I00000.0
5	Empty field –99.99
6	date in month/day/year format
7	time in hours / minutes / seconds / hundredths
8	transmit pulse window type PW1 = Rectangular, PW2 = Hamming, PW3 Cosine, PW4 Blackman
9	Primary transmit frequency PF1 = 3.5 kHz, PF2 = 12.0 kHz
10	Parametric mode secondary frequency SF1 = 3.5 kHz, SF2 = 12.0 kHz
11	Transmit pulse length PL1 = 200 usec, PL2 = 500 usec, PL3 = 1 msec, PL4 = 2 msec, PL5 = 5 msec, PL6 = 10 msec, PL7 = 25 msec, If transmit mode is set to FM, then: PL1 = 25 msec, PL2 = 50 msec, PL3 = 100 msec.
12	System Operating Mode: MO1 = CW parametric, MO2 = CW, MO3 = FM parametric, MO4 = FM
13	Frequency sweep bandwidth: SB1 = 1 kHz, SB2 = 2 kHz, SB3 = 5 kHz
14	Transmit power level: PO1 = 0 dB, PO2 = -6 dB, PO3 = -12 dB, PO4 = -18 dB, PO5 = -24 dB, PO6 = -30 dB, PO6 = -30 dB, PO7 = -36 dB, PO8 = -42 dB
15	Transmit Mode: TX1 = single ping active, TX2 = pinger listen, TX3 = multipinging TR, TX4 = multipinging TR, TX5 = multipinging TTRR, TX6 = mulitpinging TTTTRRRR, TX7 mulitpinging TTTTTRRRRR
16	Transmit Rate: TR3 = 4 Hz, TR4 = 2 Hz, TR4 = 2 Hz, TR5 = 1 Hz, TR6 = .5 Hz, TR7 = .33 Hz, TR8 = .25 Hz, TR9 = .20 Hz, TR: = .10 Hz, TR; = .05 Hz
17	System Gain Mode: GM0 = hydrographic AGC, GM1 through GM9 = hydrographic +3db through + 27db manual. GM(ASCII A through D) = hydrographic + 30db through + 60db manual, GM(ASCII E through K) = sub-bottom 1 through sub-bottom 7.
18	Speed if sound in meters
19	Draft of vessel in meters (location of sonar window below water level)
20	Background Noise Level in fixed point reference to dB/V

BAT Channel – Processed Data

Field	Parameter

1	Date
2	Epoch seconds
3	Milliseconds
4	Digital Depth

Note: Ignore single character fields between "data" fields.

GRV Channel – Raw data

Field	Parameter
1	Date
2	GMT Time
3	(Ignore)
4	Gravity

Note: Ignore single character fields between "data" fields.

GYR Channel – Processed data

Field	Parameter
1	Date
2	GMT time
3	Gyro heading

Note: Ignore single character fields between "data" fields.

MET Channel – raw data

Field	Parameter
1	Date
2	GMT time
3	Sensor header
4	Starboard wind vector Y
5	Starboard wind vector X
6	Portside wind vector Y
7	Portside wind vector X
8	Dry temp
9	PSP (Pyrgeometer)
10	PIR (Pyranometer)
11	Wet temperature
12	Relative humidity
13	PAR
14	Spare field
15	Spare field
16	Spare field
17	Spare field
18	Spare field
19	UPS voltage
20	uMac
21	Temperature
22	uMac
23	DC voltage

MET Channel – processed data

Field	Parameter
1	Epoch Seconds
2	Milliseconds
3	Dry temperature
4	Relative humidity
5	Wet temperature
6	PSP (Pyrgeometer)
7	PIR (Pyranometer)

8	Starboard wind vector Y
9	Starboard wind vector X
10	Portside wind vector Y
11	Portside wind vector X
12	PAR

Note: Ignore single character fields between "data" fields.

NGL Channel – Raw Data

Field	Parameter
1	Date
2	Time
3	Latitude
4	Longitude
5	Speed
6	Course
7	Gyro heading
8	PDOP
9	HDOP
10	Quality
11	GPS up
12	Fix Number

NGL Channel – Processed Data

Field	Parameter
1	Epoch Seconds
2	Milliseconds
3	Latitude
4	Longitude
5	Speed
6	Course made good
7	Gyro
8	PDOP
9	HDOP
10	Number of Satellites seen
11	Quality
12	GPS up
13	Fix number

Note: Ignore single character fields between "data" fields.

PCD Channel – Raw Data: GGA, GGL, VTG NMEA Strings

Field	Parameter
1	Date
2	Time
3	GGA String: $GPGGA, hhmmss.ss,xxxx.xxxx,a,yyyyy.yyyy,a,m,nn,o.o,p.p,M,q.q,M,r.r.wwww*hh<CR><LF> hhmmss.ss: UTC of position xxxx.xxxx,a: Latitude N/S yyyyy.yyyy,a: Longitude, E/W m: GPS quality indicator nn: Number of satellites in use. o.o: Horizontal dilution of precision p.p,M: Antenna altitude above/below mean sea level (geoid) (meters) q.q,M: Geoidal separation (meters) r.r: Age of differential GPS data^2 wwww:Differential Reference Station ID
4	GLL String: $GPGLL, xxxx.xx,a,yyyyy.yy.a,hhmmss.ss,A*hh<CR><LF>

xxxx.xxxx,a: Latitude N/S
yyyyy.yyyy,a: Longitude, E/W
hhmmss.ss: UTC of position
A: Status of data (A = valid)

5 VTG String: $GPVTG
www.w,T,xxx.x,M,yyy.y,N,zzz.z,K*hh<CR><LF>
www.w,T: Track, degrees True
xxx.x,M: Track, degrees Magnetic
yyy.y,N: Speed knots
zzz.z,K: Speed, km/hour

Note: precision of some fields may vary.

SIM Channel – Raw data

Field	Parameter
1	Date
2	Time (HHMM)
3	Header string
4	SIMRAD time flag
5	Digital depth in meters
6	Bottom back-scatter strength
7	Not used – spare
8	Not used – spare

SIM Channel – Processed data

Field	Parameter
1	Epoch seconds
2	Milliseconds
3	Digital depth in meters

Note: Ignore single character fields between "data" fields.

TSG Channel – Raw data

Field	Parameter	
1	Time	
2	Sea-Bird hexadecimal string, broken down as follows:	
3	Bytes	Data
	1 – 4	Temperature
	5 – 8	Conductivity
	9 – 14	Remote temperature
	15 – 17	V0, Currently Unused
	18 – 20	V1, Flourometer

TSG Channel – Processed data

Field	Parameter
1	Epoch seconds
2	Milliseconds
3	TSG Temperature
4	Conductivity
5	Remote Temperature (sea-water intake)

Note: Ignore single character fields between "data" fields.

Calibrations

The TSG calibration file (TSGcal) is included.

PROCESSING RAW TSG DATA

Raw TSG data is stored as a hex string 20 bytes long.

Bytes	Data
1-4	Sensor Temperature
5-8	Conductivity
9-14	Remote Temperature
15-17	Fluorometer voltage
18-20	Fluorometer reference voltage

In all of the formulas listed below, the variables can be found in the TSGcal file.

Calculating Temperature

T = decimal equivalent of bytes 1-4

Temperature Frequency f = T/19 +2100

q = ln(fo/f)

Temperature = 1/{a + b * q + c * q2 + d * q3} -273.15 (degrees C)

Calculating Conductivity

C = decimal equivalent of bytes 5-8

Conductivity Frequency f = sqrt(C*2100+6250000)

Conductivity = (afm +bf2 +c +dt)/[10(1+ep)] (siemens/meter)

note e = epsilon in the TSGcal file

TSG CALIBRATION FILES

Primary Temp - Serial # 1390

<insert temperature calibration sheet from SeaBird here (for Serial #1390)>

Conductivity - Serial # 1390

<Insert conductivity calibration sheet here from sensor #1390>

Secondary Temp. - Serial # 2593

<insert temperature calibration sheet from SeaBird here (for Serial #2593)>

Gravity Tie 03/27/99, Punta Arenas, Chile

<Insert Gravity Tie sheet here>

Calculation of PIR, PSP and PAR Radiances:

PIR:

Ch. 5 on the Met String contains the recorded voltage after the PIR signal has gone through the signal conditioner (gain = 307.5) and the microMAC input module (gain = 1). The calibration factor is 3.52e-6 V/(W/m^2) (BSI 23 July 98). To turn the recorded voltage into W/m^2 multiply by 923.87

PSP:

Ch. 6 on the Met String contains the recorded voltage after the PSP signal has gone through the signal conditioner (gain = 309.3) and the microMAC input module (gain = 2). The calibration factor is 8.31e-6 V/(W/m^2) (BSI 23 July 98). To turn the recorded voltage into W/m^2 multiply by 194.53

PAR:

Ch. 9 on the Met string contains the recorded voltage after the PAR signal has gone through the microMAC input module (gain = 1). The calibration factor is 1.10e-17 V/(quanta/cm^2sec) (BSI 8/20/98). To turn recorded voltage into quanta/cm^2sec divide by 1.10e-17. To turn recorded voltage into microEi/m^2sec multiply by 1509.09.

NBP9903 Underway Sensors:

Port Anemometer:	Belfort model 5-122AHD SN 92-2132 Calibrated April 98 by ASA. Installed 4/21/98.
Starboard Anemometer	Belfort model 5-122AHD SN 7957 Calibrated December 97 by ASA. Installed 12/9/97.
Barometer:	AIR model AIR-DB-3A SN 7G3095 Calibrated April 98 by AIR. Installed 11/2/98.
Humidity / Dry Air Temp:	Rotronics model MP-101A-C4 SN R45618. Calibrated Feb 97 by Rotronics. Installed 9/13/98.
Mast PAR:	BSI model QSR-240 SN 6357. Calibrated Aug 98 by BSI. Installed 10/29/98.
P-Code GPS:	Trimble model 20636-00 (SM). Keyed until 12/30/98.
Attitude GPS:	Ashtech model 12 SN 700273F2114 FW 7B13-D1-C21.
Pyranometer:	Eppley model PSP SN 28933F3. Calibrated June 98 by Eppley Labs. Installed 9/13/98.
Pyrgeometer:	Eppley model PIR SN 28903F3. Calibrated June 98 by Eppley Labs. Installed 9/13/98. New battery installed 10/29/98.
Dry Air Temp:	R. M. Young model 41342C SN 2267. Calibrated May 98 by R. M. Young. Installed 9/13/98.
TSG:	SeaBird model 21 SN 218091-1390. Calibrated Apr 98 by SeaBird Electronics. Installed 9/98. A calibration comparison was made with the Auto Sal on 3/99. The results were calculated using PSU (Practical Salinity Units) and showed an accuracy to within 0.01 .
TSG Remote Temp:	SeaBird model 3-01/S SN 031497. Calibrated Feb 97.
Fluorometer:	Turner model 10-AU-005 SN 5651 FRTD. Installed 10/97. Lamp: daylight 10-045, reference filter: 10-052, emission filter: 10-051, excitation filter: 10-050.
Magnetometer:	EG&G model G-866
Gravimeter:	Lacoste and Romberg Air/Sea Gravity Meter

NBP9903 CTD Sensors:

CTD Fish:	SeaBird model SBE 9+ SN 09510716-0377, w/Paroscientific model 410K-105 pressure sensor SN 58949
CTD Deck Unit:	SeaBird model SBE 11+ SN 11P7536-0317
Primary Temperature Sensor:	SeaBird model 3-02/F SN 031237. Last cal 8/98.
Secondary Temperature Sensor:	SeaBird model 3-02/F SN 031541. Last cal 3/97.
Primary Conductivity Sensor:	SeaBird model 4-02/0 SN 041314. Last cal 5/98.
Secondary Conductivity Sensor:	SeaBird model 4C SN041798. Last cal 1/98.
Dissolved Oxygen Sensor:	SeaBird model 13-02-B SN 130491. Last cal 6/98.
Fluorometer:	Chelsea model Mk III Aquatracka SN 088080. Last cal 7/98.
Transmissometer:	Sea Tech SN 259. Last cal 11/97. (Gene Domack's Instrument)

Acquisition Problems and Events

This section lists all known problems with acquisition during this cruise including instrument failures, data acquisition system failures and any other factor affecting this data set. The format is jjj:hh:mm (jjj is julian day, hh is hour, and mm is minute). All times are in GMT.

RVDAS:

089:11:49	Begin data collection.
092:18:45 - 092:19:45	Ship UPS power failure. All systems down, but restarted normally.
093:03:30 - 093:04:30	Error on challenger (main logging server) indicated need for cleaning of the blower fan. This was a planned event that occurred during a transit to prevent down time during the following survey.
099:19:00	End of data collection (200-mile limit).

RTDAS:

089:12:03	Begin data collection.
092:19:46 - 092:20:21	Ship UPS power failure. All systems down, but restarted normally.
099:19:00	End of data collection (200-mile limit).

ASHTEC data showed intermittent gaps throughout the cruise. The gaps were calculated for julian days 090, 095-099, and are available in geopdata/ASH/rvash_jdd.fnl.gaps.