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.

CD

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 compressed using UNIX "gzip" compression. Gzipped files have a ".gz" 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 for CDs

It is often useful to know exactly how an archive was produced when expanding its contents.all .tar files were 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 on a UNIX platform:

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

To extract the files from the archive on a UNIX platform:

```
tar xvf  archive-file files-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
```

On a PC platform, use the included Winzip 32 Bit compression tool to de-archive and expand the compressed files. Please refer to the included readme.txt or help file for more information on installing and using this software.

On a Macintosh platform, please use Stuffit deluxe or a similar compression tool to access this data.

The directory structured is illustrated on the next page.

CD-ROM

adcp:

adcp.tar (pingdata files)

track

track.ps **-** a PostScript file containing a graphical representation of the cruise track

geopdata:

bat.tar – bathymetric data
grv.tar – gravimetry data
jgof.tar – JGOF data set
mag.tar – magnetic data
mgd77.tar – MGD77 data set
ngl.tar – GPS data
pcd.tar – P-Code GPS data
sb.tar – SeaBeam bathymetric-only data
tsg.tar – Thermosalinograph data, including flourometer data

ocean:

ocean.tar – tsg data in human-readable format

rvdas:

nav.tar - navigational data (GPS), Ashtech, P-Code, NGL & Gyro
uw.tar – all other bathy, engineering das, flourometer, barometer, gravitometer, magnatometer, meterological & thermosalinograph

report

report.doc - a copy of this report in WORD97 format
report.txt - a copy of this report in .txt format

xbt:

xbt.tar - Expendable Bathy Thermograph, includes both .rdf and .edf data files.

ADCP

The ADCP files are in a DOS format and have been compressed using the pkzip command. 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 DOS (not the compression) date time stamp in the individual pingdata files.

NBP Geophysical Data Products (MGD77 / JGOFS)

Path:

/geopdata/jgof.tar
/geopdata/mgd77.tar

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 NBP9908.mgd, There is also a file named NBP9908.gmt. This file is the output of the mgd77togmt utility using NBP9908.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 in 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 filled with 9’s.
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 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.

Columns	Length	Type	Description
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 Raw Data Set

Path: rvdas/uw.tar
rvdas/nav.tar

File Naming Conventions

RVDAS data files are named following the convention: [Cruise_ID][Channel_ID].d###

- The Cruise_ID is the numeric name of the cruise, for example: NBP9908.
- The Channel_ID is a 4-character code representing the instrument of system being logged, for example: met1 (for meteorology)
- ### is the Julian day during which the data is logged.

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.tar)

- Barometer – bar1
- Bathy 2000 – bat1
- Meteorological – met1
- Flourometer – flr1
- Gravimeter – grv1
- Magnetometer – mag1
- Simrad – sim1
- Thermosalinograph – tsg1
- Engineering – eng1

Navigation (/rvdas/nav.tar)

- 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 (Y2K note: if >= 70 add 1900; if < 70, add 2000)
- DDD: Julian Day
- HH: two digit GMT hours
- MM: two digit GMT minutes
- SS.SSS: seconds, with millisecond resolution, GMT

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

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.

Field Formats

Below are the field formats for all channels logged on this cruise.

ASHTECH – PBN String

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

ASH Channel – ATT string

Field	Parameter
1	Date and Time

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

BAROMETER

Field	Parameter
1	Date and Time
2	Barometric pressure

BATHY2000

Field	Parameter
1	Date and Time
2	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.
3	Empty field I00000.0
4	Empty field –99.99
5	date in month/day/year format
6	time in hours / minutes / seconds / hundredths
7	transmit pulse window type PW1 = Rectangular, PW2 = Hamming, PW3 Cosine, PW4 Blackman
8	Primary transmit frequency PF1 = 3.5 kHz, PF2 = 12.0 kHz
9	Parametric mode secondary frequency SF1 = 3.5 kHz, SF2 = 12.0 kHz
10	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.
11	System Operating Mode: MO1 = CW parametric, MO2 = CW, MO3 = FM parametric, MO4 = FM
12	Frequency sweep bandwidth: SB1 = 1 kHz, SB2 = 2 kHz, SB3 = 5 kHz
13	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
14	Transmit Mode: TX1 = single ping active, TX2 = pinger listen, TX3 = multipinging TR, TX4 = multipinging TR, TX5 = multipinging TTRR, TX6 = mulitpinging TTTTRRRR, TX7 mulitpinging TTTTTRRRRR
15	Transmit Rate: TR3 = 4 Hz, TR4 = 2 Hz, TR4 = 2 Hz, TR5 = 1 Hz, TR6 = .5 Hz, TR 7 = .33 Hz, TR8 = .25 Hz, TR9 = .20 Hz, TR: = .10 Hz, TR; = .05 Hz
16	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.
17	Speed if sound in meters
18	Draft of vessel in meters (location of sonar window below water level)
19	Background Noise Level in fixed point reference to dB/V

GRAVITY

Field	Parameter
1	Date and Time
2	(Ignore)
3	Gravity

GYRO

Field	Parameter

1	GMT Date and TIME
2	$HEHRC
3	Gyro heading
4	Rate of Change

MAGNATOMETER

Field	Parameter
1	GMT Date and Time
2	%
3	(Ignore)
4	Julian day
5	Time
6	Quality
7	Magnetic Value

METEROLOGICAL

Field	Parameter
1	GMT Date and Time
2	Sensor Header ($MET:)
3	Starboard wind vector Y
4	Starboard wind vector X
5	Port wind vector Y
6	Port wind vector X
7	Dry Temperature
8	PSP (Pyrgeometer)
9	PIR (Pyranometer)
10	Wet Bulb Temperature
11	Relative Humidity
12	PAR
13	Spare Field
14	Spare Field
15	Spare Field
16	uMac (UPS voltage)
17	uMac (Temperature)
18	uMac (DC voltage)

NGL

Field	Parameter
1	GMT Date and Time
2	Latitude
3	Longitude
4	Speed
5	Course
6	Gyro heading
7	PDOP
8	HDOP
9	Quality

10	GPS up
11	Fix Number

POCD: GGA, GGL, VTG NMEA Strings

Field	Parameter
1	GMT Date and Time
2	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
3	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)
4	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

SIMMRAD

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

TSG

Field	Parameter
1	Time
2	Sea-Bird hexadecimal string, broken down as follows:

Bytes	Data
1 – 4	Temperature
5 – 8	Conductivity
9 – 14	Remote temperature
15 – 17	V0, Currently Unused
18 – 20	V1, Flourometer

Calibrations

Path:

/tsgcal

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 # 857

<insert temperature calibration sheet from SeaBird here (for Serial #857)>

Conductivity - Serial # 857

<Insert conductivity calibration sheet here from sensor #857>

Secondary Temp. - Serial # 2593

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

PAR Mast Sensor

Gravity Tie *DATE, LOCATION*

<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^{2}sec) (BSI 8/20/98). To turn recorded voltage into quanta/cm^{2}sec divide by 1.10e-17. To turn recorded voltage into microEi/m^{2}sec multiply by 1509.09. Please see caution note on the following page under section "Acquisition Problems and Events"

NBP9908 Underway Sensors:

Port Anemometer:	Belfort model 5-122AHD SN 7957 Calibrated April 99 by ASA.
Starboard Anemometer	None present for NBP 99-08
Barometer:	AIR model AIR-DB-3A SN 2G2461 Calibrated February 99 by AIR. Installed 04/10/99
Mast PRR:	BSI model 610 SN 9696 Calibrated Mar 99 by BSI. Installed 10/1/98.
UW PRR:	BSI model 600 SN 9695 Calibrated Mar 99 by BSI. Installed 10/1/98.
Humidity / Dry Air Temp:	Rotronics model MP-101A-C4 SN R45618. Calibrated Apr 99 by Rotronics. Installed 6/11/99.
Mast PAR:	BSI model QSR-240 SN 6356. Calibrated Apr 99 by BSI. Installed 6/11/99.
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 218091-857. Calibrated Oct 98 by SeaBird Electronics. Installed 6/99.
TSG Remote Temp:	SeaBird model 3-01/S SN 032593. Calibrated Nov 98.
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.
Gravimeter:	Lacoste and Romberg Air/Sea Gravity Meter

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 DATA COLLECTION:

230:00:00	Begin data collection.
238:01:46	UPS power failure causes data collection to seize.
238:02:21	UPS power back on line, data collection resumes.
250:17:40	End data collection

Ashtech GPS
The Ashtech GPS experienced intermittent problems during the cruise, especially during JD 230 – 235. The instruments' Attitude, pitch and roll information was not being updated as often as its position. After the instrument was re-set, the problems subsided.

Anemometers
The Starboard Anemometer was not used during this cruise. Therefore, all data fields from this particular instrument are null.