

Lamont– Doherty Earth Observatory
 Office of Marine Affairs
 61 Route 9W
 Palisades, NY 10969

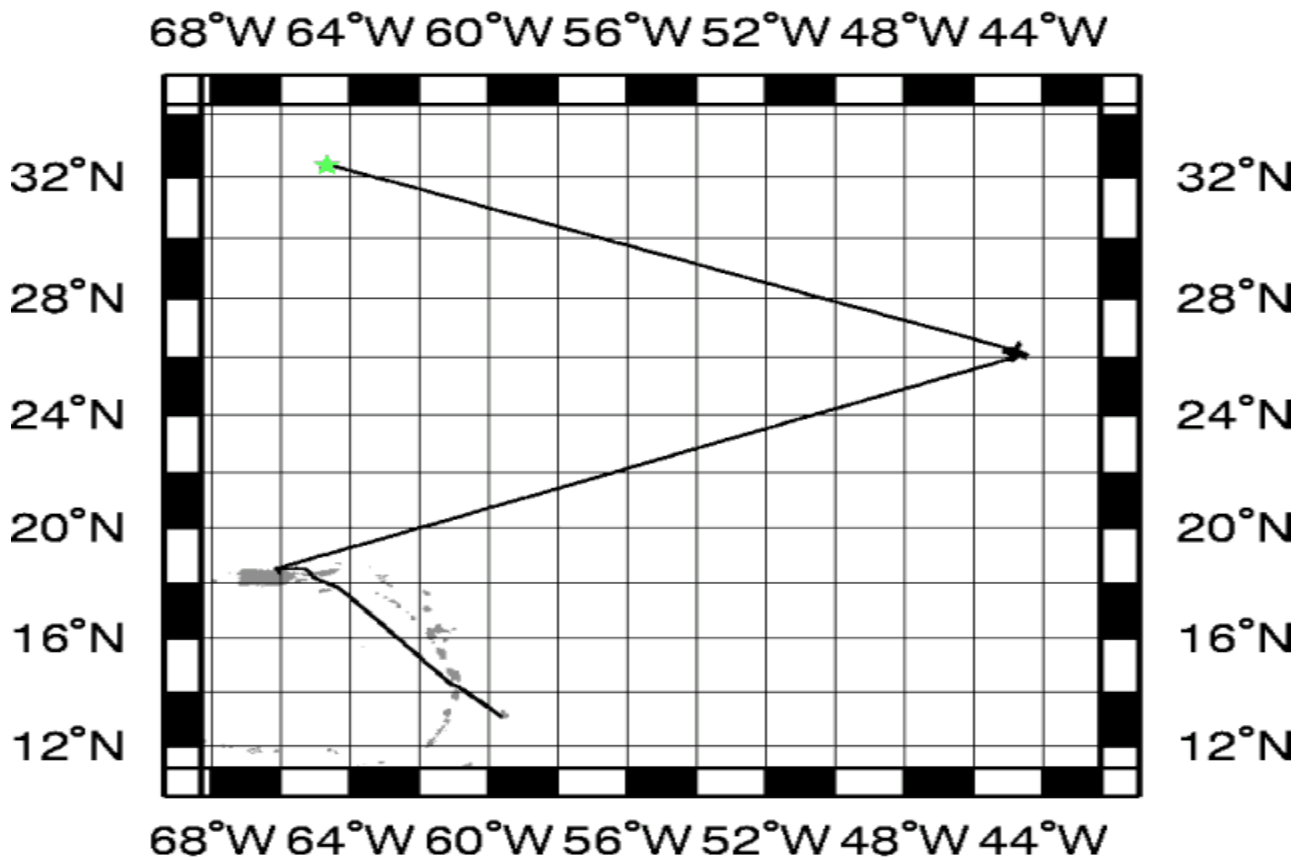


Prepared By: Ethan Gold
 etgold@ldeo.columbia.edu
 845 365-8677

R/V Maurice Ewing Data Reduction Summary

EW0309 Bridgetown, Barbados – St. George, Bermuda

Date	Julian Date	Time	Port
October 22, 2003	295	12:00 UTC	Bridgetown, Barbados
November 9, 2003	313	08:36 UTC	Bermuda



GMT 2003 Nov 9 17:55:21 TO DATE

Project Summary

DESCRIPTION

Background and Scientific Objectives

Seismic survey of a geothermal vent region, searching for evidence of magma chambers.

Cruise Members

Science Party

Juan Pablo Canales	Chief Scientist
Robert Reves–Sohn	Co–chief scientist
Katrina Jovanovic	scientist
Andrew DeLorey	scientist
Genevive Parent	scientist
Alexander Chappell	scientist
Elena Miranda	scientist
Janet Baran	scientist
Spahr Webb	scientist
Patrick Jonke	scientist
Bern McKieren	scientist
Eric Phillips	scientist
Wayne Crawford	scientist
Meike Holst	Chief MMO
Howie Goldstein	MMO
Sarah Stoltz	MMO

Ship's Science

Carlos Gutierrez	Gunner	carlosqu@ldeo.columbia.edu
Ropate Maiwiriwiri	Core Bosun	ropate@ldeo.columbia.edu
Ethan Gold	Sysadmin	etgold@ldeo.columbia.edu
Ted Koczynski	Science Officer	tedski@ldeo.columbia.edu
Jacob Greenburg	ET	jacob@ewing.ldeo.columbia.edu
Shin Ae Tassia	Technician	shinae@ldeo.columbia.edu
John DiBernardo	Gunner	honey@ewing.ldeo.columbia.edu
Justin Walsh	Gunner	cabinboy@ldeo.columbia.edu

Ship Crew

Mark Landow	Captain	captain@ewing.ldeo.columbia.edu
Steve Pica	Chief Engineer	engine@ewing.ldeo.columbia.edu
Stanley Zeigler	1 st Mate	stan@ewing.ldeo.columbia.edu
Shankar Bhardwaj	2 nd Mate	bhardwaj@ewing.ldeo.columbia.edu
Melannie Lovercheck	3 rd Mate	melannie@ewing.ldeo.columbia.edu
Miguel Flores	1 st A/Engineer	miguel@ewing.ldeo.columbia.edu
Matthew Ingerson	3 rd A/Engineer	ingerson@ewing.ldeo.columbia.edu

Mike Unger	3 rd A/Engineer	unger@ewing.ldeo.columbia.edu
Shawn Lindenmuth	Steward	shawn@ewing.ldeo.columbia.edu
David Philbrick	Bosun	davep@ewing.ldeo.columbia.edu
Fry, Robert	A/B	rfry@ewing.ldeo.columbia.edu
Baxter, Steve	Oiler	steveb@ewing.ldeo.columbia.edu
Moqo, Luke	Utility	luke@ewing.ldeo.columbia.edu
Von Mehren, Dennis	A/B	dennis@ewing.ldeo.columbia.edu
Strickland, Leslie	Oiler	gordo@ewing.ldeo.columbia.edu
Osorio, Nolan	O/S	nolan@ewing.ldeo.columbia.edu
Michael Wees	Cook	wees@ewing.ldeo.columbia.edu
Knight, Robert	Oiler	knight@ewing.ldeo.columbia.edu
Strimback, Roger	O/S	
Walker, Wakefield	A/B	walker@ewing.ldeo.columbia.edu

Cruise Notes

All data in this report is logged using GMT time and Julian days in order to avoid confusion with local time changes.

Hydrosweep

Hydrosweep operated normally.

Gravity

The Gravimeter was malfunctioning for the duration of the cruise.

Magnetics

No data taken

Navigation

The POS/MV (gp04) suffered the most from solar storm activity. gp02 (Trimble) was used for navigation processing and real-time Nav. There were several trimble outages.

Time

Time sync was not a problem despite ongoing trouble with the joetime clock. Bad time fixes are being discarded by the time master.

Spectra

Spectra was plagued with ncn node problems which resulted in some missed shots. Fortunately the shot interval was long enough that the losses weren't disastrous.

Data Logging

The R/V Maurice Ewing data logging system is run on a Sparc Ultra Enterprise Server. Attached are 48 serial ports via 3 16-port Digi International SCSI Terminal Servers. Generally, all data logged by the Ewing Data Acquisition System (DAS) is time stamped with the CPU time of the server, and broadcast to the Ewing network using UDP packet broadcasts. The CPU time of the server is synchronized once every half hour to a Datum UTC gps time clock.

GPS times are also time-tagged with cpu time, although the time of the GPS position is from the GPS fix itself.

The following tables describe the data instruments which performed logging during this cruise. The tables associated with the instruments describe logging periods and data losses for that instrument.

Time Reference

Datum StarTime 9390-1000

logging interval: 30 minutes
file id: tr2

Used as the visual UTC reference on top of the computer racks.

This clock was running and synchronizing the system the entire cruise.

Interruptions greater than 30 minutes are displayed in the following table

Log Date	LogDate	Comment
2003+300:18:12:30.196		Logging officially started
2003+300:21:12:29.756		Logging officially ends

JOETIME

logging interval: 30 minutes
file id: tr3

Used as the CPU synchronization clock. This clock is polled once every half hour to synchronize the CPU clock of the data logger to UTC time. The logger (octopus) is responsible for updating the times of the other CPUs.

This clock was running and synchronizing the system the entire cruise.

Interruptions greater than 30 minutes are displayed in the following table

Log Date	LogDate	Comment
2003+296:12:26:23.212		Logging officially started
2003+300:17:49:23.819	2003+300:21:18:30.041	Data Interruption
2003+300:22:09:29.247	2003+301:00:05:31.215	
2003+313:16:12:11.133		Logging officially ends

GPS Receivers

GPS data is usually logged at 1 – 2 second intervals. The NMEA strings GPGGA and GPVTG are logged for position, speed, and heading fixes. This data was logged constantly throughout the cruise.

Trimble NT300D

logging interval: 2 seconds
file id: gp2

The Trimble is the secondary receiver for GPS data. Data is logged at 2 second intervals and is also used as an input to Spectra, although it is weighed at a lower value than the Tasmon receiver.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2003+295:02:46:33.375		Logging officially started
2003+299:05:59:23.479	2003+299:08:36:17.634	Data Interruption
2003+300:09:20:40.119	2003+300:12:27:30.637	
2003+300:17:49:23.380	2003+300:18:40:25.623	
2003+302:05:12:55.242	2003+302:09:01:27.295	
2003+304:12:30:16.168	2003+304:12:50:54.308	
2003+305:09:04:19.555	2003+305:09:16:58.478	
2003+305:10:54:16.020	2003+305:11:57:06.317	
2003+307:15:06:13.919	2003+307:15:37:10.565	
2003+310:04:58:04.929	2003+310:19:19:37.579	
2003+311:17:21:32.329	2003+312:12:30:31.310	
2003+312:16:50:53.555	2003+312:19:59:47.009	
2003+312:20:05:09.979	2003+312:20:16:08.136	
2003+313:01:23:47.378	2003+313:01:56:27.473	
2003+313:02:41:12.603	2003+313:03:03:23.890	
2003+313:05:10:44.543	2003+313:05:31:52.159	
2003+313:16:11:51.423		Logging Ends

C-Nav

logging interval: 2 seconds
file id: gp3

The C-Nav is a global satellite-based differential receiver. This is the best individual receiver currently on the ship.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2003+295:02:46:36.596		Logging officially started
2003+300:17:49:23.717	2003+300:18:40:30.797	
2003+313:16:11:51.563		Logging Ends

POS/MV

logging interval: 1 second
file id: gp4

The POS/MV is a receiver which uses C-Nav input, its own antennae, an inertial sensor, and optional RTCM corrections (when available) and a kalman filter to produce a smooth nav output and very accurate heading. As of June 2003 it is used as the primary GPS for Hydrosweep, as an input to Spectra, and can be used as the gps for reduction processing. With the C-Nav auxiliary input, this is the most accurate receiver on the ship.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2003+295:02:46:43.295		Logging officially started
2003+300:17:49:23.136	2003+300:18:40:40.082	
2003+302:22:25:12.660	2003+302:23:39:53.660	
2003+309:06:00:30.576	2003+309:10:57:40.858	
2003+313:14:26:25.737		Logging Ends

Speed and Heading

Furuno CI-30 Dual Axis Speed Log Sperry MK-27 Gyro

logging interval: 6 seconds
file id: fu

The Furuno and Gyro are combined to output speed, heading and course information to a raw Furuno file, as well as an NMEA VDVHW signal used as an input to various systems including steering and Spectra.

Interruptions greater than 30 minutes are displayed in the following table

Log Date	Log Date	Comment
2003+295:02:47:01.517		Official start date
2003+300:17:49:18.864		Official end date

Gravity

Bell Aerospace BGM-3 Marine Gravity Meter System

logging interval: 1 second
file id: vc. (raw), vt. (processed)
drift per day: -0.205

The BGM consists of a forced feedback accelerometer mounted on a gyro stabilized platform. The gravity meter outputs raw counts approximately once per second which are logged and processed to provide real-time gravity displays during the course of the cruise as well as adjusted gravity data at the end of the cruise.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	Log Date	Comment
2003+295:02:47:10.836		Official start date
2003+300:17:49:24.067	2003+300:18:41:10.338	
2003+313:16:12:08.109		Official end time

Bathymetry

Krupp Atlas Hydrosweep-DS2

logging interval: variable based on water depth
file id: hb (centerbeam), hs (swath)

The hydrosweep full swath data is continuously logged for every cruise, and centerbeam data is extracted and processed separately. The centerbeam operates at a logging frequency dependent on the water depth.

The full swath data is not routinely processed, but can be processed with the MB-System software which can be downloaded for free. For instructions, use the website: <http://www.ldeo.columbia.edu/MB-System>.

MBSystem, version 5.0beta3 is necessary to process data after June 1, 2001.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2003+295:02:48:17.000		Official start logging
2003+299:00:33:10.000	2003+299:01:02:13.000	

Log Date	LogDate	Comment
2003+300:17:49:03.000	2003+300:18:43:55.000	
2003+303:05:04:13.000	2003+303:05:57:28.000	
2003+303:05:57:28.000	2003+303:07:53:09.000	
2003+303:14:15:32.000	2003+303:15:00:11.000	
2003+303:15:00:11.000	2003+303:17:03:59.000	
2003+303:18:05:53.000	2003+303:21:52:02.000	
2003+303:22:59:58.000	2003+304:02:33:26.000	
2003+304:02:46:36.000	2003+304:03:34:08.000	
2003+304:04:08:06.000	2003+304:05:01:57.000	
2003+304:05:47:54.000	2003+304:08:58:33.000	
2003+305:07:36:33.000	2003+305:07:51:29.000	
2003+305:08:00:34.000	2003+305:08:13:50.000	
2003+305:08:16:55.000	2003+305:09:16:35.000	
2003+305:09:24:48.000	2003+305:10:48:54.000	
2003+305:13:09:59.000	2003+305:18:29:33.000	
2003+305:19:05:05.000	2003+305:19:57:58.000	
2003+305:20:40:09.000	2003+305:23:10:13.000	
2003+305:23:58:37.000	2003+306:00:22:23.000	
2003+306:01:17:56.000	2003+306:13:12:03.000	
2003+306:13:49:10.000	2003+306:14:38:14.000	
2003+306:20:01:44.000	2003+306:22:20:00.000	
2003+307:18:29:35.000	2003+308:11:06:36.000	
2003+313:13:28:43.000		Official end logging

Weather Station

RM Young Precision Meteorological Instruments, 26700 series

logging interval: 1 minute
file id: wx

The weather station is used to log wind speed, direction, air temperature, and barometric pressure. We log this information at 1-minute intervals.

Log Date	LogDate	Comment
2003+295:02:47:47.766		Official start logging
2003+300:17:49:00.686	2003+300:18:42:07.584	
2003+313:16:12:00.100		Official end logging

Gravity Ties

LOCATION 1

EW0308 Bridgeport, Barbados

Pier/Ship	Latitude	Longitude
	13 06.07347N	59 37.75187W
Bridgeport Harbor		
Reference	Latitude	Longitude
No Lat/Lon available, (see map in gravity log).		

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0307	275	02. Oct 03	32.21	0.92	32.21
Post Cruise	EW0308	292	19. Oct 03	28.73	-0.205	0.00
Total Days			17.00	-3.48		

Time	Entry	Value	
16:10:00	CDeck Level BELOW Pier	0.30	
16:10:00	Pier 1 L&R Value	1966.10	L&R
15:50:00	Reference L&R Value	1967.58	L&R
16:30:00	Pier 2 L&R Value	1966.10	L&R
	Reference Gravity	978294.44	mGals
	Gravity Meter Value (BGM Reading)	978309.80	mGals
	Needs Potsdam Correction	1	1 if Potsdam referenced

Gravity meter is 5.5 meters below CDeck

Difference in meters between Gravity Meter and Pier	5.80	meters
Height Cor = Pier Height* FAA Constant	5.80	0.31
		1.80
		mGals/min

Difference in mGals between Pier and Gravity Meter

Pier (avg) - Reference *1.06 L&R/mGal	Delta L&R
1966.10 1967.58 1.06	-1.57
	mGals

Gravity in mGals at Pierside

Reference + Delta mGals [+ Potsdam]	IGSN-71 Referenced Pier
978294.44 -1.57 -13.60	978279.27
	mGals

Gravity in mGals at Meter

Pier Gravity+ Height Correction	Gravity@meter
978279.27 1.80	978281.07
	mGals

Current Mistie

BGM Reading	Calculated Gravity	Current Mistie
978309.80	978281.07	28.73
		mGals

Gravity Ties

Location 2

File Formats

For all formats, a - in the time field means an invalid value for some reason.

Streamer Compass/Bird Data

cb.r

This data is not processed, but can still be found in the "processed" data directory.

```
Shot Time      Line   Shot   Latitude   Longitude
2000+079:00:08:40.085  strike1 000296  N 15 49.6217 W 060 19.8019

2nd GPS Position                               Tailbuoy Position
Latitude   Longitude                               Latitude   Longitude
N 15 49.6189 W 060 19.8101   N 15 47.1234 W 060 20.1901

Furuno Streamer
Gyro      Compasses & Heading
344.1      C01 2.3 C02 1.7 ...
```

Gun Depths

dg

Gun depths in tenths of meters. There will always be 20 gundepths even if only one gun was configured and shooting.

```
Shot Time      Gun Depths
                  1  2  3  4  5  6  7  8  9  ... 20
2001+089:06:47:05.909 189 068 005 005 096 005 060 054 005 ... 6
```

Raw Furuno Log

fu.s

This data has been smoothed and output 1 fix per minute.

```
CPU Time Stamp   Track Speed Hdg  Gyro
2000+166:00:01:53.091 -    4.4   140.5 148.3
```

Hydrosweep Centerbeam

hb.n

Hydrosweep data merged with navigation

```
CPU Time Stamp   Latitude Centerbeam Longitude Depth
                N 13 6.6206   W 59 39.3908  134.9
2000+074:09:55:00.000
```

Merged Data

m

```
CPU Time Stamp   Latitude   Longitude   GPS
                N 45 54.1583 W 42 47.1770   Used Set Drift Depth
2000+200:12:25:00.000                gp1  0.0  0.0

Magnetic                               Gravity
Total Intensity Anomaly   FAA GRV   EOTVOS Drift Shift
49464.7                55.5      22.2 980735.0  -8.4   -0.1   2.8

Temperature Salinity Conductivity
0.0      0.0      0.0
```

The gravity drift and shift are values that have been added to the raw gravity to make up for drift in the meter that has been lost in accordance with a gravity check at each port stop.

Temperature, Salinity and Conductivity will only be valid while logging a Thermosalinograph, which is not usually the case.

Magnetics Data

mg.n

- A minus sign in the time stamp is flagged as a spike point, probably noise...
- Anomaly is based on the International Geomagnetic Reference Field revision 2000

<u>CPU Time Stamp</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Raw Value</u>	<u>Anomaly</u>
200+077:00:23:00.000	N 16 11.2918	W 59 47.8258	36752.2	-166.8

Navigation File

n

<u>CPU Time Stamp</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Used</u>	<u>Set</u>	<u>Drift</u>
2000+074:00:03:00.000	N 13 6.2214	W 59 37.9399	gp1	0.0	0.0

Navigation Block

nb0

Navigation is a compendium of Ewing logged data at shot time. The shot position here is the shot position from the Spectra system.

<u>Shot Time</u>	<u>Shot #</u>	<u>CPU Time</u>	<u>Shot Position</u>
2001+088:00:00:00.606	016967	2001+088:00:00:03.031	N 30 11.8324 W 042 10.8162

<u>Water Depth</u>	<u>Sea Temp</u>	<u>Wind Spd</u>	<u>Wind Dir</u>	<u>Tailbuoy Latitude</u>	<u>Tailbuoy Longitude</u>	<u>Range</u>	<u>Bearg Name</u>	<u>Line</u>	<u>Speed</u>	<u>Heading</u>
2565.1	20.7	16.4	164	N 30 12.0427	W 042 14.7319	6296.3	93.5	MEG-10	4.2	101.1

Tailbuoy Navigation

tb1.c

Raw tailbuoy fixes

<u>CPU Time Stamp</u>	<u>Latitude</u>	<u>Longitude</u>	<u>GPS Precision</u>
2001+088:00:00:02.000	N 30 12.0424	W 042 14.7309	SA

GPS Precision is either SA, DIFF or PCODE

Ewing Processed Shot Times

ts.n

Shot times and positions based on the Ewing navigation data processing

<u>CPU Time Stamp</u>	<u>Shot #</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Line Name</u>
2000+079:00:08:01.507	000295	N 15 49.5703	W 060 19.7843	strikel

Shot Data Status

ts.n.status

The ts.nxxx.status file describes the line information for that day, giving some basic statistics about the line: start, end times; missing shots; start and end shots.

```
LINE strikel: 98+079:00:00:15.568 : 000283 .. 002286
      MISSING: 347, 410, 1727
```

```
LINE dip2: 98+079:23:05:22.899 : 000002 .. 000151
```

This example says that on Julian Day 079 of 1998, two lines (strikel and dip2) were run: the end of strike 1 (shots 000283 to 002286) and the start of dip2 (shots 000002 to 000151).

Line strikel had some missing shots in the data file (probably missing on the SEG-d header as well).

Spectra Shot Times

nb2.r

The shot times and positions based on the Spectra positioning; with raw tailbuoy range and bearing.

<u>CPU Time Stamp</u>	<u>Shot #</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Line Name</u>
2001+084:00:00:05.924	009245	N 23 31.2410	W 045 25.0894	

<u>Latitude</u>	<u>Longitude</u>	<u>Tailbuoy Range</u>	<u>Bearing</u>	<u>Line Name</u>
N 23 30.4540	W 045 21.4338	6389.8	283.2	KANE-4

Raw Gravity Counts

vc.r

sample BGM-3 gravity count record (without time tag):

pp:dddddd ss

| | | _____ status: 00 = No DNV error; 01 = Platform DNV
| | | 02 = Sensor DNV; 03 = Both DNV's
| | _____ count typically 025000 or 250000
| _____ counting interval, 01 or 10
The input of data can be at 1 or 10 seconds.

Gravity Data

vt.n

- * A minus sign in the time stamp is flagged as a spike point
- * m_grv3 calculates the Eotvos correction as:
$$\text{eotvos_corr} = 7.5038 * \text{vel_east} * \cos(\text{lat}) + .004154 * \text{vel} * \text{vel}$$
- * The theoretical gravity value is based upon different models for the earth's shape.
 - 1930 = 1930 International Gravity Formula
 - 1967 = 1967 Geodetic Reference System Formula
 - 1980 = 1980 Gravity Formula
- * The FAA is computed as:
$$\text{faa} = \text{corrected_grv} - \text{theoretical_grv}$$
- * Velocity smoothing is performed w/ a 5 point window

<u>CPU Time Stamp</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Model</u>	<u>FAA</u>	<u>RAW</u>
2000+148:00:10:00.000	N 09 34.7255	W 085 38.5826	1980	9.48	978264.16

<u>Eotvos Smooth</u>	<u>Drift Total</u>	<u>DC Shift</u>	<u>Raw Velocity North</u>	<u>Raw Velocity East</u>	<u>Smooth Velocity North</u>	<u>Smooth Velocity East</u>
-74.78	0.06	4.16	1.875	-10.373	1.927	\10.166

Datum Time

ts2.r

<u>CPU Time</u>	<u>Datum Time</u>	<u>Time Reference</u>
2001+069:00:15:29.727	069 00 15 29.378	datum

Raw GPS

gp(12).d, tb1.d

Raw GPS is in NMEA Format.

Meteorological Data

WX

```

                                True
CPU Time Stamp      Spd Dir
2001+045:00:00:00.967  7.8 22

Bird1:
Speed              Direction
Inst 60sA 60mA 60sM Inst 60sA 60mA
Bird 2
Speed              Direction
Inst 60sA 60mA 60sM Inst 60sA 60mA
7.8  6.6  8.5  16.8 277 291 5      0.0  0.0  0.0  0.0  0  0  0

Temperature
Inst 60mA 60mm 60mM      Humidity
Inst 60mm 60mM      Barometer
15.0 14.2 14.3 15.1      92  90  93      1027.5

Inst:      Current
60sA:      60 second average
60mA:      60 minute average
60sM:      60 second maximum
60mm:      60 minute minimum
60mM:      60 minute maximum
```

Merged Meteorological Data

mmet

```

TSG, WX, CT merged with Nav at 1 minute fixes
date      time      lat      lon      gpu head spd
2001+244:00:00:00.000 12.14071 44.98469 gp1 10.2 83.0

tws twd temp hum press cti cte con sal ct
26.5 228.0 30.6 87.0 1000.8 28.8 28.8 5.9 36.3 28.8
```

```

gpu = gps unit in use
head = ship's heading
spd = ship's speed in knots
tws = true wind speed
twd = true wind direction
temp = air temp (celcius)
hum = relative humidity (%)
press= pressure in mb
cti = sea temp from the internal TSG sensor
cte = sea temp from the external TSG sensor
con = conductivity, Siemens/meter
sal = salinity, practical salinity units
ct = sea temp from the C-keel sensor (to tenths of a degree)
```

Tape Contents

EW0309/

CruiseReport_EW0309.pdf	This document
ew0309.cdf	NetCDF database file of this cruise
ew0309.cdf_nav	NetCDF database file of this cruise' navigation
XBT/	XBT data
spectra/	Spectra P1/P2 files and configs
configs/	logging and reduction configs
sodar/	3.5kHz digital data
waypoints/	waypoint spreadsheets and text files
docs/	File Formats, UKOOA Formats
processed/	Processed datafiles merged with navigation
shotlogs/	processed Shot Files
trackplots/	daily cruise track plots (<i>postscript</i>)
raw/	Raw data directly from logger
reduction/	Reduced data files
clean/	daily processing directory, includes daily
postscript plots of the data	
scripts/	Perl scripts and their friends
MMO/	Marine Mammal Observations
waypoints/	Waypoints working directory