

Lamont– Doherty Earth Observatory  
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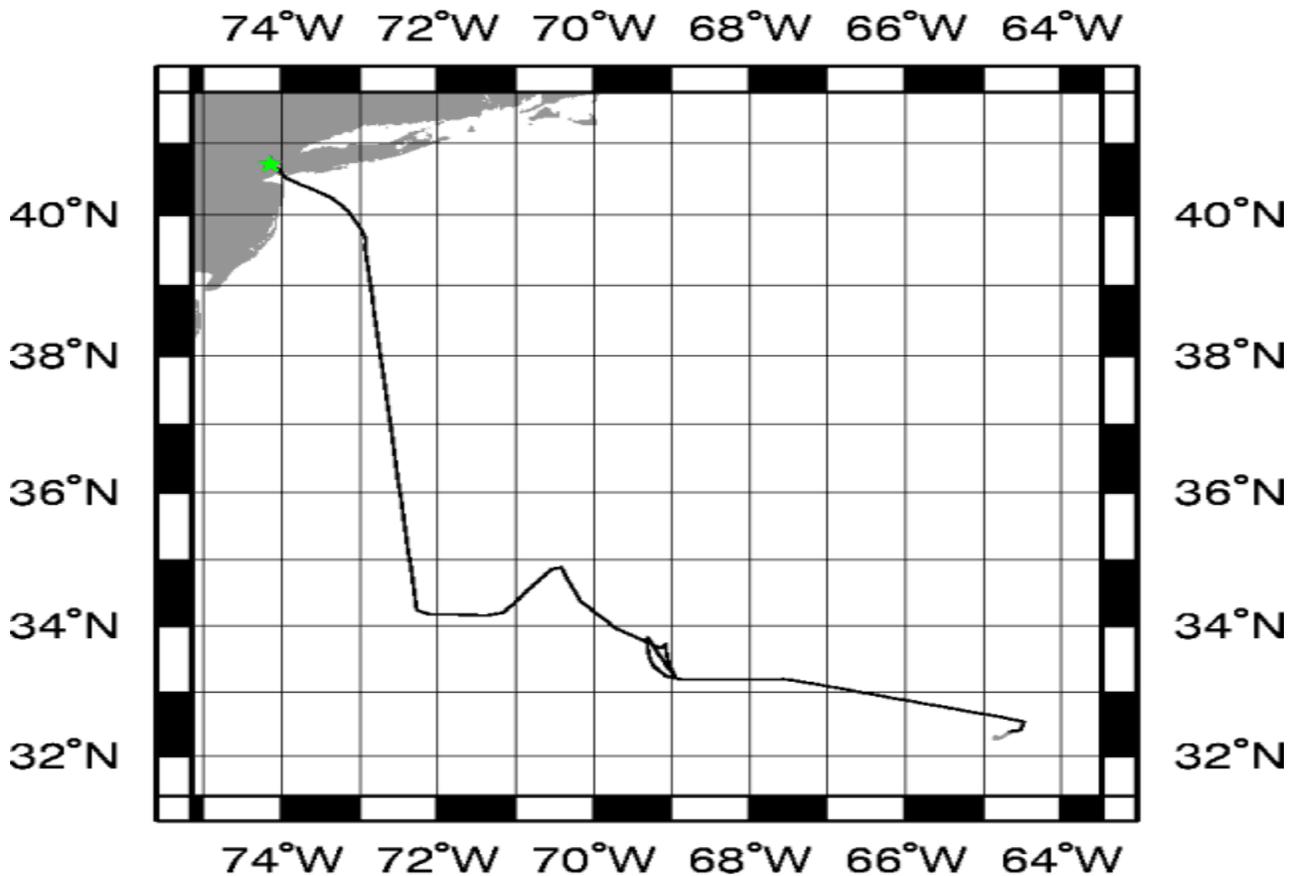


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## R/V Maurice Ewing Data Reduction Summary

EW0310 St. George, Bermuda – Newark, NJ

Date	Julian Date	Time	Port
November 14, 2003	318	12:00 UTC	St. George, Bermuda
November 20, 2003	324	12:00 UTC	Newark, NJ



**GMT** 2003 Nov 20 19:31:37 **TO DATE**

# Project Summary

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## *DESCRIPTION*

### **Background and Scientific Objectives**

Investigation of the structure beneath the Bermuda Rise.

The cruise was cancelled after four days out before any work could be done due to permitting problems at the last minute.

# Cruise Members

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## Science Party

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## Ship's Science

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## Ship Crew

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# Cruise Notes

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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. An experiment was performed to determine if variations in the POS/MV heave settings would alter an apparent heave error in the data. No significant change was detected in all three phases of the experiment.

## Gravity

The Gravimeter was malfunctioning for the duration of the cruise. A gravity tie was not taken in Bermuda, though a nearby tie from 2.5 years previous suggested a reasonable at-rest value for the gravimeter in port, though dynamic operation produces junk data.

## Magnetics

No data taken

## Navigation

Navigation operated normally.

## Time

No notes

## Spectra

Spectra was configured, but never used except for testing. The new Syntrack software seems to play nicely with spectra, log\_spectra, etc.

# 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.

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## 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
		Logging officially started
		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+324:18:53:30.021		Logging officially started
2003+324:18:53:30.021		Logging officially ends

---

## GPS Receivers

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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*

---

<b>Log Date</b>	<b>LogDate</b>	<b>Comment</b>
2003+318:06:30:39.368		Logging officially started
2003+318:07:46:19.330	2003+318:14:25:29.292	Data Interruption
2003+319:00:03:06.463	2003+319:01:58:25.306	
2003+319:10:33:25.045	2003+319:12:34:06.223	
2003+319:13:14:57.032	2003+319:14:09:56.276	
2003+324:05:46:45.492	2003+324:14:15:25.346	
2003+324:16:46:21.068	2003+324:17:37:42.335	
2003+324:18:53:19.363		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*

---

<b>Log Date</b>	<b>LogDate</b>	<b>Comment</b>
2003+318:06:30:46.630		Logging officially started
2003+324:18:53:18.643		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*

---

<b>Log Date</b>	<b>LogDate</b>	<b>Comment</b>
2003+318:06:30:56.657		Logging officially started
2003+324:18:53:20.272		Logging Ends

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## Speed and Heading

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### 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*

---

<b>Log Date</b>	<b>Log Date</b>	<b>Comment</b>
2003+318:06:31:15.027		Official start date
2003+324:18:53:20.610		Official end date

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## Gravity

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### 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+318:06:30:33.599		Official start date
2003+324:18:53:19.872		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.ideo.columbia.edu/MB-System>.

MBSsystem, 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+318:06:32:44.000		Official start logging
2003+318:06:43:04.000	2003+318:15:21:50.000	
2003+320:01:02:07.000	2003+320:01:48:29.000	
2003+320:05:25:07.000	2003+320:05:36:51.000	
2003+321:03:31:00	2003+321:04:43:00	POS Heave to z-alt setting
2003+321:04:43:00	2003+321:05:38:00	POS Heave to 200 sec bdw
2003+321:05:38:00		POS Heave to orig 20 sec bdw
2003+324:05:12:35.000		Official end logging

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## Weather Station

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### 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.

---

<b>Log Date</b>	<b>LogDate</b>	<b>Comment</b>
2003+318:06:31:43.391		Official start logging
2003+324:18:53:00.259		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

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*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
2000+074:09:55:00.000 N 13 6.6206   W 59 39.3908 134.9
```

---

## Merged Data

m

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

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

---

## Navigation File

n

CPU Time Stamp	Latitude	Longitude	Used	Set	Drift
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.

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

Water	Sea	Wind	Dir	Latitude	Longitude	Range	Bearg Name	Speed	Heading
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

CPU Time Stamp	Latitude	Longitude	GPS Precision
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

CPU Time Stamp	Shot #	Latitude	Longitude	Line Name
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        Humidity
Inst 60mA 60mm 60mM 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)
```

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# Tape Contents

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## EW0310/

CruiseReport_EW0310.pdf	This document
ew0310.cdf	NetCDF database file of this cruise
ew0310.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