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R/V Maurice Ewing Data Reduction Summary

EW-0406 Tampa, FL - San Diego, CA

Date	Julian Date	Time	Port
6/23/04		175 00:00 GMT	Tampa, FL
7/9/04		191 17:50 GMT	San Diego, CA

Project Summary

DESCRIPTION

Background and Scientific Objectives

This leg was a transit.

Cruise Members

Ship's Science

Anthony Johnson	Data Reduction	ajohnson@ldeo.columbia.edu
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Ship Crew

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David Guinn	A/B	
Elmo Harvey	Oiler	
George Mardones	Oiler	
Victoria Montgomery	Utility	
Nolan Osorio	O/S	
Michael Quick	A/B	
Fernando Uribe	Oiler	
Stan Zygarlicki	A/B	

Cruise Notes

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

Furuno

The furuno data was intermittent during the beginning of the cruise. The Furuno was set to ground track at the beginning of the cruise, and data readings were intermittent starting on day 176. The problem was identified, and the furuno set to water track at 2004+176:17:26. Furuno data collection operated normally after that.

Sea Temperature

Sea temperature logging did not begin until 2004+177:19:34.

Spectra

Spectra was not operated during this cruise.

Hydrosweep

Hydrosweep acquisition was fairly good during this cruise. No processing was done on the Hydrosweep bathymetry.

Gravity

BGM operation was normal during this cruise.

Time

Time operated normally. Data collected on octopus was tagged with the Joetime clock.

Magnetics

No magnetics data was collected during this cruise.

Seismic Acquisition

No seismic data was collected during this cruise.

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

JoeTime

logging interval: 10 seconds
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
		Logging officially started
		Logging officially ends

GPS Receivers

GPS data is usually logged at 10 second intervals. The NMEA strings GPGGA and GPVTG are logged for position, speed, and heading fixes. This data was logged constantly throughout the cruise.

The POS/MV was the primary GPS for this cruise.

Trimble Tasmon P/Y Code Receiver

logging interval: 10 seconds
file id: gp1

The Tasmon is the primary GPS receiver for the Ewing Logging system and the primary GPS for Spectra fixes. The accuracy is around 15 meters. There were no interruptions during this cruise.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2004+174:17:43:46.290		Logging officially started
2004+191:17:51:19.785		Logging officially ends

Trimble Tasmon P/Y Code Receiver

logging interval: 10 seconds
file id: gp2

The Tasmon is the primary GPS receiver for the Ewing Logging system and the primary GPS for Spectra fixes. The accuracy is around 15 meters. There were no interruptions during this cruise.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2004+174:17:43:46.290		Logging officially started
2004+191:17:51:19.785		Logging officially ends

C-NAV

logging interval: 10 seconds
file id: gp3

The Tasmon is the primary GPS receiver for the Ewing Logging system and the primary GPS for Spectra fixes. The accuracy is around 15 meters. There were no interruptions during this cruise.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2004+174:17:44:07.563		Logging officially started
2004+175:22:59:54.548	2004+176:00:00:00.263	Data Interruption
2004+191:17:51:20.591		Logging officially ends

POS-MV

logging interval: 10 seconds
file id: gp4

The Trimble is the secondary receiver for GPS data. Data is logged at 10 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
2004+174:17:43:46.278		Logging officially started
2004+191:17:51:21.352		Logging officially 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. Furuno data was lost periodically during the first few days of the cruise.

Interruptions greater than 90 seconds are displayed in the following table

Log Date	Log Date	Comment
2004+174:17:44:21		Official start date
2004+174:21:03:06	2004+176:00:44:23	Data Interruption
2004+176:00:44:26	2004+176:01:50:41	Data Interruption
2004+176:01:50:44.920	2004+176:02:00:56.899	Data Interruption
2004+176:02:00:59.919	2004+176:02:12:35.912	Data Interruption
2004+176:02:12:38.913	2004+176:03:16:50.892	Data Interruption
2004+176:03:16:53.893	2004+176:05:16:44.852	Data Interruption
2004+176:05:16:47.853	2004+176:09:17:38.765	Data Interruption
2004+176:09:17:38.765	2004+176:10:06:11.974	Data Interruption
2004+176:10:06:11.974	2004+176:17:26:23.756	Data Interruption
2004+191:17:51:14.284		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: 0.035

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
2004+174:17:44:38.521		Official start date
2004+179:10:37:33.812	2004+179:17:47:13.448	Data Interruption
2004+191:17:51:08.044		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
2004+175:19:06:37.000		Official start logging
2004+191:17:51:23.000		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
2004+174:17:44:49.511		Official start logging
2004+175:22:30:00.399	2004+175:22:31:43.400	Data Interruption
2004+175:23:18:00.688	2004+175:23:21:40.730	Data Interruption
2004+191:17:50:00.199		Official end logging

Gravity Ties

LOCATION 1

EW0404 San Juan, Puerto Rico

Pier/Ship	Latitude	Longitude
	18 27.65002N	066 05.54170W

Pierside reading was taken exactly at the reference point on map

Reference	Latitude	Longitude
	18 27.78 N	66 05.43 W

Reference station at bollard base next to Water Pipe housing.

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0403	105	14. Apr 03	0.00	0.00	28.73
Post Cruise	EW0404	155	15. Jun 03	5.00	0.081	0.00
Total Days			62.00	5.00		

Time	Entry	Value	
10:30:00	CDeck Level BELOW Pier	0.00	
10:50:00	Pier 1 L&R Value	2328.72	L&R
10:50:00	Reference L&R Value	2328.72	L&R
11:00:00	Pier 2 L&R Value	2328.70	L&R
	Reference Gravity	978666.71	mGals
	Gravity Meter Value (BGM Reading)	978671.70	mGals
	Needs Potsdam Correction	0	1 if Potsdam referenced

Gravity meter is 5.5 meters below CDeck

Difference in meters between Gravity Meter and Pier		meters
Height Cor = Pier Height* FAA Constant	0.00	0.31
		0.00 mGals/min

Difference in mGals between Pier and Gravity Meter

Pier (avg) - Reference	1.06 L&R/mGal	Delta L&R
2328.71	2328.72	1.06
		-0.01 mGals

Gravity in mGals at Pierside

Reference + Delta mGals [+ Potsdam]	IGSN-71 Referenced Pier C
978666.71	-0.01
0.00	978666.70 mgals

Gravity in mGals at Meter

Pier Gravity+ Height Correction	Gravity@meter
978666.70	0.00
	978666.70 mGals

Current Mistie

BGM Reading	Calculated Gravity	Current Mistie
978671.70	978666.70	
		5.00 mGals

Gravity Ties

Location 2

EW0406 San Diego, CA

Pier/Ship	Latitude	Longitude
	32 42.394 N	117 14.17 W
Nimitz Marine Facility -- Rosecrans St		

Reference	Latitude	Longitude
	32 42.400 N	117 14.187 W
Nimitz Marine Facility -- Rosecrans St		

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0404	155	03. Jun 04	5.00	0.10	0.00
Post Cruise	EW0105	193	11. Jul 04	7.36	0.062	5.00
Total Days			38.00	2.36		

Time	Entry	Value	
1400	CDeck Level BELOW Pier	0.00	
1405	Pier 1 L&R Value	3148.25	L&R
1410	Reference L&R Value	3148.50	L&R
1415	Pier 2 L&R Value	3148.23	L&R
	Reference Gravity	979535.52	mGals
	Gravity Meter Value (BGM Reading)	979542.60	mGals
	Potsdam Corrected	0	1 if corrected

Gravity meter is 0.0 meters below CDeck

Difference in meters between Gravity Meter and Pier **0.00** meters

Height Cor = Pier Height* FAA Constant

0.00	0.31		0.00 mGals/min
-------------	-------------	--	-----------------------

Difference in mGals between Pier and Gravity Meter

Pier (avg) - Reference	1.06 L&R/mGal	Delta L&R
3148.24	3148.50	1.06
		-0.28 mGals

Gravity in mGals at Pierside

Reference + Delta mGals [+ Potsdam]	Pier Gravity
979535.52	979535.24 mGals
-0.28	0.00

Gravity in mGals at Meter

Pier Gravity+Height Correction	Gravity@meter
979535.24	979535.24 mGals
0.00	

Current Mistie

BGM Reading	Calculated Gravity	Current Mistie
979542.60	979535.24	7.36 mGals

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

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

Merged Data

m

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

Magnetic
Total Intensity   Anomaly      Gravity
                  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 -----Tailbuoy----- Line
Depth Temp Spd 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 strike1: 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 (strike1 and dip2) were run: the end of strike 1 (shots 000283 to 002286) and the start of dip2 (shots 000002 to 000151).

Line strike1 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.

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

                               Tailbuoy
Latitude      Longitude      Range Bearing Line Name
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

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

Eotvos Drift DC      Raw Velocity      Smooth Velocity
Smooth Total Shift North East North East
-74.78 0.06 4.16 1.875 -10.373 1.927 \10.166
```

Datum Time

ts2.r

```
CPU Time      Datum Time      Time Reference
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

mnet

```

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 gpl 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)

Shot Times from Spectra P1 Files

shots.p1

These files were created with the script: `extract_shots_from_p1 -a 1`

<u>Epoch Time</u>	<u>Shot#</u>	<u>Source</u>	<u>Lat/Lon</u>	<u>TB Lat</u>	<u>TB Lon</u>
985788741.000	015570	30.283881	-41.854536	30.320144	-41.886642
<u>Vessel Ref</u>	<u>Lat/Lon</u>	<u>Antenna</u>	<u>GPS Lat/Lon</u>	<u>Water Depth</u>	
30.283478	-41.854117	30.283531	-41.854078	2894.2	

- Source is the Center of the Guns
- TB is the Tailbuoy, according to Spectra
- Vessel Ref is the location of the center of the Mast
- Antenna GPS is the location of Antenna 1 (-a 1 flag); in this case is the Tasmon GPS
- Water Depth is the HS Centerbeam depth

Shot Times from Spectra P2 Files

shots.p2

These files were created with the script: `extract_shots_from_p2 -o "V1 G1"`

<u>Epoch Time</u>	<u>Shot#</u>	<u>Vessel Ref</u>	<u>Lat/Lon</u>	<u>Source</u>	<u>Lat/Lon</u>
985716772.4	00015572	30.282803	-41.866136	30.283207	\41.866540

- Vessel Ref is the location of the center of the Mast
- Source is the Center of the Guns

Scripts

Included are some scripts for extracting information out of the P1 and P2 formatted files. In order to use these scripts you will also need to install the Ewing Perl libraries included in the scripts directory, or at least include that directory in your PERL5LIB environment. The use of perl is beyond the scope of this document.

extract_shots_from_p1 [-a antenna] [-h] filename

Given an input P1 File, create a shotpoint file with the times, and the positions of the given antenna [1 = tasmon, 2 = Trimble] and optionally the header records at the beginning of the file.

The output will be:

```
epochtime shotnumber sourcePos tbPos vesselPos antennaPos depth
```

- **epochtime** is the # of seconds since Jan 1, 1970
- **shotnumber** is the shot number
- **sourcePos** is the center position of the sound source [lat lon]
- **tbPos** is the position of the tailbuoy [lat lon]
- **vesselPos** is the position of the vessel reference (center of mast) [lat lon]
- **antennaPos** is the position of the specified antenna [lat lon]
1 = tasmon, 2 = trimble
- **depth** is the water depth in meters

extract_shots_from_p2 [-s shotnumber] [-o "output values"]

- s define if you only want the statistics for a single shot
- o "outputs" defines the outputs you want from the P2 file.

This routine will output by default the shotpoint, the line name and the shot time. Optionally, you can output position (Lat Lon) info for a number of items:

Outputs can be one or more of the following:

- V1 Vessel 1 Reference
- V1G1 Tasmon GPS Receiver
- V1G2 Trimble GPS Receiver
- V1E1 Hydrosweep Transducer
- TB1 Tailbuoy 1
- S1 Streamer 1
- V1SC Streamer Compasses
- G1 Gun Array 1

All the formats output a Lat Lon pair in decimal degrees. (*West and South being negative*)

Output will be: epochtime shotnumber [output lat/lon pairs]

Tape Contents

EW0406/	
EW0406.pdf	this document
ew0406.cdf	NetCDF database file of this cruise
ew0406.cdf_nav	NetCDF database file of this cruise' navigation
docs/	File Formats, Spectra manuals
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.	
fixes/	fixes for the RTNu HS loss of d088
scripts/	Perl scripts and their friends