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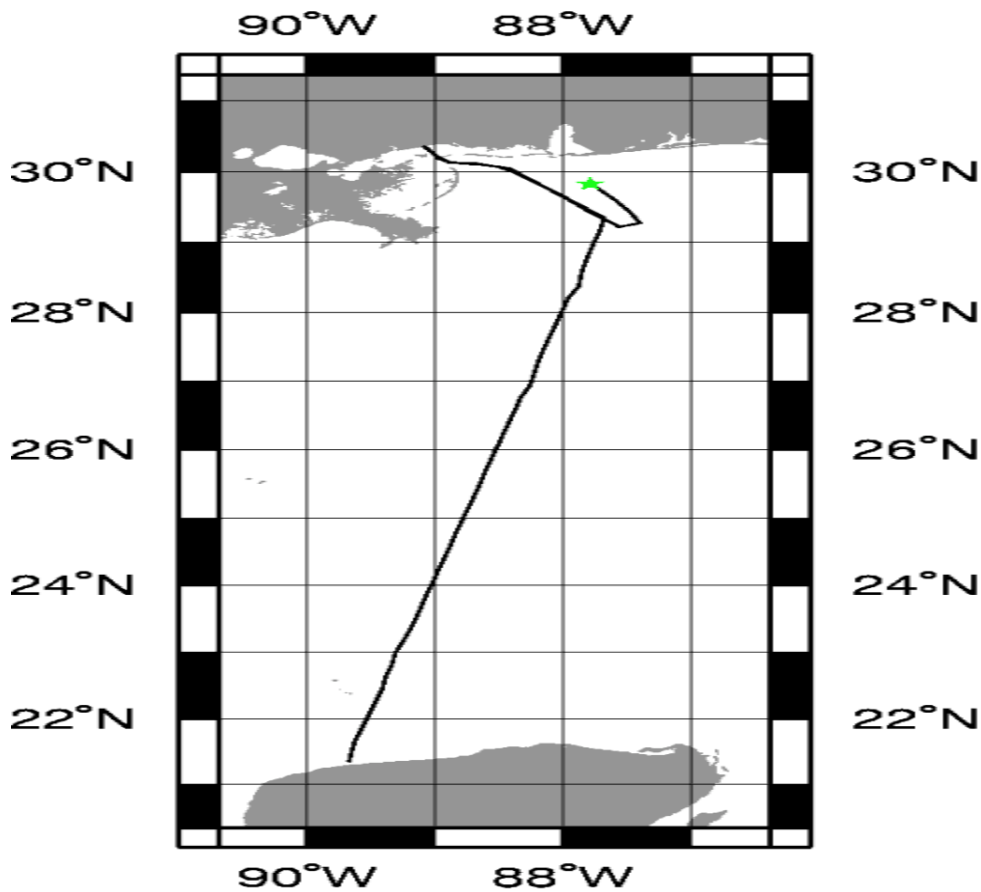


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845 365–8677

R/V Maurice Ewing Data Reduction Summary

EW–0402 Progreso, Mexico – Gulfport, MS

Date	Julian Date	Time	Port
February 27, 2004	58	18:17:09	Progreso, Mexico
March 1, 2004	61	15:20:45	Gulfport, MS



GMT 2004 Oct 8 03:35:55

TO DATE

Project Summary

DESCRIPTION

Background and Scientific Objectives

Transit. We took the transit as an opportunity to further test recently installed hydrosweep hardware and familiarize/train several UTIG technicians with the Ewing data logging and processing systems in the event that no L-DEO system administrator would be available to sail on a quickly rescheduled Chicxulub cruise.

After a short stay in Gulfport, MS, the ship shifted to Mobile, AL on julian day 61. For the record, EW0402 will end in Gulfport. However, data collected during the Gulfport to Mobile transit will be included on tape.

Cruise Members

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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

Further testing of the hydrosweep was performed during the transit.

Gravity

Gravity operated normally.

Navigation

Navigation operated normally.

Time

Timing operated normally.

Spectra

Various system testing was done, but no data were collected.

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 10 seconds to either the DATUM gps or JOETIME 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 ten seconds 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
2004+058:18:17:09.792		Logging officially started
2004+058:21:35:40.021	2004+059:19:36:09.795	Data Interruption
2004+059:19:53:30.021	2004+060:02:35:39.898	Data Interruption
2004+061:23:59:50.718		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.

The POS/MV with auxillary input from the C-Nav Global DPGS was the primary GPS for this cruise.

Trimble Tasmon P/Y Code Receiver

logging interval: 10 seconds

file id: gp1

The Tasmon GPS receiver's accuracy is around 15 meters.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2004+058:21:37:08.048		Logging officially started
2004+061:15:20:47.117		Logging officially ends

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
2004+058:21:37:15.343		Logging officially started
2004+061:15:20:47.303		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
2004+058:21:37:20.545		Logging officially started
2004+061:15:20:45.603		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
2004+058:21:37:28.900		Logging officially started
2004+061:15:20:47.361		Logging Ends

Speed and Heading

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

logging interval: 3 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
2004+058:21:37:42.735		Official start date
2004+061:15:20:50.217		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: 0.175

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+058:21:38:04.440		Official start date
2004+061:15:20:48.498		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+060:21:40:40		Official start logging
2004+061:05:35:20	2004+061:13:35:53	Data Interruption
2004+061:15:20:35		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+058:21:38:33.878		Official start logging
2004+059:19:53:00.640	2004+059:20:03:33.774	
2004+061:15:21:00.121		Official end logging

Gravity Ties

LOCATION 1

EW0308 Bridgeport, Barbados

Pier/Ship	Latitude	Longitude
Bridgeport Harbor	13 06.07347N	59 37.75187W
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

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 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	-----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

tbl.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.

```
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:
  eotvos_corr = 7.5038 * vel_east * cos(lat) + .004154 * vel*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:
  faa = corrected_grv - 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
-----
7.8  6.6  8.5  16.8 277 291 5

Bird 2
Speed              Direction
Inst 60sA 60mA 60sM Inst 60sA 60mA
-----
0.0  0.0  0.0  0.0  0  0  0

Temperature
Inst 60mA 60mm 60mM
-----
15.0 14.2 14.3 15.1
Humidity
Inst 60mm 60mM
-----
92  90  93
Barometer
-----
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)
```

Shot Times from Spectra P1 Files

shots.p1

```
These files were created with the script: extract_shots_from_p1 -a 1
Epoch Time  Shot#  Source Lat/Lon      TB Lat      TB Lon
985788741.000 015570 30.283881 -41.854536 30.320144 -41.886642
Vessel Ref Lat/Lon  Antenna GPS Lat/Lon  Water Depth
```

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

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

EW0401/	
EW0402.pdf	this document
ew0402.cdf	NetCDF database file of this cruise
ew0402.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.
scripts/	Perl scripts and their friends