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R/V Maurice Ewing Data Reduction Summary

EW–0213 Balboa, Panama– Norfolk, Virginia

Date	Julian Date	Time	Port
November 21, 2002	325	02:08:00UTC	Balboa, Panama
November 28, 2002	332	23:59:00UTC	Norfolk, Virginia

EW-0213 Balboa, Panama - Norfolk, Virginia

Project Summary

DESCRIPTION

Transit

Cruise Members

Science Party

None

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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.

Spectra

No seismic work was done during the transit.

Hydrosweep

Data Logging/Processing

Ship Offset Diagram

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 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.

Interruption s greater than 30 minutes are displayed in the following table

Log Date	LogDate	Comment
2002+325:13:59:09.732		Joetime logging starts
2002+332:23:59:50.704		Joetime logging ends

Spectra

Spectra uses its own Trimble gps receiver for synchronizing its hardware to UTC time. This is the time the shot points are referenced to; not the CPU time.

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 Tasmon GPS was the primary GPS for this cruise.

Trimble Tasmon P/Y Code Receiver

logging interval: 1 second
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.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2002+325:00:00:00.911		Tasmon logging starts
2002+332:23:59:59.721		Tasmon logging ends

Trimble NT200D

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
2002+325:00:00:00.872		Trimble logging started
2002+327:20:49:05.889	2002+328:00:41:34.950	Data interruption
2002+329:19:37:28.253	2002+329:21:29:20.790	Data interruption
2002+329:21:29:20.790		Trimble logging ends

Garmin WAAS

logging interval: 2 seconds
file id: gp1

The WAAS is the tertiary receiver for GPS data. Data is logged at 2 second intervals and is also used as an input to Spectra.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2002+325:00:00:00.292		WAAS logging started
2002+332:23:59:59.901		WAAS logging ends

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TSS POS/MV 320

logging interval: 1 second
file id: pm01

The POS/MV is the tertiary 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	Log Date	Comment
2002+325:00:00:00.011		POS/MV logging starts
2002+332:23:59:59.466		POS/MV logging officially ends

Tailbuoy Garmin GP8

logging interval: 1 second
file id: tb1

The tailbuoy GPS is a WAAS receiver. No tailbuoy data was logged.

Interruptions greater than 30 minutes are displayed in the following table

Log Date	Log Date	Comment
		Tailbuoy logging starts
		Tailbuoy 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.

Interruptions greater than 30 minutes are displayed in the following table

Log Date	Log Date	Comment
2002+325:00:00:01.892		Furuno logging starts

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Log Date	Log Date	Comment
2002+332:23:59:58.601		Furuno logging ends

Gravity

Bell Aerospace BGM–3 Marine Gravity Meter System

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

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
2002+325:00:00:00.511		Gravity logging starts
2002+332:23:59:59.041		Gravity logging ends

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
2002+326:00:38:14.000		Hydrosweep logging starts
2002+332:15:33:06.000		Hydrosweep logging ends

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
2002+325:00:00:53.841		Weather logging starts
2002+332:23:59:00.294		Official end logging

Magnetics

Varian Magnetometer

logging interval: 12 seconds
file id: mg

The following table shows the times the magnetometer was logging

Log Date	LogDate	Comment

Seismic Line

Currently, we use data from the Spectra header, data from the Digicourse cable output, data from the gun depths, and real–time data from the Ewing logging system to compose a Ewing standard SEG–D header readable by SIOSEIS to place on the 3490 tape for each shot.

There are several files for each line reflecting the line status:

File	Description
ts.n	Shot time is merged with Ewing navigation to determine shot location
nb2.r	Navigation is from Spectra, and includes tailbuoy, tailbuoy range and bearing
shotlog.p1	Shots are from the p1 file. (should be identical to nb2.r), includes source position
shotlog.p2	Shots are from the p2 file (should be identical to tss.n), includes source position

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.
                        Gun Depths
Shot Time               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                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.

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```
    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 strike1
```

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:
  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 Smooth	Drift Total	DC Shift	Raw Velocity North	East	Smooth Velocity 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.

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Meteorological Data wx

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

Bird1:							Bird 2						
Speed			Direction				Speed				Direction		
Inst	60sA	60mA	60sM	Inst 60sA 60mA			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)
```

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"*

```
Epoch Time  Shot#    Vessel Ref Lat/Lon   Source Lat/Lon
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]`

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Tape Contents

EW0213/

CruiseReport_EW0213.pdf	this document
ew0213.cdf	NetCDF database file of this cruise
ew0213.cdf_nav	NetCDF database file of this cruise' navigation
configs/	Ewing logging/reduction configuration files
docs/	File Formats, Spectra manuals
processed/	Processed datafiles merged with navigation
trackplots/	daily cruise track plots (*postscript*)
raw/	Raw data directly from logger
reduction/	Reduced data files
clean/	daily processing directory, includes daily postscript plots of the data.