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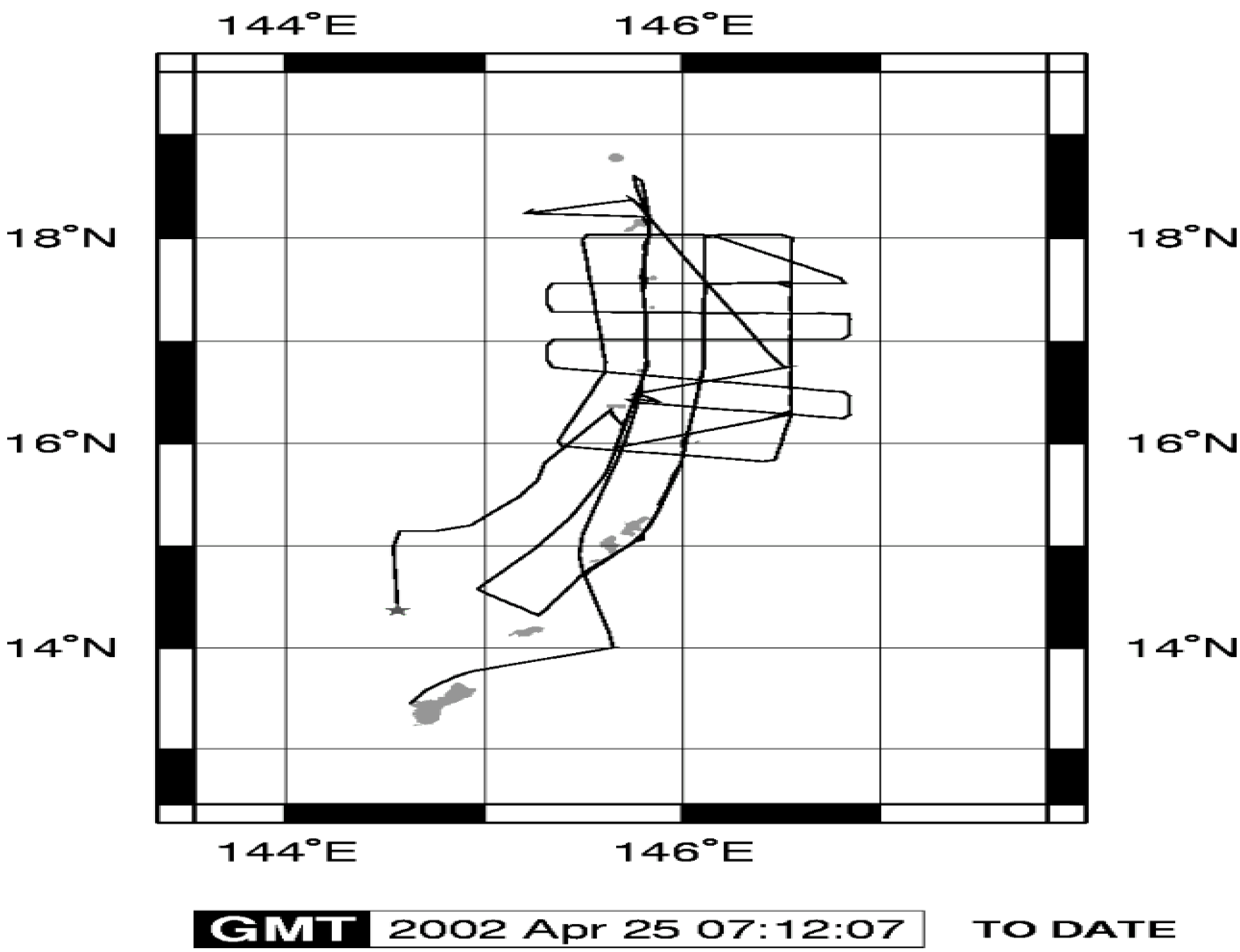
R/V Maurice Ewing Data Reduction Summary

EW0203 Guam – Guam

Date	Julian Date	Time	Port
March 31, 2002	090/2002	21:24:15	Apra, Guam
April 25, 2002	115/2002	09:04:00	Apra, Guam



Project Summary

DESCRIPTION

EW0203: US−Japan Collaborative Research:

Multi−scale Seismic Imaging Of The Mariana Subduction Factory

EW−0203 has carried out controlled−source wide−angle reflection/refraction, and supplementary multi−channel seismic reflection, imaging of the forearc and active arc of the Mariana island−arc system, at 14° to 19°N. The principal objective is to determine the velocity and density structure of the crust as a proxy for the composition of an intra−oceanic arc, with implications for models of continental growth and crustal recycling to the mantle, and if possibe to image magma chambers below active volcanoes. Our study provides baseline seismic information for the MARGINS Subduction Factory experiment in the Mariana system, and in addition to the science objectives above will provide data to guide future geochemical measurements and proposed ODP drilling to understand the material fluxes output in the forearc and volcanic arc.

The MARGINS Program has identified the Izu−Bonin−Mariana (IBM) system as a focus area for interdisciplinary investigations of the “Subduction Factory”. The IBM region is the classic example of an intra−oceanic arc – trench – back−arc system, and hence a good place to study the production rate and composition of arc magmatism. Crustal−structure images of island arcs elsewhere in the world have produced strikingly different results: data from the Izu−Bonin arc are consistent with a tonalitic middle crust, whereas data from the Aleutian arc are consistent with a more basaltic one, so that the parallel geochemical controversy, between an andesitic versus basaltic bulk arc composition, is as yet unresolved by geophysical data. We anticipate that EW−0203 data will provide a definitive answer at least for this segment of the Mariana intra−oceanic arc.

Important questions and aims of our controlled−source wide−angle study

•Is there a thick Vp=6.0−6.4 km/s “tonalitic” layer present at 15°−18°N, >1500 km south of prior observations in the Izu−Bonin arc? Or is there a thick Vp=6.4−6.8 km/s “basaltic” layer as in the Aleutian arc?

•What is the crustal thickness, hence magma production rate along the arc? Is the previous measurement of c. 2 km^3/km/Ma in the Aleutian arc, double the c. 1 km^3/km/Ma typically assumed, also typical of the Mariana arc? If so, we need to find more efficient crustal recycling mechanisms.

•How uniform is the crustal velocity structure of the arc along strike, and hence how uniform is the magmatic process generating arc crust beneath and between the active volcanoes?

•Can we distinguish velocity differences indicative of magma chambers below active volcanoes?

•Can we trace a coherent high−velocity mid−crustal layer in the arc rearward of the arc into coherent back−arc oceanic crust, thereby supporting the view from the Aleutians that such material is still recognizable as an intact density barrier to magma segregation and emplacement?

•Can we recognize “lower−crustal layering” in the Mariana arc, suggesting that the Izu−Bonin−type arc is truly a continental precursor? or is it absent (as apparently in the Aleutian arc) implying that oceanic arcs require additional tectono−magmatic evolution before becoming typical continental material?

•Can we recognize seismic bright spots on or just above subducting slab (in principal to >100 km depth using the 60 s MCS records), similar to the Aleutian bright spots and if so tie them to velocity anomalies that may indicate overpressured aqueous fluids, or shallow melting of sedimentary rocks?

•How does the Pn velocity of the mantle wedge vary across the arc, and hence how does mantle temperature vary across the arc? Does seismic velocity support the lower temperatures estimated from thermal modelling, or the higher temperatures petrologically inferred from the observed magmatic products of wedge melting.

•What is the extent of serpentinite in forearc crust and mantle, and is there enough present to materially affect the rheology of the forearc crust and upper part of the mantle wedge?

We deployed 53 OBSIP OBSs from Scripps (with 2 Hz vertical sensors and hydrophones) (54 were shipped to ensure we could deploy 50; deploying 3 extra was a bonus) in three arc−parallel lines, along the volcanic arc, along the uplifted fore−arc high, and along the modern forearc midway between the trench and the volcanic arc. OBS deployments were faster than scheduled, and we used the extra time to land from R/V Ewing on Alamagan and deploy two Reftek seismographs with 4.5Hz 3−component sensors. This deployment supplemented equivalent stations deployed on Tinian, Saipan, Anatahan and Pagan in February by our collaborators from Scripps and the CNMI Emergency Management Office.

We used the 20−airgun array (10,810 c.i. towed at 10.5 m to maximize source energy at low frequencies) of R/V Ewing as our controlled source, firing the array every 200 m (250 m in the deeper water), or about every 90 to 100 secs at c. 4.5 kts. We simultaneously recorded our airgun shots on the standard Ewing MCS 6−km streamer, recording 240 (50−m) channels every 8 ms with a 61.44 sec record length, for a nominal sub−surface penetration of c. 200 km. We recorded 3035 km of nominal 15−fold (and 12−fold) data, shooting along the three OBS deployment lines, along an additional arc−parallel line west of the active arc, and along 6 arc−crossing lines.

At the end of EW−0203, OBS retrieval operations are scheduled to end 24 hours before we begin our return transit to Guam, as a contingency against delay in OBS recovery. If time remains, we will recover as many as three OBEMs deployed by our Japanese collaborators on a previous cruise; recover as many as three Reftek seismographs from the island deployments; and take as many as four gravity cores as a test of penetration, in a prelude to possible future heat−flow measurements in this area.

EW−0203 follows the successful EW−0202 MCS cruise in the same area, which also extended its coverage east to the Mariana trench and west to the West Mariana Ridge (remnant arc). EW−0203 will be followed by a Japanese−led cruise in January 2003 to shoot a 100−OBS profile across the trench−active arc−remnant arc system. The final cruises of this US−Japanese collaboration will be the deployment in summer 2003 and retrieval one year later of a 50 OBS array for passive seismic recording.

Cruise Members

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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.

Spectra

Spectra logs data to files in UKOOA[1] P1/90 format and P2/94 Format. The file formats are included in separate PDF documents on the tape. The contents of these files contain all the parameters used during shooting each of the lines, as well as the positions of all the sensors. I have included perl scripts for extracting shot times and positions from the P1 and P2 files on the tape.

On Day 097 spectra crashed hard and we looped around to shoot the missed 4km near the islands of Saipan and Tinnian. One or both of the RTNu's crashed twice and were quickly reset. Otherwise, Spectra behaved fairly well.

Positioning of Sensors

The Spectra system defines a reference point which is used as a reference to all points which need an offset (range and bearing to TB, for example). This reference point has been defined as the center of the ship's mast, at sealevel.

Any documentation included herein that refers to the vessel reference or reference or master will be referring to this reference point.

However, daily navigation files that are not related to spectra (ie. n., hb.n, mg.n, files) are referenced to the Tasmon P−Code GPS filtered positions.

Offset information can be found under the **Ship Diagrams** section of this document.

Data Reduction

Since spectra positions its shots precisely based on a Kalman filtering algorithm, we will assume that it has the correct shot location. However, as a fallback measure, I have also processed the shots using our normal navigation filtering.

Therefore you will find the following shotlog files:

- nb0.r Contains shot times and positions based on Spectra positioning.
- nb2.r Contains shot times and positions based on Spectra navigation
- ts.n Contains shot times and positions based on Ewing navigation
- shots.p1 Contains shot times and positions based on Spectra P1 files
- shots.p2 Contains shot times and positions based on Spectra P2 files

Please see the File Formats section for more information on these files.

1 United Kingdom Offshore Operators Association

Hydrosweep

Hydrosweep data during this cruise was steady and solid. Over very shallow terrain (100m) it would occasionally track a multiple of the water depth. The IPS was running dev_ctrl_serial_big version 7.00.05 with the included outer beam feature turned off. Data processed with an average of several XBT profiles taken from the previous cruise plotted very nicely along with other gridded data from the area.

Gravity

No Gravity notes.

Seismic Acquisition

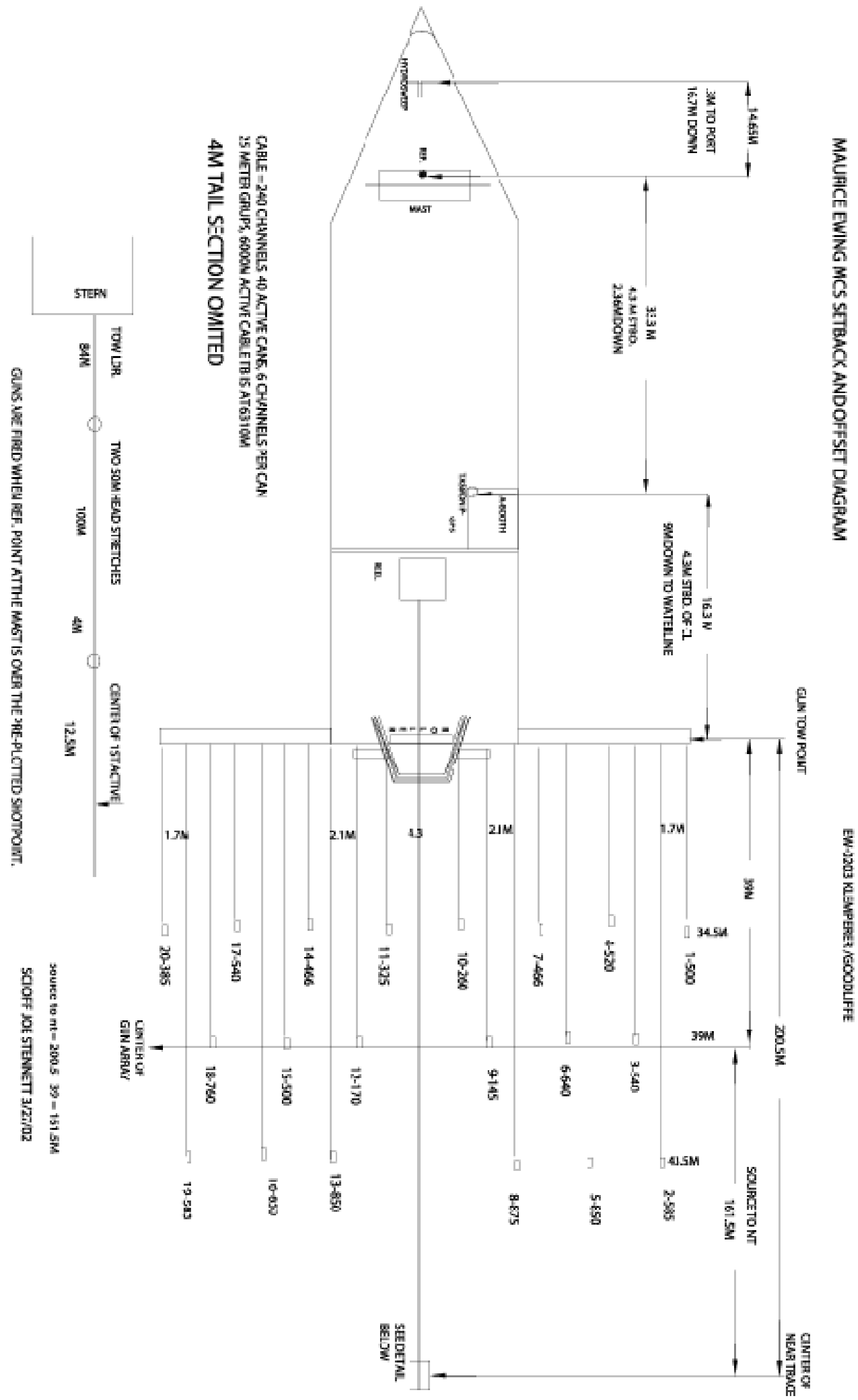
No Syntron notes.

Weather

The temperature sensor was still broken. Replacements are expected to arrive in port.

Ship Diagrams

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+090:21:31:30.241		Logging officially started
2002+114:23:35:29.721		Logging officially 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.

Spectra P2 files were logged, although due to some configuration problems, not all shots at the beginning of the lines were logged.

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: 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
2002+090:21:24:15.467		Logging officially started
2002+114:15:04:30.239		Logging officially ends

Trimble NT200D

logging interval: 10 seconds
file id: gp2

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
2002+090:21:42:23.878		Logging officially started
2002+114:15:04:28.246		Logging Ends

Tailbuoy Ashtech GP8

logging interval: 10 seconds
file id: tb1

The tailbuoy was much more reliable than on the previous cruise.

Interruptions greater than 30 minutes are displayed in the following table

Log Date	Log Date	Comment
2002+094:06:00:08.703		Tailbuoy logging starts
2002+094:06:34:45.357	2002+094:07:08:03.359	
2002+108:02:36:11.214		Tailbuoy logging officially 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
2002+090:21:24:36.052		Official start date
2002+114:15:04:28.418		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
2002+090:21:24:55.976		Official start date
2002+114:15:04:30.239		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
2002+090:21:24:33.000		Official start logging
2002+114:15:04:08.000		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
2002+090:21:25:18.650		Official start logging
2002+114:15:04:00.964		Official end logging

Magnetics

Varian Magnetometer

logging interval: 12 seconds
file id: mg

The following table shows the times the magnetometer was logging

Start Log Date	End LogDate	Comment
2002+094:08:21:48.723	2002+108:00:58:28.372	**Shooting**

Shot nav files for Lines klemp20, klemp20a, and klemp21 were concatenated for OBS processing. shot numbers for klemp20a have a base of 1000 added, and shot numbers for klemp21 have a base of 2000 added. This does not affect seismic processing.

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

Shot Files Table

Line Name	Times ()	Ewing(ts.n, nb2.r)		Spectra (shots.p1, shotlog.p2)		
		Shots	Missing	P1 Shots	P2 Shots	Missing

LOCATION 1

EW0202 Apra, Guam

Pier/Ship	Latitude	Longitude
	14 27.809N	144 39.074E

The corner of the end of the pier on Hotel Wharf (H), Apra Harbor

Reference	Latitude	Longitude
	13 27.57N	144 39.72E

Commercial Port, Wharf F-1, on the fuel pier as marked on the reference map as DOD#0061-T

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0114	25	01/25/2002	9.44	0.00	9.22
Post Cruise	EW0202	86	03/27/2002	23.80	0.235	9.44
Total Days			61.00	14.36		

Time	Entry	Value	
02:14	CDeck Level BELOW Pier	1.00	
02:14	Pier 1 L&R Value	2186.00	L&R
02:48	Reference L&R Value	2190.00	L&R
03:43	Pier 2 L&R Value	2185.85	L&R
	Reference Gravity	978514.90	mGals
	Gravity Meter Value (BGM Reading)	978536.40	mGals
	Potsdam Corrected	0	1 if corrected

*Gravity meter is **5.5** meters below CDeck*

Difference in meters between Gravity Meter and Pier: 6.50 meters

Height Cor = Pier Height* FAA Constant

6.50	0.31			2.02	mGals/min

Difference in mGals between Pier and Gravity Meter

Pier (avg) −	Reference *	1.06 L&R/mGal		Delta L&R	
2185.93	2190.00	1.06		-4.32	mGals

Gravity in mGals at Pierside

Reference +	Delta mGals	[+ Potsdam]		Pier Gravity	
978514.90	-4.32	0.00		978510.58	mgals

Gravity in mGals at Meter

Pier Gravity+	Height Correction			Gravity@meter	
978510.58	2.02			978512.60	mGals

Current Mistie

BGM Reading	Calculated Gravity			Current Mistie	
978536.40	978512.60			23.80	mGals

Location 2

EW0203 Apra, Guam

Pier/Ship	**Latitude**	**Longitude**
	13 27.624N	144 40.289E

Near the eastern end of the big crane loading pier

Reference	**Latitude**	**Longitude**
	13 27.57N	144 39.72E

Commercial Port, Wharf F-1, on the fuel pier as marked on the reference map as DOD#0061-T, Shell Oil/76

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0202	86	03/27/2002	14.36	0.24	23.80
Post Cruise	EW0203	114	04/25/2002	**23.56**	**0.317**	**14.36**
Total Days			**29.00**	**9.20**		

Time	Entry	Value	
04:10	**CDeck Level BELOW Pier**	1.00	
04:10	**Pier 1 L&R Value**	2195.50	**L&R**
04:36	**Reference L&R Value**	2189.90	**L&R**
04:57	**Pier 2 L&R Value**	2195.30	**L&R**
	Reference Gravity	978514.90	**mGals**
	Gravity Meter Value (BGM Reading)	978546.30	**mGals**
	Potsdam Corrected	0	**1 if corrected**

*Gravity meter is **5.5** meters below CDeck*

Difference in meters between Gravity Meter and Pier **6.50** meters

Height Cor =

Pier Height*	FAA Constant				
6.50	**0.31**			**2.02**	mGals/min

Difference in mGals between Pier and Gravity Meter

Pier (avg) −	Reference *	1.06 L&R/mGal		**Delta L&R**	
2195.40	**2189.90**	**1.06**		**5.83**	mGals

Gravity in mGals at Pierside

Reference +	Delta mGals	[+ Potsdam]		**Pier Gravity**	
978514.90	**5.83**	**0.00**		**978520.73**	mgals

Gravity in mGals at Meter

Pier Gravity+	Height Correction			**Gravity@meter**	
978520.73	**2.02**			**978522.75**	mGals

Current Mistie

BGM Reading	Calculated Gravity			**Current Mistie**	
978546.30	**978522.75**			**23.56**	mGals

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.

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  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:                                       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]`

Tape Contents

EW0203/

EW0203.pdf	this document
ew0203.cdf	NetCDF database file of this cruise
ew0302.cdf_nav	NetCDF database file of this cruise’ navigation
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.
scripts/	Perl scripts and their friends
spectra/	P1/90, P2/94, and config files from MCS lines
XBT/	Sound velocity profiles
aux_obs_data/	pre−segy header files for OBS data