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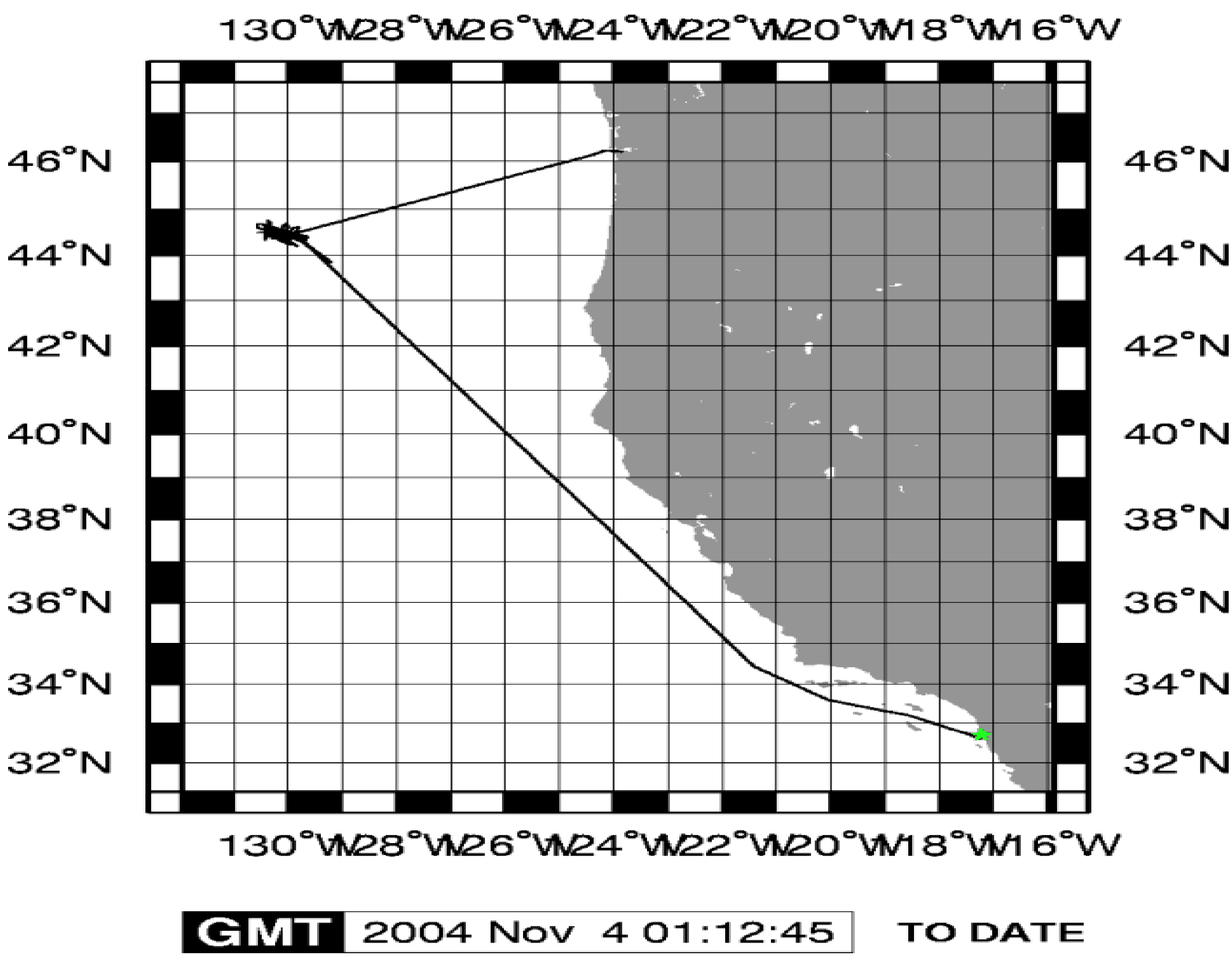
R/V Maurice Ewing Data Reduction Summary

EW−0410 Astoria, OR − San Diego, CA

Date	Julian Date	Time	Port
October 23, 2004	297	21:38:39	Astoria, OR
November 3, 2004	308	22:05:15	San Diego, CA



Project Summary

DESCRIPTION

Background and Scientific Objectives

Correlation of Seismic and Geologic Structure at Hess Deep and the Blanco Fracture Zone

Oceanic crust makes up two thirds of the Earth's surface. It is formed at mid−ocean ridges, the largest volcanic system on our planet, and is eventually consumed at major earthquake−forming trenches. The oceanic crust has been studied by geophysicists and geologists for many years geophysicists using remote sensing techniques such as seismic exploration, and geologists with samples and observation. However, the processes by which oceanic crust is formed are still not fully understood, and geologists and geophysicists are often at odds over the basic definitions of crustal structure. Seismic methods can probe deeply into the crust and gather data over unlimited distances, but interpretation of results is usually by inference. Geologic methods provide direct observation, but are limited by the few outcrops and drill holes where samples from the crust can be collected, and by the limitations of observing outcrop data with submersibles. This project seeks to reconcile the two views of oceanic crust by making a direct comparison between seismic interpretations and geologic mappings of oceanic crustal structure. The experiment will take advantage of two "tectonic windows"iorto the crust: Hess Deep, in the Equatorial Pacific, and the Blanco Fracture Zone, off the coast of Washington State. At both locations cross sections of the oceanic crust are exposed in fault scarps, and submersible studies have mapped the geologic units over distances of tens of kilometers and depths up to 2 km. The two sites provide contrasting types of oceanic crust: Hess Deep cuts into crust created at a fast spreading ridge, whereas the Blanco Fracture Zone exposes intermediate spreading rate crust. The funded experiment will gather seismic reflection and refraction data immediately adjacent to the scarps, so that seismic and geologic interpretations will be proximal and comparable. The comparison should immediately clarify the relationship between seismic boundaries and geologic units.

Description of project:

This project seeks to clarify the relationship between seismic boundaries and geologic units by acquiring seismic data at both Hess Deep (fast−spreading crust) and the Blanco Fracture Zone (intermediate−spreading crust). The Hess Deep study was carried out in July 2003; ongoing analysis of the acquired dataset will allow us to identify any correlations between seismic structure and the observed depths to the top of the sheeted dike unit and the top of the gabbro unit. The planned cruise to the Blanco Fracture Zone will acquire a similar dataset: ~13 fracture zone parallel and ~4 fracture zone perpendicular profiles. The profiles closest to the scarp will be used to tie the seismic stratigraphy with the observed outcrop geology. The remaining profiles will map lateral variability in along−axis and cross−axis directions. Two MCS profiles will be extended to the adjacent rise axis in order to directly link the crust in the detailed survey areas with that forming at the intermediate−spreading Juan de Fuca Ridge. Wide−angle data will be collected along these profiles in order to constrain the deeper velocity structure of the region, both near and ~10 km from the scarp edge. Primary questions that should be addressed by these two seismic experiments include: 1) Is there a correlation between seismic and geologic structure at Hess Deep? 2) Is there a correlation between seismic and geologic structure at the Blanco Transform? 3) If there is a correlation, are the same units correlated at fast−spreading and intermediate−spreading crust? 4) Is the seismic structure at Hess Deep typical of fast−spreading crust? 5) Is the seismic structure at Blanco typical of intermediate−spreading crust? 6) What is the evolution of the shallow velocity structure from zero−age rise−axis crust to the 1−2 Ma crust in the two study areas?

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.

Hydrosweep

The IHA for EW0410 required that we suspend hydrosweep data acquistion during turns between seismic lines. This mandate neglected to appreciate the considerable electric current necessary to operate the hydrosweep and the potential harm that frequent power cycling might have on the DS2. Throughout the early days of the survey while "on−line", the DS2 suffered intermittent "freezes" where no data was collected and often reported "multiples" of the true center beam depth. Finally on julian day 301, the DS2 failed. We managed to resuscitate the hydrosweep several hours later and kept it on for the balance of the cruise. No processing was done on any of the data

Gravity

The gravimeter performed normally.

Navigation

Navigation operated normally.

Seismic

Seisnet missed several shots throughout the survey that we were able to retrieve from tape.

With the exception of a gun controller power supply failure, Syntrak and the GCS90 operated normally.

Timing

Timing operated normally.

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 to a 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

logging interval: 30 min
file id: tr2

Used as the CPU synchronization clock. This clock is polled once every thirty minutes 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
2004+294:00:08:29.739		Logging officially started
2004+308:23:43:30.060		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 the CNAV GcGPS as an auxiliary input was the primary gps for this cruise.

Trimble Tasmon P/Y Code Receiver

logging interval: 2 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+294:21:28:33.798		Logging officially started
2004+308:22:05:15.085		Logging officially 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
2004+294:21:28:48.316		Logging officially started
2004+308:22:05:15.382		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+294:21:28:59.539		Logging officially started
2004+308:22:05:15.502		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 RTG, WTC, or WAAS 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+294:21:38:39.548		Logging officially started
2004+301:21:58:14.244	2004+301:22:17:14.460	Data Interruption

Log Date	LogDate	Comment
2004+308:22:05:15.232		Logging Ends

Tailbuoy Garmin GP8

logging interval: 10 seconds
file id: tb1

Note that often, the tailbuoy was being logged while it was on deck for testing purposes.

Interruptions greater than 30 minutes are displayed in the following table

Log Date	Log Date	Comment
2004+297:02:05:58.787		Tailbuoy logging starts
2004+299:17:01:40.543	2004+297:02:05:58.787	
2004+299:17:01:40.543	2004+301:18:06:42.914	
2004+304:05:55:55.560		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
2004+294:21:29:41.531		Official start date
2004+308:22:05:13.625		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: 0.018

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+294:21:30:14.228		Official start date
2004+308:22:05:14.965		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+295:00:34:12		Official start logging
2004+308:22:05:14		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+294:21:30:56.135		Official start logging
2004+308:02:13:00.231	2004+308:02:30:52.597	Data Interruption
2004+308:22:05:00.267		Official end logging

Magnetics

Geometrix G−882 Magnetometer

logging interval: 12 seconds
file id: mg

The magnetometer employs a Cesium atomic magnetic resonance system operating as the frequency controlling element of an oscillator. The frequency of the oscillation varies directly with the external magnetic field at the sensor.

The following table shows the times the magnetometer was logging

Start Log Date	End LogDate	Comment
2004+297:06:28:56.220		Offical start logging
2004+297:06:29:58.757	2004+298:18:39:55.287	Data Interruption
2004+299:04:37:23.665	2004+301:23:03:33.484	Data Interruption
2004+301:23:04:30.940		Official end logging

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

Shot Files Table

Line Name	Times ()	Ewing(ts.n, nb2.r)		Spectra (shots.p1, shotlog.p2)		
		Shots	Missing	P1 Shots	P2 Shots	Missing
BL111	297:03:04:25.340 297:08:42:17.364	121 − 1441				
BL106	297:09:22:38.165 297:15:20:47.195	103 − 1444				
BL113	297:16:08:16.396 297:22:05:01.419	9 − 1336				
BL105	297:23:02:16.971 298:05:00:17.882	1 − 1336				
BL109	298:05:43:48.890 298:14:04:47.213	1 − 1869				
BL102	298:15:27:43.844 298:23:47:25.997	1 − 1869	776			
BL104	299:00:33:17.213 299:06:32:00.972	3 − 1336				
BL107	299:07:14:55.988 299:13:12:09.230	1 −1336				
BL112	299:13:56:30.253 299:16:54:02.170	2 − 621	189			
BL302	301:21:39:03.866 302:05:57:14.198	1 − 311				
BL309	302:07:25:30.829 302:15:45:38.308	1 − 311				
BL201	302:19:24:20.986 302:23:35:36.494	1 − 934				
BL202	303:00:41:53.079 303:04:52:07.255	1 − 934				
BL203	303:06:04:40.859 303:10:15:31.950	2 − 934				

Line Name	**Times ()**	**Ewing(ts.n, nb2.r)**		**Spectra (shots.p1, shotlog.p2)**		
		Shots	**Missing**	**P1 Shots**	**P2 Shots**	**Missing**
BL204	303:11:21:59.406 303:15:34:56.550	1 − 934				
BL112	303:17:31:50.587 303:21:24:39.647	478 − 1336				
BL110	303:23:03:18.979 304:05:02:30.137	1 − 1336				

LOCATION 1

EW0409 Astoria, Oregon

Pier/Ship	Latitude	Longitude
	46 11.352N	123 51.567W

Pier #1

Reference	Latitude	Longitude
	46 11.42N	123 51.52W

The reference station is located along the face of Pier #1

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0408	268	24. Sep 04	−8.97	−0.49	8.02
Post Cruise	EW0409	288	14. Oct 04	−5.92	0.153	−8.97
Total Days			20.00	3.05		

Time	Entry	Value	
0	CDeck Level BELOW Pier	2.00	
07:20:00	Pier 1 L&R Value	4258.67	L&R
07:30:00	Reference L&R Value	4258.77	L&R
07:40:00	Pier 2 L&R Value	4258.63	L&R
	Reference Gravity	980712.92	mGals
	Gravity Meter Value (BGM Reading)	980722.80	mGals
	Potsdam Corrected	1	1 if corrected

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

Difference in meters between Gravity Meter and Pier: 7.50 meters

Height Cor =

Pier Height*	FAA Constant			
7.50	0.31			2.33 mGals/min

Difference in mGals between Pier and Gravity Meter

Pier (avg) −	Reference *	1.06 L&R/mGal		Delta L&R
4258.65	4258.77	1.06		−0.13 mGals

Gravity in mGals at Pierside

Reference +	Delta mGals	[+ Potsdam]		Pier Gravity
980712.92	−0.13	13.60		980726.39 mgals

Gravity in mGals at Meter

Pier Gravity+	Height Correction			Gravity@meter
980726.39	2.33			980728.72 mGals

Current Mistie

BGM Reading	Calculated Gravity			Current Mistie
980722.80	980728.72			−5.92 mGals

Location 2

EW0410 San Diego, CA

Pier/Ship	Latitude	Longitude
	32 42.393N	117 14.170W

Scripps Pier on Rosecrans Street

Reference	Latitude	Longitude
	32 42.399N	117 14.187

EW0406 gravity tie reference.

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0409	288	14. Oct 04	−5.92	0.15	−8.97
Post Cruise	EW0410	309	04. Nov 04	−5.53	0.018	−5.92
Total Days			21.00	0.39		

Time	Entry	Value	
0	CDeck Level BELOW Pier	0.00	
16:00:00	Pier 1 L&R Value	3148.65	L&R
15:55:00	Reference L&R Value	3149.01	L&R
16:05:00	Pier 2 L&R Value	3148.63	L&R
	Reference Gravity	979535.52	mGals
	Gravity Meter Value (BGM Reading)	979544.90	mGals
	Potsdam Corrected	1	1 if corrected

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

Difference in meters between Gravity Meter and Pier: 5.50 meters

Height Cor =

Pier Height*	FAA Constant			
5.50	0.31			1.71 mGals/min

Difference in mGals between Pier and Gravity Meter

Pier (avg) −	Reference *1.06 L&R/mGal			Delta L&R
3148.64	3149.01	1.06		−0.39 mGals

Gravity in mGals at Pierside

Reference + Delta mGals [+ Potsdam]				Pier Gravity
979535.52	−0.39	13.60		979548.73 mgals

Gravity in mGals at Meter

Pier Gravity+	Height Correction			Gravity@meter
979548.73	1.71			979550.43 mGals

Current Mistie

BGM Reading	Calculated Gravity			Current Mistie
979544.90	979550.43			−5.53 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 Gyro	Streamer 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 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 Centerbeam Depth
2000+079:00:08:01.507 000295 N 15 49.5703 W 060 19.7843 strike1     2345.6
```

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"*

<u>Epoch Time Shot#   Vessel Ref Lat/Lon   Source 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

Tape Contents

EW0410

EW0410df	this document
ew0410df	NetCDF database file of this cruise
ew0410df_nav	NetCDF database file of this cruise' navigation
configs/	Ewing Data System configuration files
docs/	File Formats, Spectra manuals
processed/	Processed datafiles merged with navigation
trackplots/	daily cruise track plots (*postscript*)
mbsystem/	Latest MBSystem source code
raw/	Raw data directly from logger
reduction/	Reduced data files
clean/	daily processing directory, includes daily postscript plots of the data.