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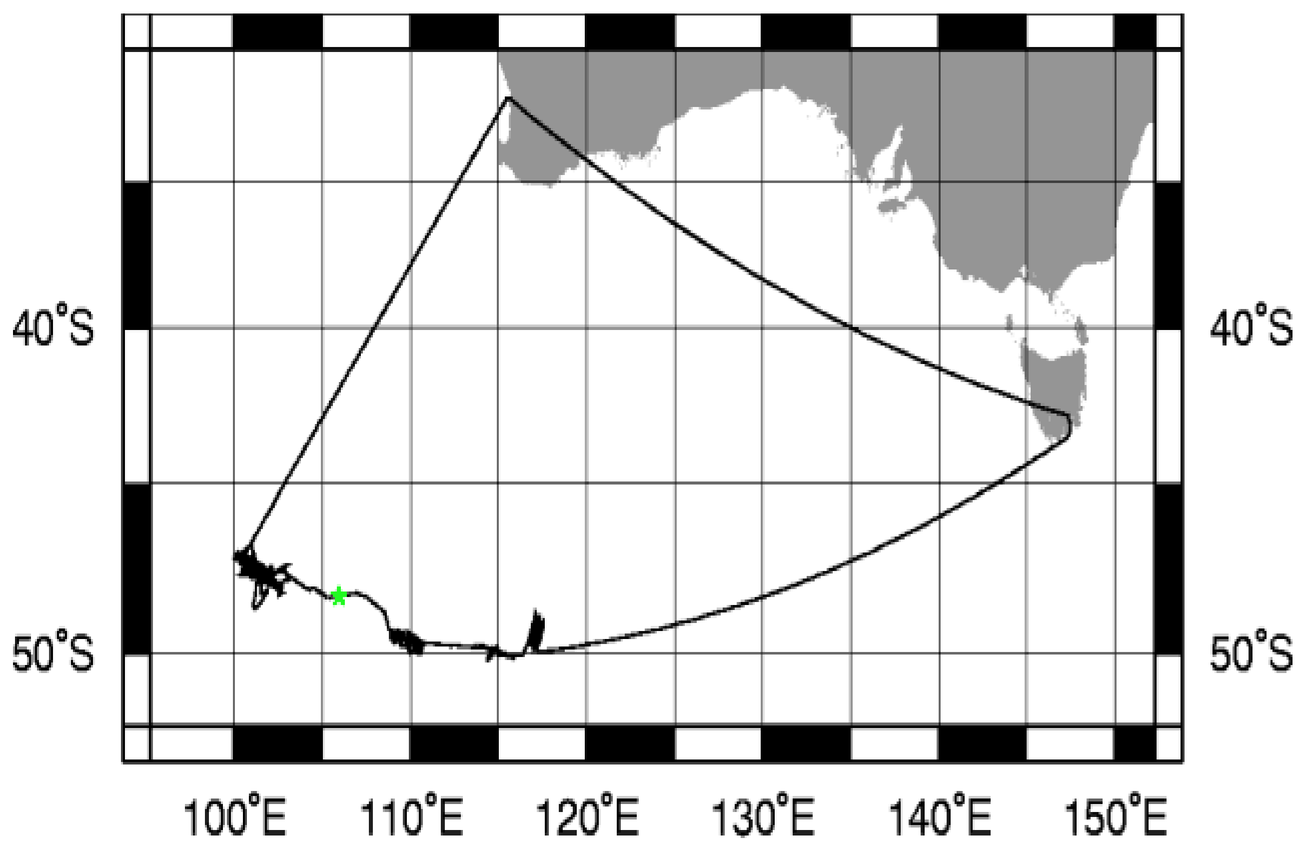
R/V Maurice Ewing Data Reduction Summary

EW−0114 Fremantle, W. Australia − Hobart, Tasmania

Date	Julian Date	Time	Port
December 6, 2001	340	2001+341:04:27:50.610	Fremantle, W. Australia
January 24, 2002	24	2002+024:23:59:55.705	Hobart, Tasmania



GMT 2002 Jan 25 01:21:53 TO DATE

Project Summary

DESCRIPTION

Background and Scientific Objectives

The supply o f melt to a spreading ridge, the distribution of the melt along the axis, melt extraction and emplacement to form the crust and the crust's subsequent tectonic modification are shaped by a matrix of parameters. The most apparent controlling parameter is spreading rate. However, spreading rate is clearly not the entire story, as demonstrated, for example, by the change from and axial valley to an axial high accompanied by changes in the ridge segmentation, volcanic landforms and crustal thickness which is observed as a slow spreading ridge approaches a hot spot. Other major forcing functions proposed as important controls on the creation of new crust at spreading centers include mantle temperature, mantle source composition, tectonic setting and ridge obliquity.

Analysis of the effects of different parameters that influence crustal accretion requires identification of areas where the individual parameters vary systematically while the spreading rate remains constant. The Southeast Indian Ridge (SEIR) south of Australia is located near the equator of its pole of rotation so the spreading rate varies slowly along the ridge. In particular, spreading rates in the region between 100°E and 116°E vary by only about 1 mm/yr, at 75−76 mm/yr. In addition, basalt major element and isotope geochemistry determined from an extensive suite of dredges between 88°E and 118°E suggest a relatively constant mantle source for the basalts.

There is a systematic depth gradient along SEIR to the east of 88°E. Near−axis isochronal ridge flank depths increase slowly from 2800 m at 91°E to 2900 m at 100°E and then more steeply to about 3300m at 115°E [Ma and Cochran, 1997] (Figure not included]. This portion of the SEIR is located between a shallow section of the ridge axis (78°E to 85°E) influenced by the Amsterdam and Kerguelin hot spots and the Australian−Antarctic Discordance (AAD) (120°E−128°E). A variety of geophysical and geochemical evidence indicates that the AAD is underlain by an unusually cold mantle. Since the spreading rate and the mantle source both are nearly constant along this portion of the SEIR, the along−axis variation in depth can reasonably be ascribed primarily to the effects of an along−axis variation in mantle temperature between the hot spot−influenced region farther to the west and the AAD farther to the east. In addition, the spreading rate on the SEIR is within the crucial intermediate range (75−80 mm/yr) where the crustal accretion process is most sensitive to small variation in melt supply. Therefore, the result of the along−axis temperature gradient is that nearly the entire range of axial morphology and abyssal hills observed at MOR axes and flanks are present within a 1200 km portion of the SEIR between 100°E and 116°E.

The SEIR is therefore an ideal laboratory in which to investigate the effects of temperature variations on magma supply and the crustal accretion process. We are proposing a geophysical investigation of the dependence of melt supply on mantle temperature and the effects of the variation in melt supply along the SEIR on the crustal accretion process. Our proposed study is built around a seismic experiment including both refraction lines utilizing ocean−bottom hydrophones (OBHs) to determine variations in crustal thickness (taken as a proxy for total melt supply) and upper mantle seismic velocity , and multichannel seismic (MCS) reflection surveys to determine the internal structure of the crust, particularly Layer 2A (extrusive) thickness and its relationship both to melt supply and to axial and abyssal hill crustal structure and axial and ridge flank morphology to better understand the crustal accretion process.

Dr. James Cochran

(excerpted from NSF Project Proposal)

Cruise Members

Science Party

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Robert Beauregard	2nd Mate	
Rick Thomas	3rd Mate	
Matt Tucke	1st A/Engineer	
Miguel Flores	2nd A/Engineer	
Chris Rooney	3rd A/Engineer	
Robert Ewing	Bosun	
Branniff, Marcella	A/B	
Doughty, Dan	O/S	
Hawthorne, Robert	Oiler	
Lee, Dan	Oiler	
Matos, Frank	Electrician	
Miller, Warren	A/B	
Moqo, Luke	Utility	

Noonan, Meg	A/B
Smith, John	Steward
Strickland, Leslie	Oiler
Sypongco, Arnold	O/S
Taylor, Kelly	Cook

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

CRUISE NOTES:

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.

1. Grossly incorrect magnetic declination was input for the compass data and resulted in incomplete P190 files.
   This was fixed by MCS Line 17.

2. Shot times are not accounted for in the millisecond range.

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

In an attempt to correct "tilted" pings, ping to ping depth differences, and chronic "narrow beams", Joe and I installed both a new Sidescan memory board (type GE6028G301) and a new Flashdisk (v. 8) in the DS−2 system on julian day 341. Although the "narrow beam" mode appeared much less often than previously witnessed, the other problems continued to present themselves.

As usual, data acquisition was excellent during this cruise. With the exception of harsh weather days, we experienced less than 1% average dropouts. Hydrosweep bathymetry processing was completed by both Ian Cochran and Ann Frailoi and is included in the ping_edits directory on tape.

Gravity

Although level to the eye, it became evident once the weather settled down that one of the gyros needed to be replaced.

Magnetics

There were sporadic problems with magnetic data acquisition as a direct result of the extremely harsh weather conditions. In fact, both a "fish" as well as a cable were damaged and lost during the cruise.

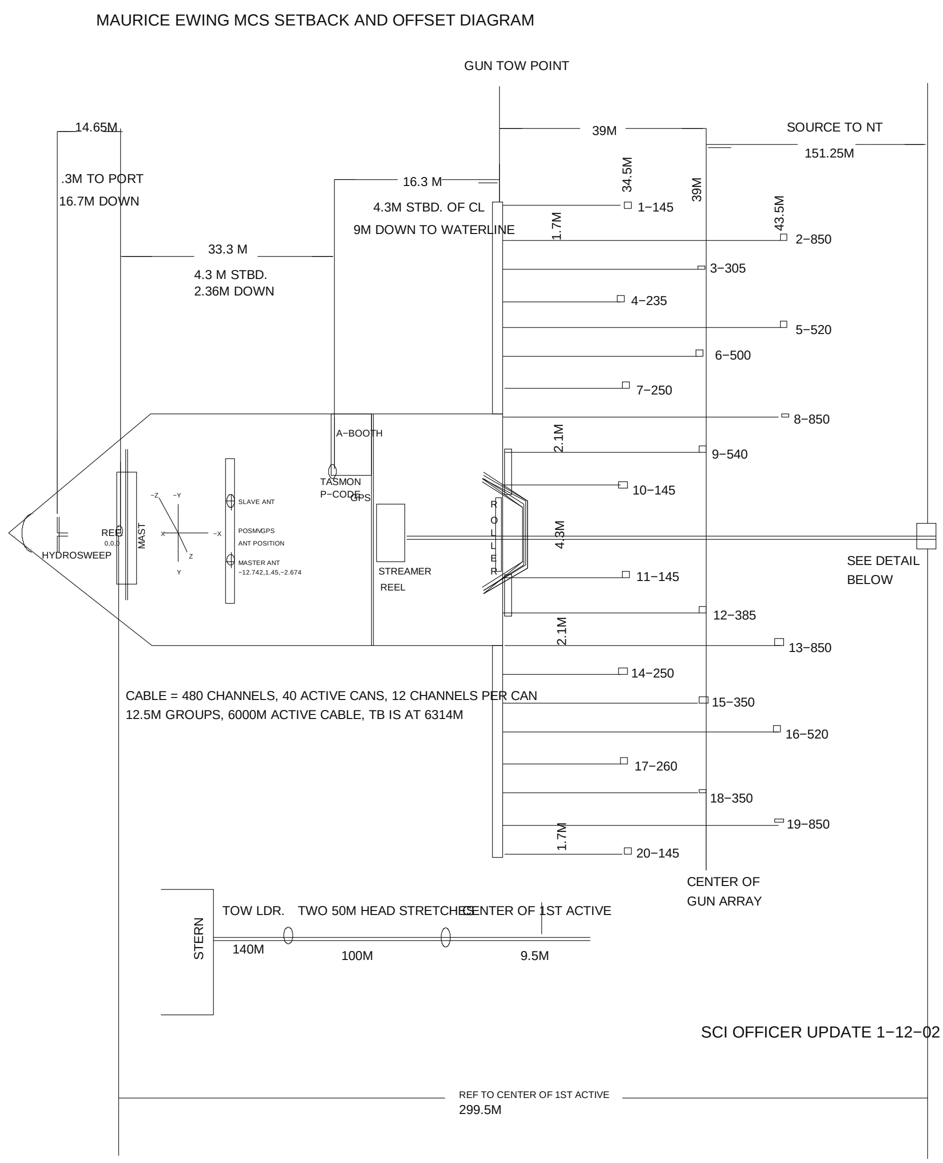
Seismic Acquisition

There were a several failures of the Syntron system related to both tape drive failures as well as VME bus hang ups. With the exception of one freeze which forced us to reshoot part of MCS Line, most of the hangups were rectified early and data loss was minimized.

Streamer configuration files are included on the tape in Excel 97 format. **Note:** As a result of extremely harsh weather conditions, bird #14 (compass/depth) was lost sometime after completion of MCS Line 17 (julian day 360). When the streamer was recovered, bird #14 was replaced by bird #1 (depth only) and the streamer was redeployed.

Ship Diagrams

Ship Offset Diagram (included separately in both .pdf and .dxf formats)



Gun Array Diagrams

```
            R/V EWING 10−AIRGUN ARRAY USED ON LEG 0114


      (Guns were arranged to match working depth transducers)
                  (not to scale)

              3050 cu in., 50 liters

STARBOARD
|−−−GUN 1−−−−−−−−−−−−−−−−−−−|145(2.4L)          |+17.8m
                           |
|−−−GUN 2−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−|850(13.9L)    |+16.3m
                           |
|−−−GUN 3−−−−−−−−−−−−−−−−−−−−−−−−|305(5.0L)         |+14.8m
                           |
                           |
|−−−GUN 7−−−−−−−−−−−−−−−−−−−−|80(1.3L)           |+8.8m
                           |
                           |
|−−−GUN 9−−−−−−−−−−−−−−−−−−−−−−−−|585(8.9L)         |+3.5m

|−−−−−−−−−−−−−−−−−−−−−−−−−−−−−centerline−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−

|−−−GUN 12−−−−−−−−−−−−−−−−−−−−−−−|385(6.3L)         |−3.5m
                           |
                           |
|−−−GUN 14−−−−−−−−−−−−−−−−−−|120(2.0L)          |−8.8m
                           |
|−−−GUN 17−−−−−−−−−−−−−−−−−−|200(3.3L)          |−13.3m
                           |
|−−−GUN 18−−−−−−−−−−−−−−−−−−−−−−−|235(3.9L)         |−14.8m
                           |
|−−−GUN 20−−−−−−−−−−−−−−−−−−|145(2.4L)          |−17.8m
PORT

|<−−−−−−  104 ft (32m)−−−−−>|
|<−−−−−−− 121 ft (37m−−−−−−−−−−−>|
|<−−−−−−− 135 ft (41m)−−−−−−−−−−−−−−−−>|

Guns 1−8 are towed from the starboard boom.
Guns 9−12 are towed from the stern A−frame.
Guns 13−20 are towed from the port boom.
Gun volumes given in cubic inches and liters.
Gunline lengths are measured from the stern.
```

GENERAL LAYOUT OF THE R/V EWING 20−AIRGUN ARRAY

(not to scale)

8480 cu in., 139 liters

```
STARBOARD
|−−−GUN 1−−−−−−−−−−−−−−−−−−−−|145(2.4L)        |+17.8m
                            |
|−−−GUN 2−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−|850(13.9L)   |+16.3m
                            |
|−−−GUN 3−−−−−−−−−−−−−−−−−−−−−−−−−|305(5.0L)      |+14.8m
                            |
|−−−GUN 4−−−−−−−−−−−−−−−−−−−−|235(3.9L)        |+13.3m
                            |
|−−−GUN 5−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−|520(8.5L)    |+11.8m
                            |
|−−−GUN 6−−−−−−−−−−−−−−−−−−−−−−−−−|500(8.2L)      |+10.3m
                            |
|−−−GUN 7−−−−−−−−−−−−−−−−−−−−|250(4.1L)        |+8.8m
                            |
|−−−GUN 8−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−|850(13.9L)   |+7.3m
                            |
                            |
|−−−GUN 9−−−−−−−−−−−−−−−−−−−−−−−−−|585(8.9L)      |+3.5m
                            |
|−−−GUN 10−−−−−−−−−−−−−−−−−−−|145(2.4L)        |+2m
                            |
|−−−−−−−−−−−−−−−−−−−−−−−−−−−−center line−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−−
                            |
|−−−GUN 11−−−−−−−−−−−−−−−−−−−|145(2.4L)        |−2m
                            |
|−−−GUN 12−−−−−−−−−−−−−−−−−−−−−−−−|385(8.9L)      |−3.5m
                            |
                            |
|−−−GUN 13−−−−−−−−−−−−−−−−−−−−−−−−−−−−−|850(13.9L)   |−7.3m
                            |
|−−−GUN 14−−−−−−−−−−−−−−−−−−−|250(4.1L)        |−8.8m
                            |
|−−−GUN 15−−−−−−−−−−−−−−−−−−−−−−−−|350(5.7L)      |−10.3m
                            |
|−−−GUN 16−−−−−−−−−−−−−−−−−−−−−−−−−−−−−|520(8.5L)    |−11.8m
                            |
|−−−GUN 17−−−−−−−−−−−−−−−−−−−|260(4.3L)        |−13.3m
                            |
|−−−GUN 18−−−−−−−−−−−−−−−−−−−−−−−−|350(5.7L)      |−14.8m
                            |
|−−−GUN 19−−−−−−−−−−−−−−−−−−−−−−−−−−−−−|850(13.9L)   |−16.3m
                            |
|−−−GUN 20−−−−−−−−−−−−−−−−−−−|145(2.4L)        |−17.8m
PORT
```

|<−−−−−− 104 ft (32m)−−−−−>|
|<−−−−−−−− 121 ft (37m−−−−−−−−−−−>|
|<−−−−−−−− 135 ft (41m)−−−−−−−−−−−−−−−−>|

Guns 1−8 are towed from the starboard boom.
Guns 9−12 are towed from the stern A−frame.
Guns 13−20 are towed from the port boom.
Gun volumes given in cubic inches and liters.
Gunline lengths are measured from the stern.

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
2001+341:00:01:29.725		Logging officially started
		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 P1 and P2 files were logged. Due to some configuration problems with respect to "approach" shots, the first shot of a few lines were not logged. However, since these shots were "approach" shots or shots before the official line start, data loss was trivial.

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
2001+341:04:24:57.416		Logging officially started
2002+024:23:59:57		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
2001+341:04:25:47.810		Logging officially started
2002+024:23:59:55.705		Logging Ends

Tailbuoy Garmin GP8

logging interval: 10 seconds
file id: tb1

The tailbuoy receiver stopped working after MCS Line 17 due to damage suffered in fierce weather conditions. Subsequent to this, tailbuoy position, range and bearing were eliminated from Spectra's Kalman Filtering process. Also 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
2001+352:11:47:59.337		Tailbuoy logging starts
2001+352:12:10:27.026	2001+354:04:56:24.501	Tailbuoy data interruption
2001+354:04:57:57.726	2001+355:03:05:24.227	Tailbuoy data interruption
2001+355:03:37:39.600	2001+355:10:07:01.778	Tailbuoy data interruption
		Start MCS
2001+355:23:58:02.816	2001+356:05:06:12.894	Tailbuoy data interruption
2001+360:13:38:27.644	2001+360:14:48:25.782	Tailbuoy data interruption
2001+361:10:18:14.828		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
2001+341:04:31:42.499		Official start date
2002+024:23:59:57.198		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
2001+341:04:33:12.297		Official start date

Log Date	Log Date	Comment
2001+360:13:38:51.666	2001+360:14:28:46.116	Gravity data interruption
2002+024:23:59:59.438		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 hydrosweep was intermittently disabled during OBH instrument deployment and recovery.

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
2001+341:04:38:14		Official start logging
2001+341:04:40:22	2001+341:06:23:45	HS data interruption
2001+349:07:50:57	2001+349:08:47:49	HS data interruption
2001+360:13:38:18	2001+360:14:30:30	HS data interruption
2001+361:06:36:50	2001+361:06:58:10	HS data interruption
2002+024:23:59:59		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
2001+341:04:34:08.880		Official start logging

Log Date	LogDate	Comment
2001+360:13:40:06.144	2001+360:14:29:24.384	
2001+361:06:37:00.760	2001+361:06:56:24.712	
2002+024:23:59:00.156		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
2001+343:05:42:52.980	2001+345:21:30:18.867	
2001+355:14:14:47.672	2001+360:19:17:38.603	
2001+362:08:00:40.628	2001+362:12:55:56.425	
2001+365:01:51:13.036	2002+006:08:03:12.303	
2002+018:07:51:27.856	2002+023:11:10:33.515	

The following items were of concern during this cruise:

- The P2 and P1 formats do not store the shot time in millisecond range
- SIOSEIS cannot handle the Spectra output header for SEG−D

Due to these facts, Jeff Turmelle created a system where we would 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

Shot Files Table

Line Name	Times ()	Ewing(ts.n, nb2.r)		Spectra (shots.p1, shotlog.p2)		
		Shots	Missing	P1 Shots	P2 Shots	Missing
OBHL_1	346:08:07:34 347:02:28:21	0005−0468 **(Note: Shots 0385−0468 are the first "ranging" shots.)**				
TEST1	347:03:27:19 347:11:25:54	0001−0025 0001−0018 0001− 0022				
OBHL_2	348:03:51:47 348:16:44:17	0001−0390				
TEST2	348:19:30:15 349:07:04:04	0001−0041 0001−0036 0001−0046 0001−0037				
OBHL_3	349:21:08:01 350:12:06:01	0001−0450				

Line Name	Times ()	Ewing(ts.n, nb2.r)		Spectra (shots.p1, shotlog.p2)		
		Shots	Missing	P1 Shots	P2 Shots	Missing
TEST3	350:15:30:59 351:03:00:53	0001−0046 0001−0045 0002−0036 0001−0003 0001−0049	0001			
OBHL_4	352:10:07:29 353:00:35:08	0001−0288 0001−0126				
TEST4	353:22:54:52	0001−0005 0001−0102 0001−0052 0001−0048 0001−0049				
MCSTEST	355:12:01:47 355:13:28:55	0001−0286 0001−0041 0001−0024		0001−0286 0001−0041 0001−0024	0001−0286 0001−0041 0001−0024	
MCSL_1	355:13:52:52 355:23:51:02	0002−1771		0003−1771	0003−1771	0002
MCSL_2	356:00:40:25 356:10:28:52	0024−1841	1280	0024−1841	0024−1841	
MCSL_3	356:10:35:11 356:12:59:07	0004, 0019−0360		0004,0019−0360	0004,0019−0360	
MCSL_4	356:13:17:22 356:23:31:55	0001−1845		0001−1845	0001−1845	
MCSL_5	357:00:24:38 357:09:54:16	0099−1743		0099−1743	0099−1743	
MCSL_6	357:10:08:57 357:13:34:22	0030−0628	0016−0029	0016−0628	0016−0628	
TEST6	357:14:03:37 357:14:45:11	0001−0029 0001−0111				
MCSL_7	357:14:54:47 357:19:26:58	0001−0002 0001−0762		0001−0002 0001−0762	0001−0002 0001−0762	
MCSL_8	357:20:42:37 358:00:32:09	0015−0765		0015−0765	0015−0765	
MCSL_9	358:02:06:06 358:07:44:37	0001−0950		0001−0950	0001−0950	
MCSL_10	358:08:55:03 358:16:15:47	0003−1344		0003−1344	0003−1344	
MCSL_11	358:17:42:39 359:00:20:04	0001−1153		0001−1153	0001−1153	
MCSL_12a	359:01:39:14 359:04:59:22	0001−0633		0001−0633	0001−0633	

Line Name	Times ()	Ewing(ts.n, nb2.r)		Spectra (shots.p1, shotlog.p2)		
		Shots	Missing	P1 Shots	P2 Shots	Missing
MCSL_12b	359:06:46:14 359:08:03:45	0001−0240	0038−0046	0001−0240	0001−0240	
MCSL_12c	359:10:01:58 359:10:41:01	0140−0257	0133	0133,0140−0257	0133,0140−0257	
MCSL_13	359:11:58:24 359:17:15:07	0001−0951		0001−0951	0001−0951	
MCSL_14	359:18:37:40 360:00:50:14	0001−1140		0001−1140	0001−1140	
MCSL_15	360:02:17:24 360:06:53:12	0001−0005, 0031−0848		0001−0005, 0031−0848	0001−0005, 0031−0848	
MCSL_16	360:08:03:16 360:12:43:43	0001−0824		0001−0824	0001−0824	
MCSL_17	360:14:46:04 360:19:18:58	0088−0939		0088−0939	0088−0939	
MCSL_18	362:05:19:21 362:12:37:37	0002−1308	0515	0003, 0005−1308	0003, 0005−1308	0002, 0004
MCSL_19	362:14:32:16 362:20:18:14	0002−0958	**Note: No shots officially missed; line ended @ shot #958**	0003−1101	0003−1101	0002
MCSL_20	364:10:51:16 364:17:13:19	0002−1128		0003−1128	0003−1128	0002
MCSL_21	364:22:14:36 365:10:52:35	0002−2330		0003−0004, 0059−2330	0003−0004, 0059−2330	0002
MCSL_22	365:12:38:07 365:18:52:59	0095−1436		0095−1436	0095−1436	
MCSL_23	365:19:47:31 001:08:01:31	0120−2488		0120−2488	0120−2488	
MCSL_24	001:08:43:21 001:22:38:53	0001−2520		0120−2520	0120−2520	
MCSL_25	002:05:35:04 002:21:40:35	0001−0010, 0014−3975	1727	0001−0010, 0014−3975	0001−0010, 0014−3975	
MCSL_26	002:21:58:05 002:23:46:58	0048−0475		0048−0475	0048−0475	
MCSL_27	002:23:57:51 003:15:23:34	0037−3565		0037−3565	0037−3565	
MCSL_28	003:15:42:04 003:18:08:41	0054−0670		0054−0670	0054−0670	

Line Name	Times ()	Ewing(ts.n, nb2.r)		Spectra (shots.p1, shotlog.p2)		
		Shots	Missing	P1 Shots	P2 Shots	Missing
MCSL_29	003:18:21:54 003:22:13:03	0031−0978		0031−0978	0031−0978	
MCSL_30	003:23:40:20 004:04:26:07	0001−1027		0001−1027	0001−1027	
MCSL_30A	004:04:26:07 004:06:03:26	0015,0034−0392		0015,0034−0392	0015,0034−0392	
MCSL_31	004:06:16:35 004:10:48:28	0001−1031		0001−1031	0001−1031	
MCSL_32	004:10:48:28 004:16:55:17	0055−1557		0055−1557	0055−1557	
MCSL_33	004:18:29:39 004:22:36:10	0001−1020		0001−1020	0001−1020	
MCSL_33A	004:22:51:31 005:00:41:22	0049−0479		0049−0479	0049−0479	
MCSL_34	005:00:55:37 005:06:13:06	0057−1330		0057−1330	0057−1330	
MCSL_35	005:06:25:56 005:12:46:34	0049−0058, 0069−0071 0115−1536		0049−0058, 0069−0071 0115−1535	0049−0058, 0069−0071 0115−1535	1536
MCSL_36	005:12:57:06 005:18:29:51	0044−1350		0044−1350	0044−1350	
MCSL_36A	005:18:45:01 005:19:53:17	0046−0458	0321	0046−0458	0046−0458	
MCSL_37	005:20:51:19 006:01:20:34	0055−1118		0055−1118	0055−1118	
MCSL_38	006:02:49:17 006:07:58:11	0001−1236		0001−1236	0001−1236	
OBHL_5	007:04:08:02 007:06:40:02	0001−0077				
OBHL_5A	010:02:12:13 010:14:12:13	0001−361				
TEST5A	010:19:46:29 011:08:11:01	0001−0034 0001−0034 0001−0028 0001−0023				
TEST7	016:01:56:35 016:08:04:41	0001−0041 0001−0037 0001−0039 0001−0032				
OBHL_7	016:12:36:51 016:20:50:51	0001−0248				

Line Name	**Times ()**	**Ewing(ts.n, nb2.r)**		**Spectra (shots.p1, shotlog.p2)**		
		Shots	**Missing**	**P1 Shots**	**P2 Shots**	**Missing**
OBHL_7A	017:07:58:43 017:16:32:43	0001−0258				

Fremantle, W. Australia

EW0113 Fremantle, Australia

Pier/Ship	Latitude	Longitude
	32 02.960S	115 44.720E

The pier tie was taken at Bollard 57, which is near Shed D at

Reference	Latitude	Longitude
	32 03.156S	115 48.800E

The reference tie was made to Bollard "E" which is the 6th Bollard from the end of th

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0112	299	10/26/2001	8.94	−8.58	34.68
Post Cruise	EW0113	338	12/03/2001	**9.22**	**0.007**	**8.94**
Total Days			**38.00**	**0.28**		

Time	Entry	Value	
10:30	**CDeck Level BELOW Pier**	2.00	
10:00	**Pier 1 L&R Value**	3025.70	**L&R**
14:00	**Reference L&R Value**	3028.20	**L&R**
10:05	**Pier 2 L&R Value**	3025.70	**L&R**
	Reference Gravity	979417.30	**mGals**
	Gravity Meter Value (BGM Reading)	979426.20	**mGals**
	Potsdam Corrected	0	**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	
3025.70	**3028.20**	**1.06**		**−2.65**	mGals

Gravity in mGals at Pierside

Reference +	Delta mGals	[+ Potsdam]		Pier Gravity	
979417.30	**−2.65**	**0.00**		**979414.65**	mgals

Gravity in mGals at Meter

Pier Gravity+	Height Correction			Gravity@meter	
979414.65	**2.33**			**979416.98**	mGals

Current Mistie

BGM Reading	Calculated Gravity			Current Mistie	
979426.20	**979416.98**			**9.22**	mGals

Hobart, Tasmania

EW0114 Hobart, Tasmania

Pier/Ship	Latitude	Longitude
	47 53.140S	147 20.042E

The pier tie was taken at an unumbered bollard five (5) set on drain opening seve marking on warehouse. (Shed #2)

Reference	Latitude	Longitude
	32 03.156S	115 48.800E

The reference tie was made inside the main terminal at the extreme right of the Q

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0113	338	12/03/2001	9.22	0.01	8.94
Post Cruise	EW0114	25	01/25/2002	9.44	0.004	9.22
Total Days			53.00	0.22		

Time	Entry	Value	
15:00	CDeck Level BELOW Pier	1.00	
15:00	Pier 1 L&R Value	4004.32	L&R
15:39	Reference L&R Value	4001.16	L&R
16:30	Pier 2 L&R Value	4004.32	L&R
	Reference Gravity	980449.40	mGals
	Gravity Meter Value (BGM Reading	980464.20	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	
4004.32	4001.16	1.06		3.35	mGals

Gravity in mGals at Pierside

Reference + Delta mGals [+ Potsdam]				Pier Gravity	
980449.40	3.35	0.00		980452.75	mgals

Gravity in mGals at Meter

Pier Gravity+	Height Correction			Gravity@meter	
980452.75	2.02			980454.76	mGals

Current Mistie

BGM Reading	Calculated Gravity			Current Mistie	
980464.20	980454.76			9.44	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 Latitude	Longitude	Tailbuoy Position 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 Depth	Sea Temp	Wind Spd	Wind Dir	Tailbuoy Latitude	Tailbuoy Longitude	Tailbuoy Range	Tailbuoy Bearg	Line 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	

Latitude	Longitude	Tailbuoy Range	Tailbuoy 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	Raw Velocity East	Smooth Velocity North	Smooth Velocity 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

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

Bird1: Speed Inst	60sA	60mA	60sM	Direction Inst	60sA	60mA	Bird 2 Speed Inst	60sA	60mA	60sM	Direction 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 Inst	60mA	60mm	60mM	Humidity 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

EW0114

EW0114.pdf	this document
ew0114.cdf	NetCDF database file of this cruise
ew0114.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 (*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 and P2/94 files from MCS lines
streamer/	Excel spreadsheets of streamer configuration