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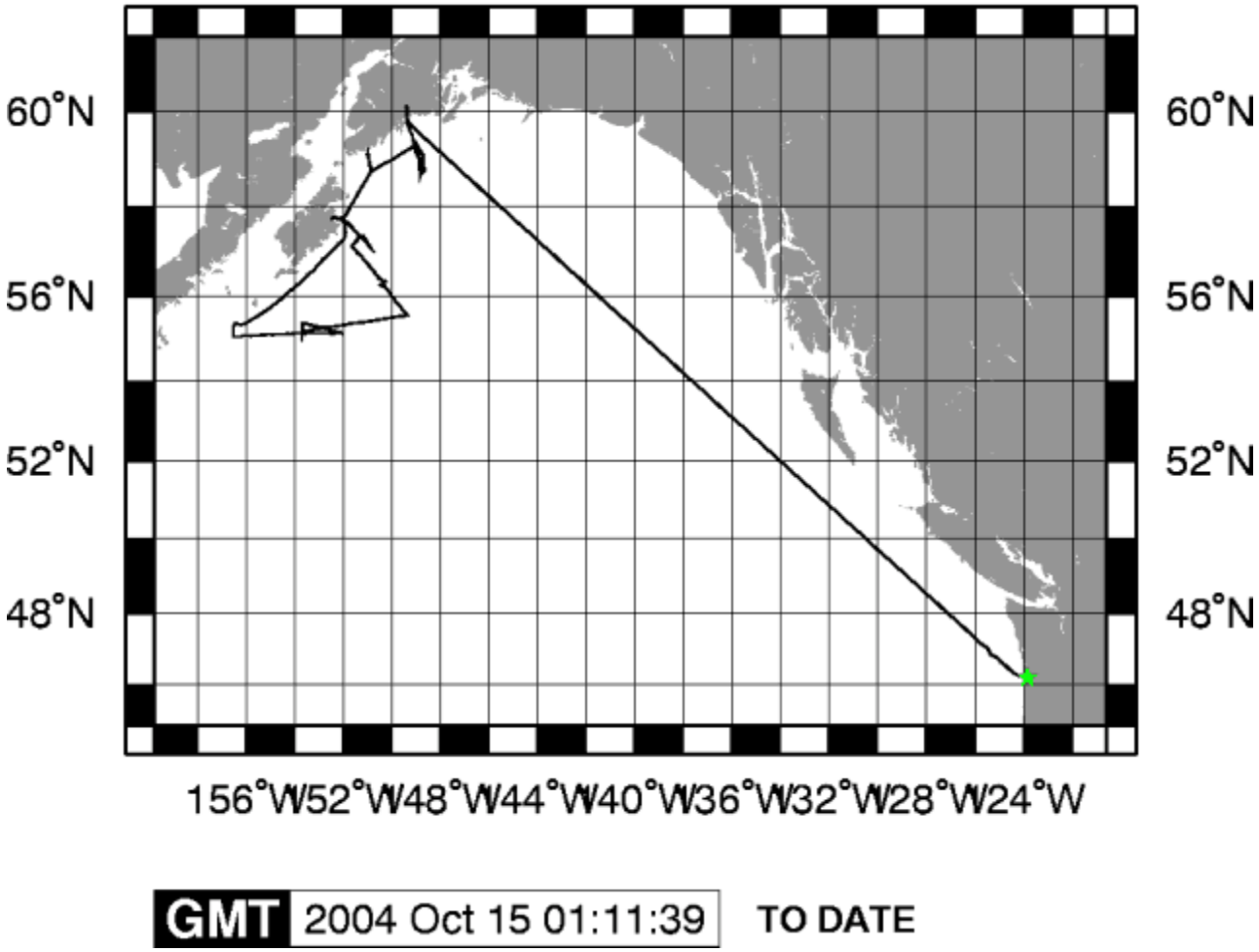
R/V Maurice Ewing Data Reduction Summary

EW−0409 Kodiak, AK − Astoria, OR

Date	Julian Date	Time	Port
September 28, 2004	272	00:52:30.072	Kodiak, AK
October 14, 2004	289	21:58:44.497	Astoria, OR



Project Summary

DESCRIPTION

Background and Scientific Objectives

Cruise No.: EW0409 July 7, 2004 FOCI No.: 1EW04 and shellfish stocks in Alaskan waters. This cruise is in support of the United States Global Ocean Ecosystems Dynamics (U.S. GLOBEC) and the Steller Sea Lion Research Programs. This cruise is being undertaken by FOCI in support of research into the physical, chemical, and biological mechanisms acting in the coastal Gulf of Alaska that make it one of the most productive ecosystems on earth.
We will focus our hydrographic efforts on the physical, chemical, and biological processes occurring in the eddies that impact this region and contribute to onshore and offshore fluxes of nutrients, as well as larval fish (see Section 8.2 Sea Surface Altimetry). This will involve casts with a CTD profiler equipped with a fluorometer and PAR sensor, and a rosette with 5−liter Niskin bottles, from which we will take samples for salinity calibrations, chlorophyll, and nutrient analyses. A few of the CTD stations will be followed by Marine Assessment Monitoring and Prediction (MARMAP) Bongo tows, so that we can sample for zooplankton and larval fish.
We plan to occupy hydrographic station across two eddies that are located off the shelf, one east of Kodiak Island, the other to the south of the western part of the island. The positions of these eddies shown in Section 8.2 Sea Surface Altimetry are from June 28, 2004, and will change before this cruise. Therefore, the positions shown in the figures, and in the itinerary, are for planning purposes only.
Then, we plan to go to Larsen's Bay, a part of Uyak Bay near the west end of the north side of Kodiak Island on Tuesday, October 5, 2004, to embark the mooring technicians on Wednesday, October 6, 2004.

Cruise Members

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Cruise Notes

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

Hydrosweep

Hydrosweep perfromed normally. No data was collected on julian day 286 due to operator error. No processing was done on any of the data

Gravity

The gravimeter performed normally.

Navigation

Towards the end of julian day 285, the Cnav GPS lost differential corrections and produced incorrect position fixes. As a result, the Tasmon GPS was used as the primary source of navigation for day 285.

Timing

Timing operated normally.

TSG/Flourometer

Clogged drains forced the shutdown of the salt water pump early on julian day 282.

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+272:16:42:30.079		Logging officially started
2004+288:23:42:29.730		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+272:00:55:23.157		Logging officially started
2004+288:21:58:46.200		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+272:00:55:32.344		Logging officially started
2004+288:21:58:45.494		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+272:00:55:44.569		Logging officially started
2004+288:21:58:45.694		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+272:00:55:55.660		Logging officially started
2004+285:21:39:46.804	2004+285:21:54:59.222	Data Interruption
2004+285:23:29:28.308	2004+285:23:43:49.576	Data Interruption

Log Date	LogDate	Comment
2004+288:21:58:46.301		Logging Ends

Speed and Heading

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

logging interval: 3 seconds
file id: fu

The Furuno and Gyro are combined to output speed, heading and course information to a raw Furuno file, as well as an NMEA VDVHW signal used as an input to various systems including steering and Spectra.

Interruptions greater than 30 minutes are displayed in the following table

Log Date	Log Date	Comment
2004+272:00:56:43.797		Official start date
2004+288:21:58:44.497		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: −0.485

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+272:00:57:16.278		Official start date
2004+288:21:58:46.177		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+272:17:09:48		Official start logging
2004+285:22:00:14	2004+285:22:14:59	Data Interruption
2004+285:22:14:59	2004+285:23:37:08	Data Interruption
2004+288:21:58:42		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+272:19:40:49.019		Official start logging
2004+288:21:58:01.023		Official end logging

LOCATION 1

EW0408 Kodiak, Alaska

Pier/Ship	Latitude	Longitude
	32 22.71N	64 40.89W
Pier 8		
Reference	**Latitude**	**Longitude**
	32 15.00N	64 41.67W
Cruise Ship terminal		

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0407	233	20. Aug 04	8.02	0.02	7.36
Post Cruise	EW0408	268	24. Sep 04	**−8.97**	**−0.485**	**8.02**
Total Days			**35.00**	**−16.99**		

Time	Entry	Value	
0	**CDeck Level BELOW Pier**	4.00	
17	**Pier 1 L&R Value**	5218.68	**L&R**
214	**Reference L&R Value**	5223.23	**L&R**
	Pier 2 L&R Value	5219.15	**L&R**
	Reference Gravity	981752.80	**mGals**
	Gravity Meter Value (BGM Reading)	981742.20	**mGals**
	Potsdam Corrected	0	**1 if corrected**

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

Difference in meters between Gravity Meter and Pier: **9.50** meters

Height Cor =	Pier Height*	FAA Constant			
	9.50	**0.31**			**2.95** mGals/min

Difference in mGals between Pier and Gravity Meter

Pier (avg) −	Reference *	1.06 L&R/mGal		Delta L&R
5218.92	**5223.23**	**1.06**		**−4.57** mGals

Gravity in mGals at Pierside

Reference +	Delta mGals [+ Potsdam]			Pier Gravity
981752.80	**−4.57**	**0.00**		**981748.23** mgals

Gravity in mGals at Meter

Pier Gravity+	Height Correction			Gravity@meter
981748.23	**2.95**			**981751.17** mGals

Current Mistie

BGM Reading	Calculated Gravity			Current Mistie
981742.20	**981751.17**			**−8.97** mGals

Location 2

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

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

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

Tape Contents

EW0409/	
EW0409.pdf	this document
ew0409.cdf	NetCDF database file of this cruise
ew0409.cdf_nav	NetCDF database file of this cruise' navigation
adcp/	Acoustic Doppler Profile data
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.