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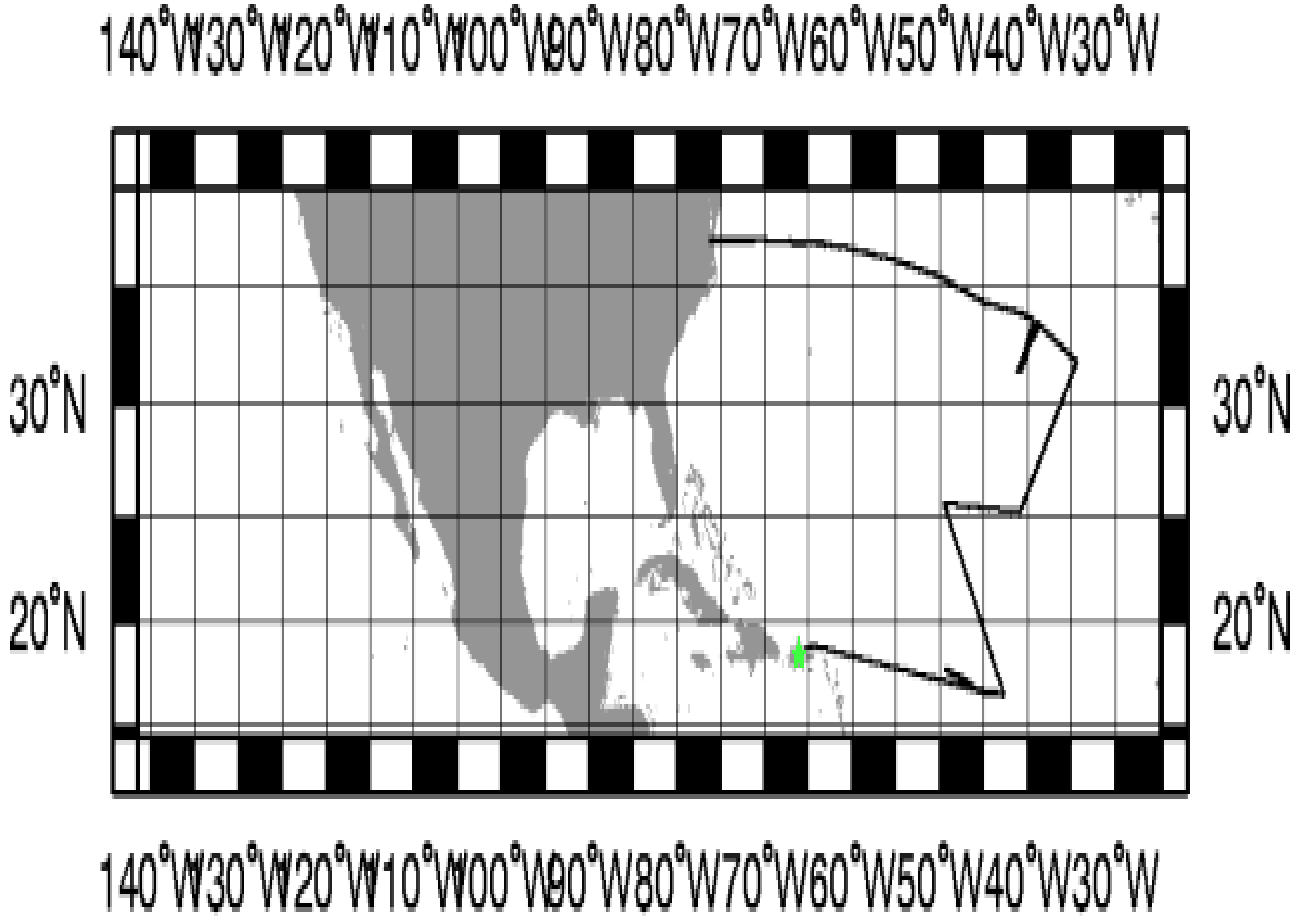
R/V Maurice Ewing Data Reduction Summary

EW–0301 Norfolk, VA – San Juan, P.R.

Date	Julian Date	Time	Port
April 13, 2003	103	14:00 UTC	Norfolk, Virginia
May 10, 2003	130	23:45 UTC	San Juan, Puerto Rico



Project Summary

DESCRIPTION

Background and Scientific Objectives

The basic science objectives of Ewing cruise 0301 included the recovery and redeployment of 6 haruphone moorings, an attempt to image and drag for an unresponsive/lost mooring and completion of two multibeam surveys of northern and southern areas of the Mid−Atlantic Ridge.

No abstract provided.

Cruise Members

Science Party

Joe Haxel	Chief Scientist	haxel@pmel.noaa.gov
Sheffield Corey	Scientist	shef_corey@excite.com

Ship's Science

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Ship Crew

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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.

Gravity

No gravity notes.

Hydrosweep

Unfortunately, hydrosweep acquisition was frought with problems during this cruise.

Immediately upon departure, almost all of the port side beams (from or very near nadir out) were missing. Although behavior of this kind is quite atypical of the Ewing DS2, it is not entirely uncommon for mid to deep water echosounding systems to incur difficulites evaluating return signals in relatively shallow water. Around ~23:00 on day 103, as we sailed past Thimble Shoals and approached +100m depths, the DS2 seemed to settle down and the entire beam fan appeared.

By early jday 104, Science Officer, Ted Koczynski, Shef Corey and I noticed what is best described as "ramping" in the outer port side beams from beam number 0 to ~ 25 (counting from port to starboard). Despite the unlikelihood of there existing any correlation between the "ramping" behavior and poor sound speed or roll bias, we waited for a relative flat to cast our initial XBT and conduct a roll bias test.

The roll bias test commenced at 15:32 on day 105 at a speed of 5 knots. I applied the first sound velocity profile (which failed to correct the ramp) and derived a roll bias error of (+)0.13 around 18:30. I failed to locate the DS2 password that would enable us to make the correction and used the next couple of days to retrieve the password, review our findings with both Krupp Atlas and Lamont−Doherty engineers, and continue to observe the behavior of the hydrosweep.

At 19:00 on day 107 I applied the (+)0.13 correction to the existing (−)0.10 value to produce a (−)0.23 bias value. It is very important to note that adding a positive roll bias correction from MBSystem to the DS2 has the effect of lowering the starboard beams. We observed no visual improvement in the DS2 cross profile display. In an effort to try to "see" something, I increased the roll bias correction by 0.05 at 19:54, added 0.05 more at 20:03 and still observed no visual improvement. After several minutes, I returned the roll bias value to (−)0.23.

On day 113 at 02:00, during hydrosweep survey #1, Shef and I discovered several unusual black lines extending orthagonally from the ship's track on the DS2 display. This coincided with the complete loss of any cross profile display and the cessation of swath contour "painting". In an effort to capture a X window dump via command line, the X server crashed. 02:05; I restarted the DS2 display application, but continued to experience chronic system failures. A reboot of the hydrosweep on−line workstation was performed at 03:12 and Ted asked the bridge to turn around in an effort to retrieve missed survey coverage. Within several minutes, we continued to experience system faults. For the next two hours, Ted and I reseated boards, rebooted the hydrosweep online workstation, interface processor, and cycled power to the transducers. This last bit of troubleshooting apparently addressed the system failures but the "ramp" remained.

By mid−day 114, we discovered a bad filter card in the Preformed Beam Module and replaced it with a spare around 22:00. With the exception of a few "turned down" beams on the extreme

edges of the swath, the subsequent data was very good.

Sound velocity profiles generated from XBT data merged with levitus databases were applied to DS2 as follows:

ew0301_4−15.xt5 ==> ew0301_1.svp @ 16:34 on day 105

ew0301_4−17.xt7 ==> ew0301_2.svp @ 21:13 on day 107

ew0301_4−19.xt5 ==> ew0301_3.svp @ 20:19 on day 107

ew0301_4−21.xt7 ==> ew0301_4.svp @ 05:16 on day 111

ew0301_4−23.xt5 ==> ew0301_5.svp @ 19:04 on day 114

ew0301_4−26.xt5 ==> ew0301_6.svp @ 22:11 on day 116

ew0301_4−28.xt5 ==> ew0301_7.svp @ 05:32 on day 119

ew0301_5−1.xt5 ==> ew0301_8.svp @ 22:44 on day 121

ew0301_5−3.xt5 ==> ew0301_9.svp @ 01:33 on day 124

ew0301_5−1.xt5 ==> ew0301_8.svp @ 07:00 on day 124 (Shef Corey)

Sheffield Corey processed the Hydrosweep bathymetry data during this cruise.

Magnetics

The magnetometer produced very noisy data upon initial deployment. Ted and Karl pulled in the maggie and found some leakage. After draining the water, Karl machined an o−ring plug and we redeployed the fish ~ 20:15 on day 112. Subsequent tuning resulted in very nice data.

Navigation

After the time synching problem was fixed, the Tasman, the primary GPS source for this cruise hiccuped once @ ~22:00 on day 114. The Trimble, however, proved somewhat flaky over the course of the cruise. Ted found an apparently intentionally cut antenna cable and fashioned a new one on day 126 ~19:00, which improved things greatly.

Time

On days 103 and 104, the Datum GPS clock suffered from chronic hiccups. Since Octopus, the data logging server, uses time records from the GPS clock to provide a single master time source, all logging processes were stopped as several manual time adjustments were made.

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.

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

Log Date	LogDate	Comment
2003+103:14:46:30.084		Logging officially started
2003+103:15:22:30.092	2003+103:19:05:30.101	Data Interruption
2003+104:17:48:29.742	2003+104:19:07:30.090	Data Interruption
2003+121:22:42:29.736	2003+121:23:13:45.072	
2003+130:23:42:29.733		Logging officially ends

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.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2003+103:11:07:30.863		Logging officially started
2003+103:15:04:25.495	2003+103:15:16:59.509	Data Interruption
2003+103:15:22:31.744	2003+103:15:34:12.490	Data Interruption
2003+130:23:45:11.215		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
2003+103:11:07:46.129		Logging officially started
2003+103:15:22:35.192	2003+103:15:34:38.041	Data Interruption
2003+104:18:41:21.674	2003+104:19:29:27.416	Data Interruption
2003+105:20:38:48.568	2003+105:23:46:25.418	Data Interruption
2003+106:20:20:18.472	2003+106:22:20:24.404	Data Interruption
2003+126:19:10:09.495	2003+126:23:09:08.691	Data Interruption
2003+127:16:18:13.319	2003+127:17:55:13.146	Data Interruption
2003+130:23:45:11.437		Logging 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
2003+103:11:08:13.451		Official start date
2003+130:23:45:09.795		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: 0.019

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
2003+103:11:11:01.889		Official start date
2003+103:14:54:13.470	2003+103:15:35:09.751	Data Interruption
2003+130:23:45:10.975		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.

**During this cruise, the hydrosweep was routinely stopped in an effort to range, activate, and/or image submerged instruments and acoustic releases. Gaps corresponding to these data interruptions may not be displayed.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2003+103:14:14:31		Official start logging
2003+103:14:49:31	2003+103:15:37:15	Data Interruption
2003+104:08:29:07	2003+104:08:39:45	Data Interruption
2003+105:15:38:05	2003+105:20:56:24	Data Interruption
2003+113:04:40:13	2003+113:04:54:08	Data Interruption
2003+113:06:19:18	2003+113:07:15:04	Data Interruption
2003+115:17:44:55	2003+115:18:14:33	Data Interruption
2003+121:22:51:46	2003+121:23:04:16	Data Interruption
2003+130:23:45:13		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
2003+103:11:11:49.377		Official start logging
2003+103:15:24:00.624	2003+103:15:35:35.570	Data Interruption
2003+130:23:45:00.788		Official end logging

Magnetics

Varian Magnetometer

logging interval: 12 seconds
file id: mg

The following table shows the times the magnetometer was logging

Log Date	LogDate	Comment
2003+112:02:19:48.162	2003+112:12:30:31.002	Official start logging
2003+112:20:20:41.045	2003+113:03:20:21.625	
2003+115:21:21:01.802	2003+116:18:56:19.647	
2003+117:04:07:40.956	2003+118:20:33:09.035	
2003+119:04:50:15.294	2003+121:16:49:34.881	
2003+122:16:04:24.782	2003+122:17:24:39.796	
2003+122:18:13:27.867	2003+123:19:42:20.141	
2003+124:06:16:55.386	2003+125:19:06:48.404	
2003+126:09:32:07.014	2003+126:09:33:17.028	
2003+126:10:05:09.860	2003+127:00:06:45.971	
2003+127:00:53:02.087	2003+128:13:20:34.260	Official end logging

LOCATION 1

EW0301 Norfolk, Va.

Pier/Ship	Latitude	Longitude
	36 50.886N	076 17.810W

Nauticus Pier @ shore side of Zed Ballard – South End of Pier

Reference	Latitude	Longitude

NOAA Dock 439 West York Street. (Closer to foot of Bute St. SE corner of concrete Dock 75 cm east of center of cleat #1. Benchmark "Bole No.1 1961"

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0210	304	31. Oct 02	3.05	−0.14	10.21
Post Cruise	EW0301	102	12. Apr 03	0.00	−0.019	3.05
Total Days			163.00	−3.05		

Time	Entry	Value	
07:30:00	CDeck Level BELOW Pier	0.00	
08:00:00	Pier 1 L&R Value	3456.08	L&R
1110	Reference L&R Value	3456.84	L&R
1020	Pier 2 L&R Value	3456.08	L&R
	Reference Gravity	979859.40	mGals
	Gravity Meter Value (BGM Reading)	979873.90	mGals
	Needs Potsdam Correction	1	0 if referenced

*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
3456.08	3456.84	1.06		−0.81 mGals

Gravity in mGals at Pierside

Reference + Delta mGals [+ Potsdam]				Potsdam Referenced Pier (
979859.40	−0.81	13.60		979872.19 mgals

Gravity in mGals at Meter

Pier Gravity+	Height Correction			Gravity@meter
979872.19	1.71			979873.90 mGals

Current Mistie

BGM Reading	Calculated Gravity			Current Mistie
979873.90	979873.90			0.00 mGals

Location 2

EW0302 San Juan, P.R.

Pier/Ship	Latitude	Longitude
	18 27.731N	066 06.804W

Pier 1 Old San Juan

Reference	Latitude	Longitude
	18 27.75 N	066 065.64W

The tie was taken on a GPS survey marker on Puerta De Tierras street next to the jail The Army Corps of Engineers is at the end of the street at the bottom of the hill.

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0301	102	12. Apr 03	0.00	−0.02	3.05
Post Cruise	EW0301	133	13. May 03	4.79	0.155	0.00
Total Days			31.00	4.79		

Time	Entry	Value	
13:30:00	CDeck Level BELOW Pier	0.33	
13:30:00	Pier 1 L&R Value	2330.44	L&R
10:30:00	Reference L&R Value	2331.95	L&R
14:00:00	Pier 2 L&R Value	2330.44	L&R
	Reference Gravity	978688.40	mGals
	Gravity Meter Value (BGM Reading)	978693.40	mGals
	Needs Potsdam Correction	0	0 if referenced

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

Difference in meters between Gravity Meter and Pier: 5.83 meters

Height Cor = Pier Height* FAA Constant

5.83	0.31			1.81 mGals/min

Difference in mGals between Pier and Gravity Meter

Pier (avg) − Reference *1.06 L&R/mGal — Delta L&R

2330.44	2331.95	1.06		−1.60 mGals

Gravity in mGals at Pierside

Reference + Delta mGals [+ Potsdam] — Potsdam Referenced Pier (

978688.40	−1.60	0.00		978686.80 mgals

Gravity in mGals at Meter

Pier Gravity+ Height Correction — Gravity@meter

978686.80	1.81			978688.61 mGals

Current Mistie

BGM Reading Calculated Gravity — Current Mistie

978693.40	978688.61			4.79 mGals

File Formats

For all formats, a **–** in the time field means an invalid value for some reason.

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
```

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)
```

Tape Contents

EW0301/

EW0301.pdf	this document
ew0301.cdf	NetCDF database file of this cruise
ew0301.cdf_nav	NetCDF database file of this cruise' navigation
ew0301_offsets.tif	R/V Ewing offsets
configs/	Ewing data system logging and reduction configuration files
docs/	File Formats
hs_data/	EW0301 raw and processed hydrosweep data
mbsystem	lastest MBSystem source
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.
svps/	Derived sound velocity profiles
XBT/	XBT data