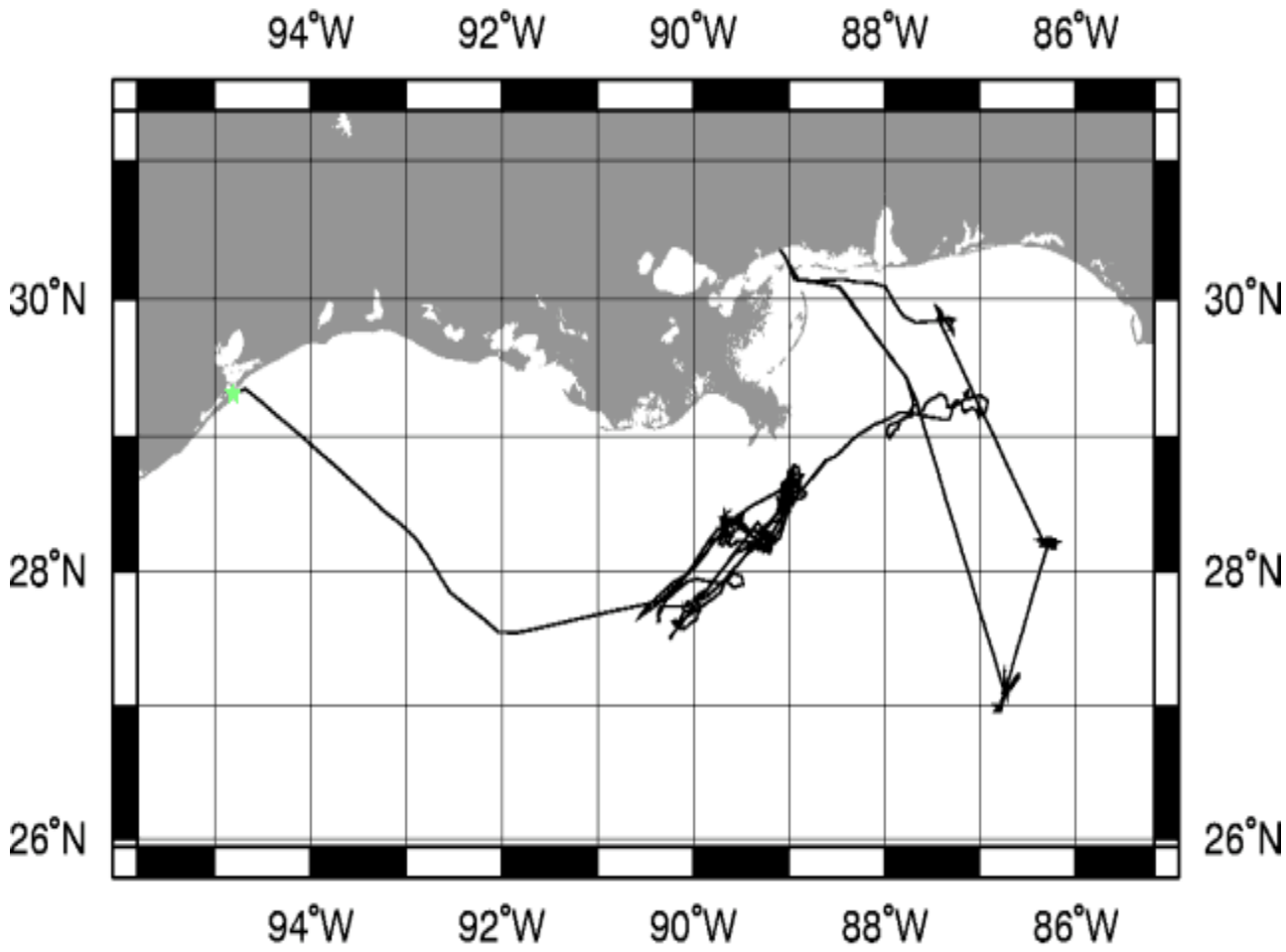
Lamont– Doherty Earth Observatory
Office of Marine Affairs
61 Route 9W
Palisades, NY 10964

Prepared By: Ethan Gold
etgold@ldeo.columbia.edu
845–365–8677

R/V Maurice Ewing Data Reduction Summary

EW–0303 Gulfport, Missippi – Galveston, Texas

Date	Julian Date	Time	Port
May 27, 2003	147	UTC 16:00	Gulfport, Missippi
June 24, 2003	175	UTC 15:18	Galveston, Texas



Project Summary

DESCRIPTION

Background and Scientific Objectives

The primary objective of this leg of the Ewing cruise is to measure the response of sperm whales in the NE Gulf of Mexico to controlled experimental exposures (CEE) of an industry−standard seismic airgun sounds and various control sounds. We will observe and record whale behavior using a combined acoustic and movement recording tag “D−tag”, in tandem with supporting visual and acoustic observations from the R/V and the tagging vessel. When possible, we will attempt to tag up to 3 sperm whales simultaneously in a multiple−animal tagging paradigm. In the first four days of the cruise, tagged animals will be exposed to playback of either a no−sound control or naturally−occurring patterned series of clicks produced by sperm whales, called codas. No−sound controls are critical for establishing relatively undisturbed behavior, and to identify risk factors for disturbance, such as feeding specializations, or acoustically−mediated social interactions. Our plan for this year 2 SWSS cruise is to build up our sample size of CEEs on sperm whales implementing improvements to our methodology developed over this year, make calibrated recordings of seismic transmissions as a function of aspect, range and receiver depth, and conduct tagging with a mix of no−sound controls, coda playback, and seismic CEEs.

The first goal once the R/V Kondor the R/V Ewing on 6 June will be to measure received levels from the Kondor airgun array at various ranges to the vertical array provided by LDEO, the SEAMAP array towed from the R/V Ewing, and the EARS buoys to be deployed off the Kondor. The planned rendezvous point (27.7°N 90.4°W) is historically a location with few sperm whale sightings – the Kondor should arrive at this location on 5 June PM and acoustically survey for a location near this position to deploy the EARS buoys in a location where there are no audible sperm whales. The Ewing will join the Kondor on June 6 at the location of the EARS buoys. Following this calibration run and inspection of the received−level data from the vertical and towed arrays, we will establish mitigation zones from the Kondor and design desired geometries for controlled exposures of tagged whales to air−gun transmissions. On all days where weather is acceptable, we will attempt to tag whales and conduct a CEE. Tagged animals will primarily be exposed to controlled exposures from an airgun array. On rough−weather days, further calibration (of the Kondor or ongoing survey sources) may be undertaken.

Cruise Members

Science Party

Patrick Miller	Co−Chief Scientist	pmiller@whoi.edu
Mark Johnson	Co−Chief Scientist	majohnson@whoi.edu
John Diebold	Co−Chief Scientist	marscico@ldeo.columbia.edu
Alessandro Bocconcelli	scientist	
Valeria Teloni	scientist	vteloni@whoi.edu
Maria Quero	scientist	mquero@whoi.edu
Michela Podesta	scientist	michela_podesta@hotmail.com
Todd Pusser	scientist	tpusser@carolina.net
Kara Buckstaff	scientist	kara@mote.org
Suzanne Yin	scientist	syinnie@hotmail.com
Irene Briga	scientist	508−487−4854
Amy Beier	scientist	beiera@hotmail.com
Spahr Webb	LDEO Scientist	
Meike Holst	scientist	
Emily Chapp	LDEO Technician	chapp@ldeo.columbia.edu
Del Bohenstih	scientist	del@ldeo.columbia.edu
Chad Holmes	scientist	cholmes@ldeo.columbia.edu
Matthew Grund	scientist/programmer	matt@whoi.edu
Kenneth Shorter	scientist	kshorter@whoi.edu
Natacha Aguilar de Soto	scientist	naguilar@upp.es
Sue Rocca	scientist	srocca9249@aol.com
Anna Nousek	scientist	anna_nousek@alum.wellesley.edu
Dan Englehaupt	scientist	DanEnglehaupt@xtra.co.nz
Dee Allen	scientist	allen.dee@nmnh.si.edu
Doug Nowacek	scientist	dnowacek@whoi.edu
Terry Ketler	Videographer	
Aaron Thode	Seamap technician	thode@mpl.ucsd.edu
Tim Pennington	Seamap Technician	

Ship's Science

Chris Leidhold	Science Officer	sci@ewing.ldeo.columbia.edu
Ethan Gold	Computing	etgold@ldeo.columbia.edu

Ship Crew

James O'Laughlin	Captain	captain@ewing.ldeo.columbia.edu
Al Karlyn	Chief Engineer	engine@ewing.ldeo.columbia.edu
Stan Zeigler	1st Mate	chmate@ewing.ldeo.columbia.edu

Richard Thomas	2nd Mate	rickt@ewing.ldeo.columbia.edu
Meredith Mecketsy	3rd Mate	mecketsy@ewing.ldeo.columbia.edu
Matthew Tucke	1st A/Engineer	tuk@ewing.ldeo.columbia.edu
Alejandro Santiago	2nd A/Engineer	santiago@ewing.ldeo.columbia.edu
Dexter James	3rd A/Engineer	dexter@ewing.ldeo.columbia.edu
Ryan Dennis	Steward	ryan@ewing.ldeo.columbia.edu
Kelly Tomas	Boatswain	tomask@ewing.ldeo.columbia.edu
Florendo, Rodolfo	Oiler	rudy@ewing.ldeo.columbia.edu
Uribe, Fernando	Oiler	gato@ewing.ldeo.columbia.edu
Judd, Carl	Oiler	judd@ewing.ldeo.columbia.edu
Nolan Osorio	O/S Electrician	nolan@ewing.ldeo.columbia.edu
Gahr, Edward	Cook	gahr@ewing.ldeo.columbia.edu
Brown, Herman	Utility	herman@ewing.ldeo.columbia.edu
Sypongco, Arnold	A/B	arnold@ewing.ldeo.columbia.edu
Syferd, Jim	O/S	jims@ewing.ldeo.columbia.edu
Sylvia, Jeff	A/B	jeffs@ewing.ldeo.columbia.edu
Wakefield, Walker	A/B	walker@ewing.ldeo.columbia.edu

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

On day 161, most shipboard data between 0100 and 0600 was lost due to the disk being full on the logging host. Network broadcasts, watchdata, and joe's data line continued to operate, which is why it went unnoticed.

Gravity

No gravity notes

Hydrosweep

Very little hydrosweep data was collected in order to avoid exposing the whales to unnecessary sound sources.

June 7, jday 158, 1730:

Changed xhs to read $*HDT from a commandline−specfied header ID It is at the moment using the HDT from gp04 (posmv).

Hydrosweep can now read any HDT string, and can be toggled between gyro and POS.

A GPS receiver offset was changed from the POS antenna mast to the vessel reference (0,0,0)

A small amount of data was taken just before pulling into port.

Magnetics

no data taken

Navigation

Rt_nav+geo was updated to read $*GGA so that the POS can be used as the primary realtime GPS. The Hydrosweep reads nav from rt_nav (via xhs), so the DS2 can now get full POS navigation.

Early in the cruise for the calibration leg (EW0303A), gp03, the WAAS was removed to be mounted on Spahr's buoy and was logged as tailbuoy.

Time

no notes

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+148:23:14:59.830		Logging officially started
2003+158:04:38:40.021	2003+158:17:41:59.026	
2003+161:01:52:20.021	2003+161:06:10:40.021	
2003+175:16:15:20.041		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: 1 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+147:16:03:35.178		Logging officially started
2003+161:01:42:04.06		
2003+161:06:10:41.088		
2003+175:16:15:15.271		Logging officially ends

Trimble NT300D

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
2003+147:16:13:16.344		Logging officially started
2003+158:04:12:13.372	2003+158:04:33:49.375	
2003+161:01:43:17.261	2003+161:06:10:42.393	
2003+161:21:51:56.268	2003+161:23:46:45.895	
2003+168:16:18:24.864	2003+168:16:30:03.265	
2003+174:21:04:41.420	2003+174:23:37:49.872	
2003+175:16:15:16.327		Logging Ends

POS/MV

logging interval: 2 seconds
file id: gp4

The POS/MV is a receiver which uses P−code input, its own antennae, an inertial sensor, and optional RTCM 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.

Interruptions greater than 10 minutes are displayed in the following table

Log Date	LogDate	Comment
2003+147:16:13:53.315		Logging officially started
2003+148:01:56:31.980	2003+157:20:54:10.560	
2003+161:01:42:13.160	2003+161:04:32:44.900	
2003+161:04:33:08.601	2003+161:06:10:39.58	
2003+175:16:15:17.182		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+147:16:14:18.659		Official start date
2003+161:01:51:05.120	2003+161:06:10:41.128	
2003+175:16:15:14.690		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+147:16:15:02.648		Official start date
2003+161:01:45:19.000	2003+161:06:10:40.029	

Log Date	Log Date	Comment
2003+175:16:15:16.591		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
2003+148:01:57:38.000		Official start logging
2003+149:22:55:03.000	2003+151:14:31:17.000	
2003+175:16:15:32.000		Official end logging

Weather Station

RM Young Precision Meteorological Instruments, 26700 series

logging interval: 1 minute
file id: wx

The weather station is used to log wind speed, direction, air temperature, and barometric pressure. We log this information at 1−minute intervals.

Log Date	LogDate	Comment
2003+147:16:29:56.594		Official start logging
2003+161:02:19:00.059	2003+161:06:12:22.400	
2003+175:16:15:00.199		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
		Official start logging
		Official end logging

LOCATION 1

EW0302 Gulfport, Mississippi

Pier/Ship	Latitude	Longitude
	30 21.330 N	089 05.555 W

Western Terminal, Section 5, btw doors 5B & 5C

Reference	Latitude	Longitude
	30 21.441 N	089 05.647 W

No noticeable mark, using reference point 5629–2, Eastern edge of the Western Terminal just opposite NE corner of Pier warehouse btw 10th and 11th bolla

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0301	133	13. May 03	18.39	0.59	3.05
Post Cruise	EW0302	143	23. May 03	25.76	0.737	0.00
Total Days			10.00	7.37		

Time	Entry	Value	
17:35:00	CDeck Level BELOW Pier	1.40	
16:00:00	Pier 1 L&R Value	2945.66	L&R
17:35:00	Reference L&R Value	2944.49	L&R
17:45:00	Pier 2 L&R Value	2944.48	L&R
	Reference Gravity	979316.19	mGals
	Gravity Meter Value (BGM Reading)	979344.70	mGals
	Needs Potsdam Correction	0	1 if Potsdam referenced

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

Difference in meters between Gravity Meter and Pier: 6.90 meters

Height Cor = Pier Height* × FAA Constant

6.90	0.31			2.14 mGals/min

Difference in mGals between Pier and Gravity Meter

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

2945.07	2944.49	1.06		0.61 mGals

Gravity in mGals at Pierside

Reference + Delta mGals [+ Potsdam] = IGSN−71 Referenced Pier

979316.19	0.61	0.00		979316.80 mgals

Gravity in mGals at Meter

Pier Gravity+ Height Correction = Gravity@meter

979316.80	2.14			979318.94 mGals

Current Mistie

BGM Reading − Calculated Gravity = Current Mistie

979344.70	979318.94			25.76 mGals

Gravity Ties

Location 2

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

EW0303/	
EW0303.pdf	this document
ew0303.cdf	NetCDF database file of this cruise
ew0303.cdf_nav	NetCDF database file of this cruise' navigation
ew0303_offsets.tif	R/V Ewing offsets
configs/	Ewing data system logging and reduction configuration files
docs/	File Formats
hs_data/	Raw and processed hydrosweep data
mbsystem	Latest 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