Lamont-Doherty Earth Observatory
Office of Marine Affairs
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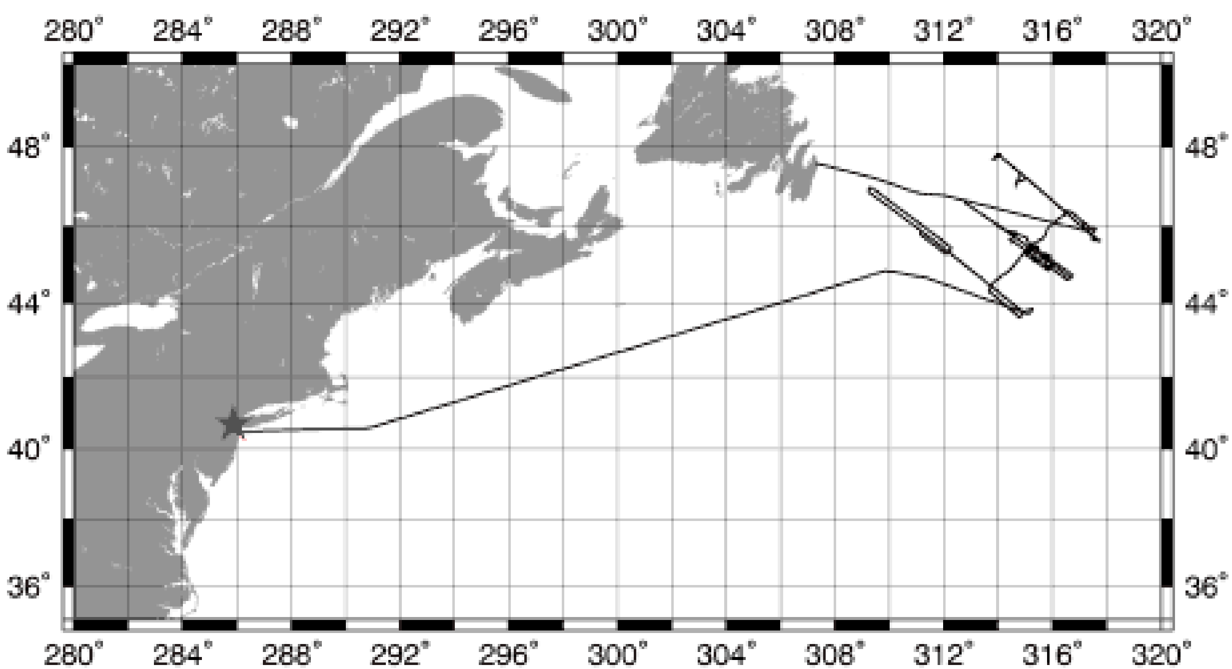
R/V Maurice Ewing Data Reduction Summary EW-0007

St. John's Newfoundland to Newark, NJ

Port Dates

Date	Julian	Time	Port
July 15, 2000	197	12:50	St. John's Newfoundland
August 16, 2000	229	2100	Newark, NJ



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Project Summary

Deformation and magmatism during continental rifting and eventual breakup are fundamental yet poorly understood issues in earth science. To significantly advance our understanding of these processes we must characterize, in unprecedented detail and accuracy, the structure and composition of conjugate rifted margins across the full width of the transition from un-deformed continental crust to normal oceanic crust. The northern Newfoundland Basin - Iberia Abyssal Plain (NNB-IAP) conjugate pair is an excellent natural laboratory for such a study. Geological characteristics there are favorable to address the fundamental scientific questions, logistically the areas are readily accessible, and a large database (strongly skewed toward the Iberia margin) already exists to focus scientific inquiries.

This proposal is centered around a field program in the NNB half of the NNB-IAP transect, but the results will be integrated with complementary data on the IAP side to give an unequaled overview of a complete, mature rift system. The critical characteristics of the NNB that need to be understood are the structure, composition and thickness of crust beneath the "breakup unconformity". We propose to study this basin with state-of-the-art wide-angle reflection/refraction seismic experiments, together with multichannel seismics, gravity, magnetics, and heat flow data, on R/V Ewing. The proposed research is a US-Canadian-Danish cooperative effort which includes Dr. Keith Louden (Dalhousie University), who has already received NSERC funding to cover his participation, and Dr. Hans Christian Larsen (Danish Lithosphere Center), who is requesting Danish funds to offset some of the costs in our proposed project. The research is also being coordinated with studies on the conjugate, Iberia half of the transect by Dr. Robert Whitmarsh (IOS) and Dr. Tim Minshull (Cambridge U.).

The proposed experiment will use dense arrays of ocean-bottom seismic instruments together with a large, tuned airgun array and the R/V Ewing's 4-km-long hydrophone streamer. Survey work will be done in two transects which extend from known continental crust on the shelf, seaward to known oceanic crust, thus completely traversing a wide region of thin crust of enigmatic origin. Together with existing and planned studies on the Iberian margin, these data will constitute the first densely sampled, combined wide-angle/vertical-incidence transects across conjugate non-volcanic rifted margins. Specific goals of the research will be to: 1) Provide key constraints on the volcanic/non-volcanic paradigm for rifted continental margins by determining the amount of igneous material accreted on this "non-volcanic" margin; 2) Characterize the regional crustal structure of the Newfoundland Basin and the eastern, unextended edge of the adjacent Grand Banks so as to constrain the origin of the crust in the Newfoundland Basin (continental vs. oceanic) and its tectonic evolution; 3) Constrain the position and nature of the continent-ocean boundary; and 4) Compare the crustal structure of the Newfoundland Basin directly with that of the conjugate Iberian margin to allow a well constrained and systematic evaluation of pure-shear vs. simple-shear models for the rifting process.

Cruise Members

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Cruise Notes

Initial Setup

There was some initial problems setting up the HP systems that Steve Holbrook brought from Wyoming. The system would not allow any logins from CDE. As soon as a user would login, the CDE would crash and restart to the login screen. Upon review of the CDE log files I found errors accessing the Display, which led me to believe it was a security problem. Eventually, I installed the hostnames in our DNS server and the systems came up normally. I still don't know why they needed to find themselves on DNS before they would boot, but this solved the problem.

Simply switching them back to their Wyoming DNS server and Wyoming IP addresses should bring them back to their original state. No real changes were done to any of the HP systems..

MCS

Catching a net on the tailbuoy on only the 2nd day of shooting (201:18:51, shot 1147) caused us to lose the tailbuoy and consequently the tailbuoy GPS as well as the piece supplying power to the tailbuoy GPS. Therefore no replacement of the tailbuoy GPS was possible. After removing the net and putting the streamer back out we were able to continue from the same spot (202:08:59:11, shot 2000).

Shooting ended early on the 11th due to the impending hurricane Albert.

Hydrosweep

The beginning of the cruise saw major problems with Hydrosweep, which Joe managed to get working after about 24 hours at sea by performing some hardware replacements.

Hydrosweep logging ended abruptly on day 228 due to the logging terminal crashing. Since there were no watchstanders on duty at this time, the mishap wasn't noticed until the following day. By that time the water was very shallow and useful hydrosweep was not available. The hydrosweep is not reliable below 50 m of water.

Magnetics

Magnetics data tended to be fairly noisy throughout much of the cruise.

Network

We acquired 2 new Netgear 100-BaseT networking switches at the start of this cruise. After installation we found that data transmission between the server and the new switches was extremely poor. After trying several changes, none of which seemed to make any difference, I decided to wait until the port stop to make a full investigation of the problem. In order to determine the problem it is necessary to reconnect the switches bringing down many of the systems that are currently using them. It was felt that the inconvenience wasn't worth the possibility of crashing the systems involved.

Tape Drives

During this cruise, we more or less successfully moved the DLT and the 3490 tape drives to grampus. This setup was more conducive to tape copying and realtime stacking during the cruise. There were a couple major problems with the 3490 tape drive crashing which necessitated a full reboot of grampus on two separate occasions. I feel that the problem came about while repositioning the 3490 drive for the cartridge loader. Moving the 3490 drive seemed to cause a loose connection on the SCSI adapter, which made grampus lose track of the device.

Data Logging

The following tables describe the data instruments performing logging during this cruise. The tables associated with some of the instruments describe the logging intervals for those instruments not logged during the entire cruise. Daily QA postscript plots can be found on the data tape under the "reduction/ clean/d*xxx*.ps" directories.

Time References

Datum StarTime 9390-1000

Used as the CPU Synchronization clock at 1/2 hour intervals. This keeps the CPU in synch with UTC time with a varying error of up to 10ms. This is QA'd every day with a plot showing the drift of the CPU clock based on the UTC clock time: *ps.tr2.xxx* The CPU seems to lose approximately 20ms/hour when not synchronized to UTC at regular intervals.

Date	Comment
208:19:12:30 - 209:20:40:30	Lost datum, cpu synchronization lost 680 ms
210:10:10:30 - 210:16:19:30	Lost datum, cpu synchronization lost 140 ms.
211:00:19:30 - 211:21:50:30	Lost datum, cpu synchronization lost 500 ms.

TrueTime GPS/VME (Syntron system)

This clock which is integrated with the Syntron VME system is used to time tag the shot times through its IRIG interface connected to *Joe's TimeTagger* box. Every shot is synced to this interface to get the exact shot time. In case of a rare failure, the CPU clock is used. These shots are tagged with a '-' in the shot time. This process is QA'd against the CPU clock for every shot in the plot *ps.ts2.xxx.*

GPS Receivers

Trimble Tasman Y-Code (Primary)

Trimble NT200D (Secondary)

Garmin G8 (Tailbuoy)

GPS NMEA data is logged at 10 second intervals. The NMEA strings GPGGA, and GPVTG are logged for position, speed and heading fixes. This data is
logged constantly throughout the cruise with minor interruptions on the secondary GPS during e-mail connects when the INMARSAT interrupts communications with the GPS receiver.

Instrument	Date	Comment
Tailbuoy GPS	202:34:04	Lost Tailbuoy

Speed and Heading

Furuno CI-30 Dual Axis Speed Log, Sperry MK-27 Gyro

The Furuno is used to log the ship's water speed, heading, and gyro. The gyro data is fed into the ship's steering as an NMEA VDVHW signal. The Furuno data is logged constantly at 3 second intervals and is also used during data reduction for determining drift in case of GPS failures.

Additionally, the Furuno logs the "pitlog" distance. This is logged as raw data in the file 0007pl.dxxx

Gravimeter

Bell Aerospace BGM-3 Marine Gravity Meter System

The BGM consists of a forced feedback accelerometer mounted on a gyro stabilized platform. The gravity meter outputs counts at approximately once per second which are all logged. There were no interruptions of gravity logging during the cruise.

Hydrosweep Bathymetry

Krupp Atlas Hydrosweep-DS

The HS full swath data is logged for each ping, and the centerbeam data is extracted and processed separately. The hydrosweep operates at varying intervals based on water depth.

The full swath data can be read and processed using the MB-System software which can be downloaded from the web site: http://www.ldeo.columbia.edu/MB-System

MB-System 4.6.10 is necessary to process data after Jan. 1, 2000.

Date	Comment
198:12:34	Hydrosweep logging begins late in the cruise due to hardware problems
214:17:23 - 214:20:32	Hydrosweep turned off during OBS recovery
228:19::27 - 229:12:24	Logging terminal crashed taking hydrosweep logging with it. Restarted at 12:24
229:16::28	Hydrosweep logging ends due tue extreme shallow water.

Weather Station

R.M. Young Precision Meteorological Instruments; 26700 series

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

Magnetics

Geometrics G-886 Marine Magnetometer

The marine magnetometer logs data at 12 second intervals. Only interruptions larger than 10 minutes are accounted for here.

Date	Comment
198:10:29 - 199:03:45	Logged magnetics
200:08:41 -	Logged magnetics
200:10:52 - 11:07	magnetic logging interruption
214:17:27 - 214:23:09:	magnetics temporarily stopped during OBS recovery
224:15:03	magnetics logging ends with pulling in of the guns.

Sea Temperature

Sea temperature is logged at one minute intervals from a thermometer mounted at the ship's keel.

Seismic Lines

Gun Depths

Shot Times

Compass Block Data

Seismic logging outside of the Syntron MCS system logs gun depths via individual depth transducers mounted on each gun; shot times via the TrueTime clock IRIG interface (described previously); and compass block data from the Digicon system.

The following tables describe the shooting logs for each line.

Additionally, data from the logging system (shot time, navigation, weather, centerbeam, sea temp, tailbuoy, furuno course and speed, gun depths and compass information) is inserted into the SEG-D Header of the MCS 3490 tape data for every shot. r. *See "Seismic SEG-D Header Data" on page 25.*

Realtime navigation is calculated via a "real-time" navigation program that filters the shot points to come up with an average speed and heading in order to calculate the time until the next shot. This navigation, while far from perfect, is fairly accurate and is used as the navigation fix for the 3490 tape header.

Line	Shots	Times	Comment
test1	1 - 435	200:09:54:08.125 - 200:12:55:50.723	Test line before real shooting. Many missing shots in here
LINE1OBS:	1 - 1147	200:13:00:00.125 - 201:18:55:12.079	Line ended due to fishing net snared on tailbuoy. Lost tailbuoy after this shot Missing Shots: 349
LINE1OBS	2000 - 2454	202:08:59:11.139 - 202:19:40:15.464	Continuation after redeploying streamer

Line	Shots	Times	Comment
LINE1MCS	2455 - 8855	203:03:31:47.129 - 204:17:39:34.077	
LINE1MCST	8856 - 9083	204:17:40:06.138 - 204:19:31:23.376	
101	9084 - 10479	204:19:31:54.137 - 205:05:40:44.910	Missing shots 9257, 9259.9260, 9263
102	10480 - 10757	205:05:42:34.123 - 205:07:42:47.621	
102t	10758 - 10885	205:07:43:38.127 - 205:08:34:28.824	
103	10886 - 11078	205:08:35:08.125 - 205:10:01:30.433	
103t	11079 - 11185	205:10:01:51.134 - 205:10:46:34.511	
104	11186 - 11324	205:10:47:02.131 - 205:11:45:18.310	
104a	11325 - 14721	205:11:45:34.130 - 206:15:00:56.810	
105	14722 - 16341	206:15:01:34.141 - 207:03:12:51.378	
106	16342 - 16907	207:03:13:43.119 - 207:06:29:30.456	
107	16908 - 18422	207:06:30:08.137 - 207:15:32:02.636	
108	18423 - 18750	207:15:32:44.137 - 207:18:41:17.709	
109	18751 - 21431	207:18:41:54.135 - 208:14:32:14.333	
109t	21432 - 21704	208:14:32:38.133 - 208:16:09:14.648	
LINE2OBS	21705 - 23533	208:16:09:37.128 - 210:09:19:19.867	
LINE2OBSt	23534 - 23819	210:09:20:32.134 - 210:10:57:08.047	
LINE2MCS	23820 - 31250	210:10:57:31.133 - 212:08:51:09.491	Missing Shots: 23858, 28342, 29766, 29767
LINE2MCSt	31251 - 31495	212:08:51:27.132 - 212:10:14:03.775	
LINE201	31496 - 32839	212:10:14:15.135 - 212:18:13:09.211	
LINE202	32840 - 33283	212:18:13:25.132 - 212:21:09:36.219	
LINE203	33284 - 33545	212:21:09:54.140 - 212:22:35:23.474	
LINE204	33546 - 34004	212:22:35:36.134 - 213:01:04:06.194	
2mcsx	34005 - 34723	213:01:06:13.127 - 213:05:42:03.022	
204b	34724 - 35144	213:05:42:45.128 - 213:08:00:33.987	Missing Shots: 34911
205	35145 - 35458	213:08:00:52.127 - 213:09:46:58.417	
206	35459 - 36079	213:09:47:19.138 - 213:14:30:32.142	
207	36080 - 36563	213:14:34:38.138 - 213:17:10:28.700	

Line	Shots	Times	Comment
208	36564 - 37078	213:17:11:51.142 - 213:20:03:16.674	
209	37079 - 37338	213:20:03:31.134 - 213:22:06:54.686	
210	37339 - 37413	213:22:07:32.127 - 213:22:59:57.226	
301	37414 - 37845	215:00:16:32.131 - 215:02:41:58.584	Missing Shots: 37462, 37486, 37487
302	37846 - 39639	215:02:42:11.124 - 215:13:41:22.863	Missing Shots: 37866-37867, 37871-37873, 37882, 37887-37889, 37894-37899, 37906-37908, 37915-37944, 37956-37963, 37979-37981, 38021-38027, 38031-38034, 38043-38057, 38092, 38107-38111, 38115-38116, 38172-38173, 38179, 38183-38185, 38281-38284
302t	39640 - 39874	215:13:41:54.124 - 215:15:06:08.144	
303	39875 - 40365	215:15:06:23.124 - 215:18:16:47.539	
304	40366 - 40518	215:18:17:06.120 - 215:19:21:59.208	
305	40519 - 44206	215:19:22:35.129 - 216:19:41:23.430	
306	44207 - 46636	216:19:41:49.131 - 217:13:00:56.910	
306t	46637 - 47042	217:13:02:18.132 - 217:15:44:38.157	
3obs	47043 - 48750	217:15:46:14.125 - 219:07:10:40.532	Missing Shots: 48376
3mcs1	48751 - 53210	219:07:11:02.132 - 220:09:23:53.413	
3mcs1T	53211 - 53626	220:09:24:15.134 - 220:11:44:29.330	
401	53627 - 59288	220:11:44:50.130 - 221:21:09:20.201	
402	59289 - 59823	221:21:09:43.121 - 222:00:21:38.832	
403	59824 - 61636	222:00:22:38.133 - 222:11:07:32.005	
403T	61637 - 61873	222:11:08:03.126 - 222:12:27:27.970	
3MCS2	61874 - 69357	222:12:28:38.137 - 224:09:00:24.369	
501	69358 - 69746	224:09:00:56.135 - 224:11:46:54.769	
502	69747 - 70092	224:11:47:33.131 - 224:14:33:31.941	

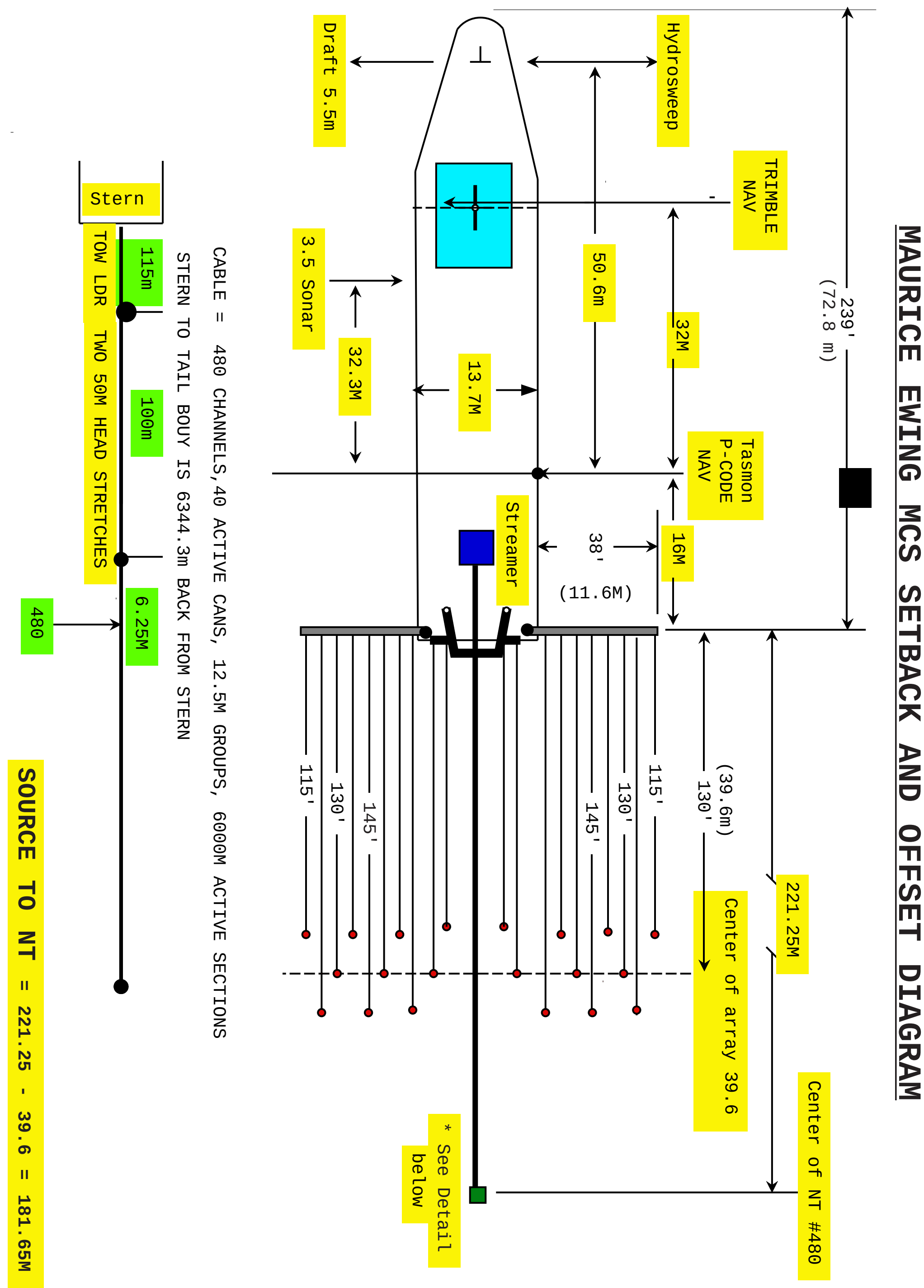
Streamer

MOD	SERIAL #	CAN#	SHIP OFFSET	CHANNELS	BIRD	COMMENTS
TB			6344.3M			TAIL BUOY AT 6345M
STIC	CABLE 25.3M		6319M TO 6344M			
1		2151				POWER MODULE 12151
HS	30120-HS	50M	6269M TO 6319M			
TS	0697-30284TS	50M	6219M TO 6269M			
AT	0498-30024	4M	6215M TO 6219M			
	0398-31433	RED	6140M TO 6215M	1 TO 3	1C	Bird aft on 31433. 6219M
2		3538				
	0298-31388	ORNG	6065M TO 6140M	4 TO 6		
	0298-31407	RED	5990M TO 6065M	7 TO 9		
3		2734			2	Bird at 5994. SRD1
	0198-31319	ORNG	5915M TO 5990M	10 TO 12		
	0198-31333	RED	5840M TO 5915M	13 TO 15		
4		2731				BIRD AT 5844M
	0298-31385	ORNG	5765M TO 5840M	16 TO 18		
	0298-31399	RED	5690M TO 5765M	19 TO 21		
5		3165			3C	COMPASS Bird at 5694M
	0298 31416	ORNG	5615M TO 5690M	22 TO 24		Ch. 2 sections. No telemetry
	0298 31361	RED	5540M TO 5615M	25 TO 27		
6		3607			23	BIRD AT 5544M
	0298-31402	ORNG	5465M TO 5540M	28 TO 30		
	0298-31337	RED	5390M TO 5465M	31 TO 33		
7		3189			4	BIRD at 5394M
	0298-31382	ORNG	5315M TO 5390M	34 TO 36		
	0298-31390	RED	5240M TO 5315M	37 TO 39		
8		3606				
	0298-31346	ORNG	5165M TO 5240M	40 TO 42		
	0298-31381	RED	5090M TO 5165M	43 TO 45		
9		3107			5C	Bird at 5094M
	0298-31391	ORNG	5015M TO 5090M	46 TO 48		
	0298-31336	RED	4940M TO 5015M	49 TO 51		
10		3395				
	0298-31384	ORNG	4865M TO 4940M	52 TO 54		
	0198-31341	RED	4790M TO 4865M	55 TO 57		
11		3599			6	Bird at 4794. SRD2
	0198-31398	ORNG	4715M TO 4790M	58 TO 60		
	0298-31387	RED	4640M TO 4715M	61 TO 63		
12		3597				
	0298-31378	ORNG	4565M TO 4640M	64 TO 66		
	0298-31369	RED	4490M TO 4565M	67 TO 69		
13		3604			7C	Bird at 4494M
	0298-31396	ORNG	4415M TO 4490M	70 TO 72		
	0198-31335	RED	4340M TO 4415M	73 TO 75		

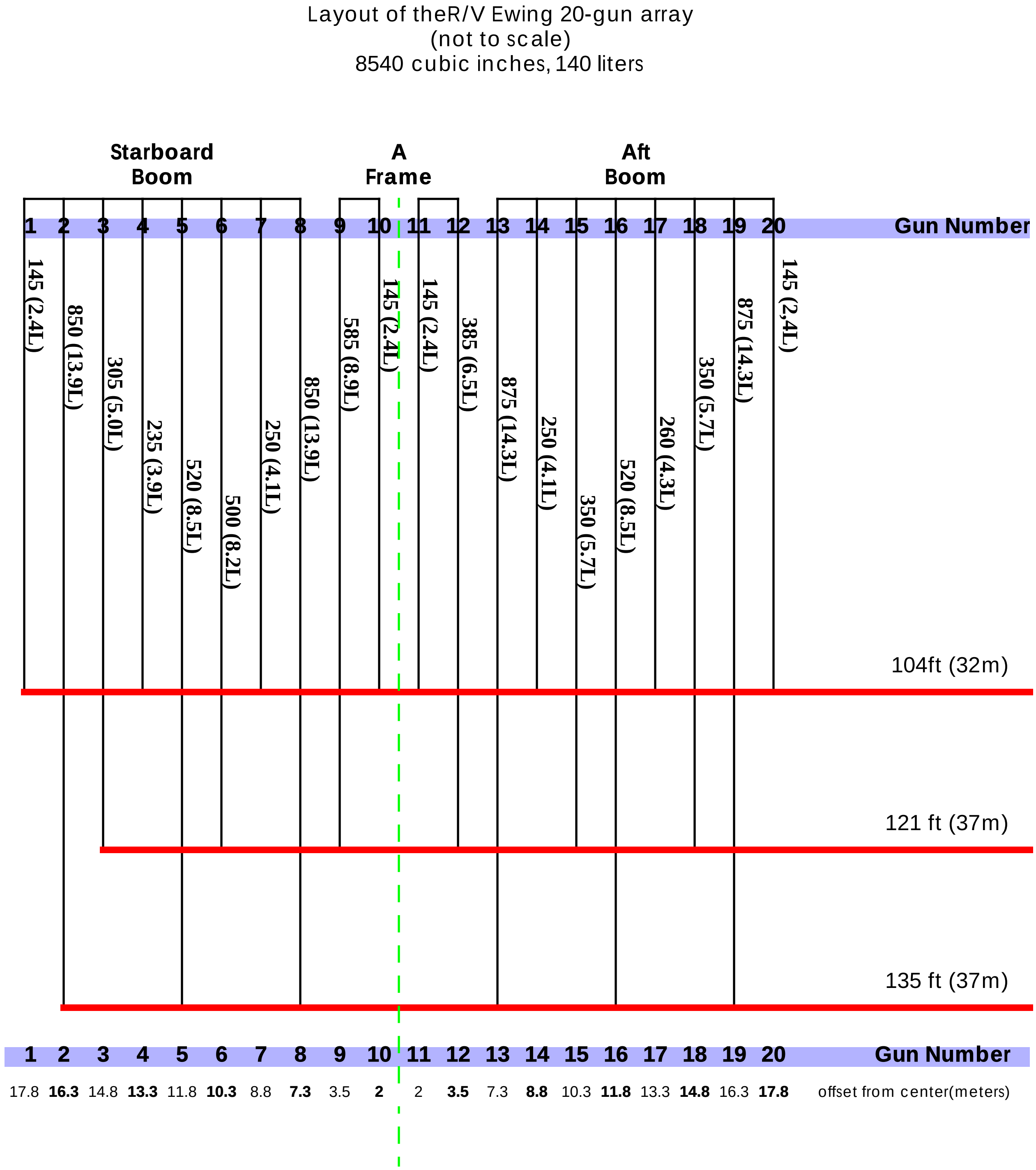
MOD	SERIAL #	CAN#	SHIP OFFSET	CHANNELS	BIRD	COMMENTS
14		2965				
	0198-31362	ORNG	4265M TO 4340M	76 TO 78		
	0298-31373	RED	4190M TO 4265M	79 TO 81		
15		2714			8	BIRD at 4194M
	0198-31334	ORNG	4115M TO 4190M	82 TO 84		
	0298-31405	RED	4040M TO 4115M	85 TO 87		
16		2757				
	0198-31348	ORNG	3965M TO 4040M	88 TO 90		
	0397-31119	RED	3890M TO 3965M	91 TO 93		
17		3031			9C	Bird at 3894M
	0198-31318	ORNG	3815M TO 3890M	94 TO 96		
	0198-31343	RED	3740M TO 3815M	97 TO 99		
18		3602				
	1296-30312	ORNG	3665M TO 3740M	100 TO 102		
	0996-30302	RED	3590M TO 3665M	103 TO 105		
19		2940			10	BIRD at 3594M
	30804	ORNG	3515M TO 3590M	106 TO 108		
	0996-30327	RED	3440M TO 3515M	109 TO 111		
20		2935				
	0197-31058	ORNG	3365M TO 3440M	112 TO 114		
	0298-31389	RED	3290M TO 3365M	115 TO 117		
21		3185			11C	Bird at 3294. SRD3
	31329	ORNG	3215M TO 3290M	118 TO 120		ch 2704. No telemetry
	0996-30279	RED	3140M TO 3215M	121 TO 123		
22		2563				
	0297-31082	ORNG	3065M TO 3140M	124 TO 126		
	1096-30330	RED	2990M TO 3065M	127 TO 129		
23		2507			12	BIRD at 2994M
	31350	ORNG	2915M TO 2990M	130 TO 132		
	31363	RED	2840M TO 2915M	133 TO 135		
24		2567				
	0996-30300	ORNG	2765M TO 2840M	136 TO 138		
	0696-31347	RED	2690M TO 2765M	139 TO 141		
25		2717			13C	Bird at 2694M
	0697-31351	ORNG	2615M TO 2690M	142 TO 144		
	31383	RED	2540M TO 2615M	145 TO 147		
26		2523				
	0996-30304	ORNG	2465M TO 2540M	148 TO 150		
	0996-30283	RED	2390M TO 2465M	151 TO 153		
27		3163			14	Bird at 2394. SRD4
	298 31372	ORNG	2315M TO 2390M	154 TO 156		
	0996-30301	RED	2240M TO 2315M	157 TO 159		
28		2511				
	1096-30332	ORNG	2165M TO 2240M	160 TO 162		
	????	RED	2090M TO 2165M	163 TO 165		
29		2570			15C	Bird at 2094M
	0597-31248	ORNG	2015M TO 2090M	166 TO 168		
	0597-31269	RED	1940M TO 2015M	169 TO 171		

MOD	SERIAL #	CAN#	SHIP OFFSET	CHANNELS	BIRD	COMMENTS
30		3172				
	0597-31268	ORNG	1865M TO 1940M	172 TO 174		
	0996-30281	RED	1790M TO 1865M	175 TO 177		
31		2505			16	BIRD at 1794M
	???	ORNG	1715M TO 1790M	178 TO 180		
	0996-30303	RED	1640M TO 1715M	181 TO 183		
32		2554				
	1096-30346	ORNG	1565M TO 1640M	184 TO 186		
	30313	RED	1490M TO 1565M	187 TO 189		
33		3182			17C	Bird at 1494M
	0696-10388	ORNG	1415M TO 1490M	190 TO 192		
	0697-31277	RED	1340M TO 1415M	193 TO 195		
34		2506				
	0696-31280	ORNG	1265M TO 1340M	196 TO 198		
	SS1-0696-10057	RED	1190M TO 1265M	199 TO 201		
35		2462			18	Bird at 1194. SRD5
	1096-30320	ORNG	1115M TO 1190M	202 TO 204		
	0996-31349	RED	1040M TO 1115M	205 TO 207		
36		2747				
	0697-31282	ORNG	965M TO 1040M	208 TO 210		
	1096-30337	RED	890M TO 965M	211 TO 213		
37		3192			19C	Bird at 894M
	SS1-0696-0140	ORNG	815M TO 890M	214 TO 216		
	31400	RED	740M TO 815M	217 TO 219		
38		3543				
	0298-31410	ORNG	665M TO 740M	220 TO 222		
	0298-31365	RED	590M TO 665M	223 TO 225		
39		2728			20	Bird at 594M
	31346	ORNG	515M TO 590M	226 TO 228		
	0298-31377	RED	440M TO 515M	229 TO 231		
40		2485			21C	BIRD AT 444
	0198-31321	ORNG	365M TO 440M	232 TO 234		
	???	RED	290M TO 365M	235 TO 237		31357 Leaks
41		2970			22	BIRD AT 294M
	0298-31360	ORNG	215M TO 290M	238 TO 240		
42	30128HS	10284	165M TO 215M	STRETCH		PASSIVE CAN 10284
	30134HS		115M TO 165M	STRETCH		
LDR	0498-30025		STERN TO 115M	LEADER		FIBER OPTIC

Gun Offsets


MAURICE EWING MCS SETBACK AND OFFSET DIAGRAM
239' (72.8 m)
Hydrosweep
TRIMBLE NAV
Draft 5.5m
50.6m
32M
3.5 Sonar
32.3M
13.7M
Tasmon P-CODE NAV
Streamer
38' (11.6M)
16M
(39.6m) 130'
115'
130'
145'
221.25M
Center of array 39.6
Center of NT #480
* See Detail below
CABLE = 480 CHANNELS,40 ACTIVE CANS, 12.5M GROUPS, 6000M ACTIVE SECTIONS
STERN TO TAIL BOUY IS 6344.3m BACK FROM STERN
Stern
115m
TOW LDR
TWO 50M HEAD STRETCHES
100m
6.25M
480
SOURCE TO NT = 221.25 - 39.6 = 181.65M

Airgun Array



GPS Processing

Navigation data is post-processed in order to accurately determine the position and remove GPS accuracy errors.

1. Format the raw NMEA data, removing any data that has a DOP greater than 4.0. If we are using differential data, remove all data of quality less than differential quality:
   2000+009:00:28:50.091 N 42 14.1536 W 063 25.5897 P-trimble
2. Interpolate and reduce data. Fixes are reduced to 30 second fixes using GMT sample1d:
   sample1d -Fl -I30
3. Further reduce to 1 minute intervals.
4. Perform dead reckoning using the smoothed Furuno speed and heading to insure the accuracy of the GPS data

Furuno Processing

Furuno speed and heading is processed by smoothing the data using a vector summing algorithm. Data is reduced and output at 60 second intervals by taking the smoothed values and calculating the mean value for the 30 seconds before and after the whole minute.

Hydrosweep Processing

Center Beam

1. Remove all survey and calibration records from the raw data and all 0 level depths
2. Reduce data to one minute intervals on 00 seconds of the minute by computing the median values from the raw values that lie between +-30 seconds of 00 seconds of the minute.
3. Merge the data with the processed navigation to end up with one minute hydrosweep centerbeam fixes with navigation.

Full Swath Processing

Hydrosweep swath data is processed using the MB-System software, and consists primarily of hand-editing the beam data. Source code and documentation for MB-System may be found at the Web site: http://www.ldeo.columbia.edu/MB-System.

Magnetics Processing

1. Data is cleaned by removing any mutant records; with raw data logged as *gammas*.

2. Raw, cleaned data is plotted for QA to *ps.mg.rxxx*
3. Raw data is de-spiked using a standard deviation filter. Due to the noisy data during this cruise, this step used a 20 point window throwing away all values with a std. deviation greater than 0.00025. This is done after throwing away any values that spiked less than 48000 or greater than 52000 gammas. This is specific to the region we were surveying. The de-spiked data is plotted to *ps.mg.cxxx*
4. The median value for each minute is output and plotted to *ps.mg.mxxx*
5. The median values are merged with navigation and the magnetic anomaly is calculated based on the IGRF 2000-2005 data and output as the *mg.nxxx*

Gravity Processing

bias	*= 852645.3;*	*Dec. 5, 1997*
scale	*= 5.0940744*	*July 9, 1992*
mGals	*= raw_gravity_count * scale + bias;*	

Each cruise, the gravity meter is tied to a local reference point. The offset between the gravity tie and the gravity meter is known as the '*dc-shift*'. The difference between the last two ***dc**-shifts* gives us a ***drift** rate*. Using the last known ***dc** shift*, as well as the last known ***drift** rate*; we continue to accumulate the drift onto the at-sea values to give an approximate gravity value at sea.

At-sea values:

dc=2.80	*drift=0.011*	*dt=2000:194:19:00:00*

1. Raw gravity is filtered using a 6 minute gaussian filter and mGals are output. The raw mGals are represented by, outputting a gravity count once every 6 seconds. This is plotted to *ps1.vt.xxx*
   ```
   mGals = gravitycount * scale + bias
   ```
2. A second filter is then applied; an 8 minute Gaussian filter using the GMT system:
   ```
   filter1D -G480 -R -E
   ```
3. The filtered output is then reduced to 1 minute intervals by using sample1d to tie the gravity values to the processed navigation. This smoothed data is plotted to *ps2.vt.xxx*
   ```
   sample1d -Nnavtimes
   ```
4. The results from step 3 are used to calculate the velocities between navigation fixes, which are smoothed using a 9-minute averaging window. The smoothed velocities are used to calculate the Eotvos correction. At this point, the drift corrections are applied and the final faa value calculated using the 1980 theoretical gravity formula.
   ```
   corrected_grv = raw_grv + eotvos_corr - drift - dc_shift
   faa = corrected_grv - theoretical_grv
   ```
5. Finally, this output is checked for spikes which are then removed (flagged as bad). This final output is plotted to *ps.vt.fxxx,* with the resultant file saved as *vt.nxxx.*
6. At the end of the cruise, a new gravity tie is taken, and a new DC shift value is calculated. Thus, a new drift rate is determined from the previous two gravity ties. At this time, all the gravity values are reprocessed using the latest known values. Of course, this assumes a constant drift rate over the cruise, but that's the best we can hope to get.

Gravity Tie

It is usual practice to have a *gravity tie* to a gravity reference base station during the port stay. A portable gravity meter: the Lacoste Model G #70, is used to make **1)** a pier-side reading; **2)** a reading at the base station; **3)** an additional pier-side reading.

The pier-side gravity value, adjusted in value to correspond to the height of the BGM gravity meter, (5.5 meters below the waste deck, aka c-deck) is compared to the real-time BGM Gravity Reading. This *real-time* reading is actually a 6 minute gaussian filtered reading.

The practice is not to adjust the BGM-3 so that its reading agrees with the pier-side gravity value, but to establish a *bgm-offset*, aka *dc-shift*, which represents a constant correction to be applied to all gravity values on the next cruise.

For example, suppose the pier-side value equaled 980274.7 mGal and the BGM reading was 980279.9, the *bgm-offset* would be 5.2 mGal. In other words, the BGM is 5.2 mGal high. This value is subtracted from observed values of gravity following the cruise as a constant correction. The “drift” of the Bell gravity meter is determined from the two in-port gravity station ties. In the pre-cruise tie the BGM might have been found to be 5.3 mGal high and during the post-cruise tie it is 8.4 mGal high. The drift during the cruise is therefore equal to 3.2 mGal (8.4 - 5.2). The amount of drift per day is then calculated and gravity data is processed with the drift values corrected for the length of the cruise.

While at sea, the drift rate from the last gravity tie is used. Once in port, the gravity values are all re-calculated based on the new in-port gravity tie.

pre-cruise

EW-0006 St. John's Newfoundland

Pier/Ship	Latitude	Longitude
	47 33.852N	52 42.306W
Wharf 11		

Reference	Latitude	Longitude
Wharf 11		

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0005	179	6/27/00	2.63	0.012	1.26
Post Cruise	EW0006	194	7/12/00	2.80	0.011	2.63
Total Days			15.00	0.17		

Time	Entry	Value	
18:40	CDeck Level BELOW Pier	0.00	
18:40	Pier 1 L&R Value	0.00	L&R
19:07	Reference L&R Value	0.00	L&R
19:39	Pier 2 L&R Value	0.00	L&R
11/1/71 0:00	Reference Gravity	980828.60	mGals
18:40	Gravity Meter Value (BGM Reading)	980846.70	mGals
	Potsdam Corrected	1	1 if corrected

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

	Difference in meters between Gravity Meter and Pier				5.50	meters
Height Cor =	Pier Height*	FAA Constant				
	5.50	0.31			1.71	mGals/min

Difference in mGals between Pier and Gravity Meter

	Pier (avg) -	Reference *	1.06 L&R/mGal		Delta L&R	
	0.00	0.00	1.06		0.00	mGals

Gravity in mGals at Pierside

	Reference + Delta mGals [+ Potsdam]				Pier Gravity	
	980828.60	0.00	13.60		980842.20	mgals

Gravity in mGals at Meter

	Pier Gravity+	Height Correction			Gravity@meter	
	980842.20	1.71			980843.91	mGals

Current Mistie

	BGM Reading-	Calculated Gravity			Current Mistie	
	980846.70	980843.91			2.80	mGals

post-cruise

EW0007 Newark, NJ

Pier/Ship	Latitude	Longitude
	40 41.866N	074 08.774W

Berth 11, Port Newark

Reference	Latitude	Longitude

Oceanography Building at Lamont; Potsdam Corrected
Used the gravity tie from 1997 as a reference to this point

	Id	Julian	Date	Mistie	Drift/Day	Prev Mistie
Pre Cruise	EW0006	194	7/12/00	2.80	0.01	2.63
Post Cruise	EW0007	230	8/12/00	3.44	0.021	2.80
Total Days			31.00	0.64		

Time	Entry	Value	
15:30	CDeck Level BELOW Pier	0.33	
	Pier 1 L&R Value	0.00	L&R
	Reference L&R Value	0.00	L&R
	Pier 2 L&R Value	0.00	L&R
4/9/97 0:00	Reference Gravity	980228.95	mGals
15:30	Gravity Meter Value (BGM Reading)	980247.80	mGals
	Potsdam Corrected	1	1 if corrected

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

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
0.00	0.00	1.06		0.00 mGals

Gravity in mGals at Pierside

Reference +	Delta mGals	[+ Potsdam]		Pier Gravity
980228.95	0.00	13.60		980242.55 mgals

Gravity in mGals at Meter

Pier Gravity+	Height Correction			Gravity@meter
980242.55	1.81			980244.36 mGals

Current Mistie

BGM Reading-	Calculated Gravity			Current Mistie
980247.80	980244.36			3.44 mGals

Raw Compass Block cb1.d

Official Shot Time	Line	Shot	GPS1 Position	
2000+009:00:01:29.572	LAU1	021144	S 19 26.4331	W 176 16.3491

GPS2 Position *Trimble*	Tailbuoy Position	Gyro	Compass# Position
S 19 26.4393 W 176 16.3198	S 19 25.2864 W 176 19.7897	107.0	C01 97.8...

No processing is performed on compass block data.

Raw Furuno Log fu.d

CPU Time Stamp	Track	Speed	Heading	Gyro
2000+009:00:01:53.091	-	4.4	140.5	148.3

Hydrosweep Center Beam merged w/ Navigation hb.n

CPU Time Stamp	Position		Depth
2000+009:09:55:00.000	N 13 6.6206	W 59 39.3908	3409.1

Hydrosweep is median filtered at 1 minute intervals, then merged with navigation at 1 minute intervals.

Magnetic Data mg.n

CPU Time Stamp	Position	Raw Value	Anomaly
200+077:00:23:00.000	N 16 11.2918 W 59 47.8258	36752.2	-166.8

Merged Data m.

CPU Time Stamp	Position		GPS	Set	Drift	Depth
2000+200:12:25:00.000	N 45 54.1583	W 42 47.1770	gp1	0.0	0.0	4662.0

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

Magnetic Anomaly is the IGRF for the given year subtracted from the recorded intensity.

The gravity drift and shift are values that have been added to the raw gravity logged to make up for drift in the meter that has been lost in accordance with a gravity check at each port stop.

Temp, salinity and conductivity are only valid when the thermosalinograph is being logged.

Navigation File n.

CPU Time Stamp	Position		Used	Set	Drift
2000+009:00:03:00.000	N 13 6.2214	W 59 37.9399	gp1	0.0	0.0

Time Shot File ts.n

Official Shot Time	Shot #	Shot Position		Line Name
2000+009:00:15:00.000	000295	N 16 11.8600	W 59 48.0157	strike1

Navblock File (processing file) nb.r

Official Shot Time	Shot Number	CPU Time Stamp	Official Shot Position	
2000+103:00:00:05.150	012016	2000+103:00:00:05.138	N 02 33.4911	W 094 16.3357

Depth	Sea Temp	Wind Speed	Wind Direction	Tailbuoy Position	Tailbuoy Distance	Tailbuoy Bearing
2444.2	27.7	2.5	52	N 02 33.8605 W 094 19.7385	6338.9	96.2

Line Name	Speed	Course
gsc-AA2	4.9	100.0

Gravity File merged with navigation vt.n

```
eotvos_corr = 7.5038 * vel_east * cos(lat) + .004154 * vel*vel
faa = corrected_grv - theoretical_grv
```

CPU Time Stamp	Position		Model	FAA	Raw
2000+009:00:15:00.000	N 16 11.8600	W 59 48.0157	1980	-175.9	978253.6

Eotvos Smooth	Drift Total	DC Shift	Raw Velocity North	Raw Velocity East	Smooth Velocity North	Smooth Velocity East
9.7	0.0	4.5	-4.350	1.282	-4.333	1.329

Raw Weather File Format wx.d

CPU Time Stamp	True Speed	True Dir	Bird 1 Wind Speed Instant	Bird 1 Wind Speed 60secAvg	Bird 1 Wind Speed 60minAvg	Bird 1 Wind Speed 60secMax
2000+175:01:49:00.288	17.5	62	19.6	21.3	24.6	29.3

Bird1 Wind Direction Current	60secAvg	60minAvg
303	302	2

Bird2 Wind Speed Instant	60secAvg	60minAvg	Max	Bird2 Wind Direction Current	60secAvg	60minAvg
0.0	0.0	0.0	0.0	0	0	0

Temperature Current	60minAvg	60minMin	60minMax
28.7	28.7	28.6	28.8

	Humidity		
Current	**60minMin**	**60minMax**	**Barometric Pressure**
69	67	75	1011.3

Bird 2 is deactivated.

True wind speed and direction are calculated based on the heading and speed of the ship.

Seismic SEG-D Header Data

The following data is included on the tape in the SEG-D Extended header. Much of it is used by Paul Henkart's **sioseis** software when converting SEG-D to SEG-Y. Our Syntrak system uses SEG-D Revision 1.0.b

Data	Description	N Bytes	Position	type
000000-999999	shot number	6	00-05	ascii
\s	space	1	06	ascii
yyyy+ddd:hh:mm:ss.mmm	Official Shot-time	21	07-27	ascii
\s	space	1	28	ascii
yyyy+ddd:hh:mm:ss.mmm	shot cpu clock tag	21	28-49	ascii
\s	space	1	50	ascii
N/S	North/South Lat.	1	51	ascii
\s	space	1	52	ascii
0-90	Latitude in degrees	2	53-54	ascii
\s	space	1	55	ascii
0.0000-60.0000	Latitude in minutes	7	56-62	ascii
\s	space	1	63	ascii
E/W	East/West Lon	1	64	ascii
\s	space	1	65	ascii
0-180	Longitude in degrees	3	66-68	ascii
\s	space	1	69	ascii
0.0000-60.0000	Longitude in minutes	7	70-76	ascii
\s	space	1	77	ascii
0.0-9999.9	Hydrosweep Center Beam Depth	6	78-83	ascii
\s	space	1	84	ascii
0.0-99.9	Sea Temperature in degrees. C	4	85-88	ascii
\s	space	1	89	ascii
0.0-99.9	Wind Speed in knots	4	90-93	ascii
\s	space	1	94	ascii
0-999	Wind Direction	3	95-97	ascii
\s	space	1	98	ascii
N/S	Tail Buoy North/South Lat.	1	99	ascii
\s	space	1	100	ascii
0-90	Tail Buoy Latitude in degrees	2	101-102	ascii
\s	space	1	103	ascii

Data	Description	N Bytes	Position	type
0.0000-60.0000	Tail Buoy Latitude in minutes	7	104-110	ascii
\s	space	1	111	ascii
E/W	Tail Buoy East/West Lon	1	112	ascii
\s	space	1	113	ascii
0-180	Tail Buoy Longitude in degrees	3	114-116	ascii
\s	space	1	117	ascii
0.0000-60.0000	Tail Buoy Longitude in minutes	7	118-124	ascii
\s	space	1	125	ascii
0.0-9999.9	distance between ship and tailbuoy	6	126-131	ascii
\s	space	1	132	ascii
0.0-360.0	bearing ship - tailbuoy	5	133-137	ascii
line name	Current line name	10	138-147	ascii
0.0-99.9	Furuno speed over water	4	148-151	ascii
\s	space	1	152	ascii
0.0-360.0	Furuno course	5	153-157	ascii
0	blanks	32	158-189	0
0-255	gun depth 1	1	190	binary
0-255	gun depth 2	1	191	binary
0-255	gun depth 3	1	192	binary
0-255	gun depth 4	1	193	binary
0-255	gun depth 5	1	194	binary
0-255	gun depth 6	1	195	binary
0-255	gun depth 7	1	196	binary
0-255	gun depth 8	1	197	binary
0-255	gun depth 9	1	198	binary
0-255	gun depth 10	1	209	binary
0-255	gun depth 11	1	200	binary
0-255	gun depth 12	1	201	binary
0-255	gun depth 13	1	202	binary
0-255	gun depth 14	1	203	binary
0-255	gun depth 15	1	204	binary
0-255	gun depth 16	1	205	binary
0-255	gun depth 17	1	206	binary
0-255	gun depth 18	1	207	binary
0-255	gun depth 19	1	208	binary
0-255	gun depth 20	1	209	binary
0-255	checksum	1	210	binary

The following bytes represent the extended navblock information (Streamer Data)

Data	Description	N Bytes	Position	Type
0 - 9999	Number of bytes in extended navblock	4	211 - 214	ascii
24 hour format: hh:mm:ss	Digicourse time	8	215 - 222	ascii
0 - 99999	Event number?	5	223 - 227	ascii

Data	Description	N Bytes	Position	Type
Compass Data				
0 - 32 (inclusive)	Number of compasses	2	228 - 229	ascii
C/c	compass status (C=good, c = bad)	1		ascii
0 -31	compass unit number	2		ascii
0 - 3599	heading (tenths of degree)	4		ascii
Depth Sensors				
0 - 63	Number of Depth Sensors	2		ascii
D/d	Depth Sensor Status	1		ascii
T/t	Temperature Sensor Status	1		ascii
0 -62	Unit number	2		ascii
0 - 6096 centimeters	Depth	4		ascii
0 - 80	Temperature (tenths of Celsius)	2		ascii
Birds				
0 - 64	Number of Birds	2		ascii
B/b	Bird Status	1		ascii
T/t	Temp status	1		ascii
0 - 63	unit number	2		ascii
0 - 6096	Depth (centimeters)	4		ascii
0 - 37	Fin Angle (tenths of degree)	2		ascii
0 - 80	Temperature (tenths of celsius)	2		ascii

Tape Contents

- *EW0007.pdf*
  this cruise report (Adobe Acrobat 3 PDF file)
- *ew0007.cdf*
  final one-minute processed data tied to navigation (NetCDF files) for LDEO MG&G database
- *ew0007.cdf_nav*
  final one-minute processed navigation (NetCDF files) for LDEO MG&G database
- *docs/*
  File Formats for all the files included on tape, hydrosweep info, etc.
- *processed/*
  final processed data tied to navigation (daily files) plus track plots.
- *scripts*
  scripts and programs useful to the science party
- *raw/*
  original logged data (daily files)
- *reduction/*
  intermediate processed data (daily files), including daily PS plots of various reduction parameters: gravity plots, magnetics plots, hydrosweep centerbeam, etc. These postscript plots can be found for each day in the directories *d**jjj**.ps/*, where ***jjj*** is the julian day.