APPENDIX 4: PRE-DEPLOYMENT OBS TESTS

In the three month period immediately prior to the cruise, a great deal of effort was made to ensure that all instruments would perform satisfactorily during the cruise. This was particularly important because a number of changes were made to the configuration of the OBS prior to the 504B experiment. The most significant change involved the data recording system. Prior to the 504B cruise, the OBS utilized a 400 Mbyte WORM optical disk drive as the data recorder. This system was exchanged for two 1.2 Gbyte hard disk drives, substantially increasing recording capacity. This upgrade was driven by the need to carry out 6-12 month duration microearthquake/teleseismic monitoring experiments. It was also hoped that the hard disks would prove more reliable than the optical recording system. An additional change consisted of replacing the lithium battery pack with an alkaline battery. Because alkaline batteries droop with time, a power regulator board was added to the recorder package. For the 504B experiment, five data channels (three geophone channels, a hydrophone channel, and a high-frequency event detect channel) would be recorded at a sample rate of 128 Hz on 13 OBS. Although the ONR OBS can nominally record 6 channels at 256 Hz, previous field experiments showed that the OBS have difficulty recording 6 channels at 128 Hz, because the microprocessor is overworked. This occurs, not because of any inherent limitation of the processor, but because the workload is distributed very unevenly with time. When this happens, the recorded data stream is corrupted. An important goal of the pre-cruise testing was to determine whether we could accurately record 5 channels at 128 Hz.

The first step was to demonstrate that the basic design of the modified OBS was successful. To do this, we placed a complete system (consisting of acquisition package, recorder package, geophone, and hydrophone) in the cold room in the OBS lab at WHOI and recorded data in the planned acquisition mode for one week. The test was set up so that both disks were exercised. Power was provided by an alkaline battery pack. The ambient temperature of 0°C simulated ocean-bottom conditions. Previous experience has demonstrated that testing under cold conditions is essential. On completion of this test, the data from both disks were read with the program "obs.c" to ensure that the data headers were in the correct location and that the time in each data header had the appropriate value. Note that this program cannot determine whether the actual data are corrupted or not. Having passed this cold room test, the prototype system was then deployed off the WHOI dock for 1-2 days and programmed to record data on both disks. The data from this test were contiguous. At this time, we concluded that we had a working design.

The next step was to test each system in the cold room. At this stage, we arbitrarily matched up the various components that make up a complete system with the intent that we would endeavor to retain these configurations for the 504B cruise (Table A4-1). Each system was programmed to record 100 Mbytes of data on each of the two disks. The OBS were powered from the mains. The recorded data was then checked to make sure that the data header locations and data header times were appropriate. Not all systems passed this test at first. Systems that failed the test were repaired and retested until they passed the test.

A series of tests was also performed to determine the internal electronic noise of each system (Table A4-2). This was done by replacing the geophone sensor with a resistor pack of equivalent impedance and recording 2 minutes of data on each geophone channel. The test was carried out at two different pre-amp. gain settings, x2 and x512. The power spectra calculated from these data, corrected for the instrument transfer function, are a frequency-domain representation of each system's internal noise. The results of these tests were disturbing in that the spectra from most of the systems showed discrete lines up to 10-

15 dB greater than the background value. These lines varied in location and magnitude when the test was repeated 1-2 weeks later, sometimes disappearing completely. The origin of these spectral lines is not understood but the noise that they represent probable originates from an external source.

On the transit from San Diego to the Hole 504B site, all 13 systems were put through another series of tests. These tests consisted of recording 100 Mbytes of data on each disk (Table A4-3). Three of the 13 systems failed this test, two because the controlling PC was rebooted during the test and one because of a bad memory card in the recorder package. Each of these three systems later passed a test in which 50 Mbytes of data were recorded on each disk (Table A4-4).

We also repeated some noise tests on the transit from San Diego. (Table A4-5). On none of the systems did we see the discrete spectral lines that we saw in the lab back in Woods Hole. This observation lends support to the notion that the noise lines are brought about by a noise source external to the OBS.

Table A4-1 Results of WHOI Cold Room 100 Mbyte Tests

Acq. S/N	Clock S/N	Rec. S/N	Geo. S/N	Hydro. Preamp. S/N	Disk 1 (Bottom) S/N	Disk 2 (Top) S/N	Test Result
13	30	26	7	9	5235073	4236193	Pass
51	17	32	13	1	5260031	4237205	Pass
23	18	2a	14	6	5247168	5235065	Pass
33	37	40	28	11	1247043	5237071	Pass
17	31	38	32	10	5246174	4265160	Pass
21	27	36	31	4	4228169	5261044	Pass
59	34	34	33	31	5246168	1247050	Pass
15	28	42	20	14	4261148	4261193	Pass
27	46	2e	24	7	5229066	4237171	Pass
19	41	3c	11	8	5234068	5242005	Pass
53	20	2c	27	5	5265056	4229213	Pass
31	51	3e	4	15	5261046	4238087	Pass
15	28	30	15	30	4243089	4234161	Pass
11	32	42	20	14	5246168	1247050	Fail

Table A4-2 OBS Configuration for WHOI Noise Tests

Acq. S/N	Clock S/N	Rec. S/N	Geo. S/N	Hydro. Preamp. S/N	Serial Cable S/N	Preamp Cable S/N	Geo. Cable S/N
13	30	26	7	9	21	2	2
51	17	32	13	1	31	5	5
23	18	2a	14	6	17	1	1
33	37	40	28	11	3	7	7
17	31	38	32	10	1	9	9
21	27	36	31	4	50	6	6
59	34	34	33	31	9	13	13
27	46	2e	24	7	11	4	4
19	41	3c	11	8	23	3	3
53	20	2c	27	5	15	10	10
31	51	3e	4	15	33	12	12
15	28	30	15	13	5	11	11
11	32	42	20	14	29	8	8

Table A4-3 Results of R/V EWING 100 Mbyte Tests

Acq. S/N	Clock S/N	Rec. S/N	Geo. S/N	Hydro. S/N	Hydro. Preamp. S/N	Serial Cable S/N	Hydro. Preamp. Cable S/N	Hydro. Cable S/N	Geo. Cable S/N	Disk 1 (Bottom) S/N	Disk 2 (Top) S/N	Test Result
13	30	26	7	GF13	9	21	2	16	2	5235073	4236193	Pass
51	17	32	13	1386	1	31	5	27	5	5260031	4237205	Pass
23	18	2a	14	G10	6	17	1	20	1	5247168	5235065	Pass
33	37	40	28	GF14	11	3	7	18	7	1247043	5237071	Pass
17	31	38	32	GF11	10	1	9	23	9	4234143	4265160	Pass
21	27	36	31	1	4	50	6	17	6	4228169	5261044	Fail[1]
59	34	34	33	GF8	31	9	13	21	13			Fail[2]
11	32	42	20	1502	14	29	8	14	8	4261148	4261193	Pass
27	46	2e	24	2	7	11	4	25	4			Fail[2]
19	28	3c	11	GF9	8	25	3	15	3	5234068	5242005	Pass
53	20	2c	27	1328	5	15	10	19	10	5265056	4229213	Pass
31	51	3e	4	GF15	15	33	12	24	12	5261046	4238087	Pass
55	29	30	15	1503	13	5	11	26	11	4243089	4234161	Pass

[1]Bad RAMBO card in recorder.
[2]Controlling PC was rebooted during test, thereby resetting the control loop to these packages.

Table A4-4 Results of R/V EWING 50 Mbyte Tests

Acq. S/N	Clock S/N	Rec. S/N	Geo. S/N	Hydro. S/N	Hydro. Preamp. S/N	Serial Cable S/N	Hydro. Preamp. Cable S/N	Hydro. Cable S/N	Geo. Cable S/N	Disk 1 (Bottom) S/N	Disk 2 (Top) S/N	Test Result
21	27	36	31	1	4	50	6	17	6	4228169	5261044	Pass
59	34	34	33	GF8	31	9	13	21	13	5246168	1247050	Pass
27	46	2e	24	2	7	11	4	25	4	5229066	4237171	Pass

Table A4-5 Electronics Configuration for R/V EWING Noise Tests

Acquisition S/N	Geophone S/N
13	13
13	9
13	9
51	13
15	16
15	9

APPENDIX 5: OBS LAUNCH AND RECOVERY PROCEDURES

OBS Deck Operations

Deck operations were carried out in a manner similar to previous cruises aboard the *Ewing*; the OBSs were deployed over the stern using the fantail articulated crane, and recovered from the forward part of the waist utilizing the small crane on A deck. Four persons plus a crane operator took part in both operations. Two people manned tag lines to control the instrument's motion, one person handled the crane hook, and the fourth handled the hooking or releasing of the OBSs and controlled the operation.

In general, there were no major problems with launching and retrieving the instruments. Launching procedure was straight forward. Instruments were hoisted into a position over the water just astern of the ship as the deployment site was approached. The articulated crane is excellent for this procedure, since the OBSs could be held over the water with little whip wire out, minimizing the instrument's motion. When the deployment position was reached, the OBSs were lowered to the sea surface, their tag lines slipped, and released to free-fall to the sea floor.

Ship handling during recoveries was excellent, usually bringing the OBSs down the starboard side of the ship within easy reach of the pick-up pole. The instruments were pulled up to deck level using a slightly inboard position of the crane boom to keep them against the ship's side. The hard hats were allowed to come just above deck level, and at this point the instruments were secured to the ship's side with the tag lines. A second pick-up hook was used to recover the sensor, which dangled approx. 2.5 Meters below the frame. Once the sensor was aboard, the frame was lifted onto the deck with the crane and secured.

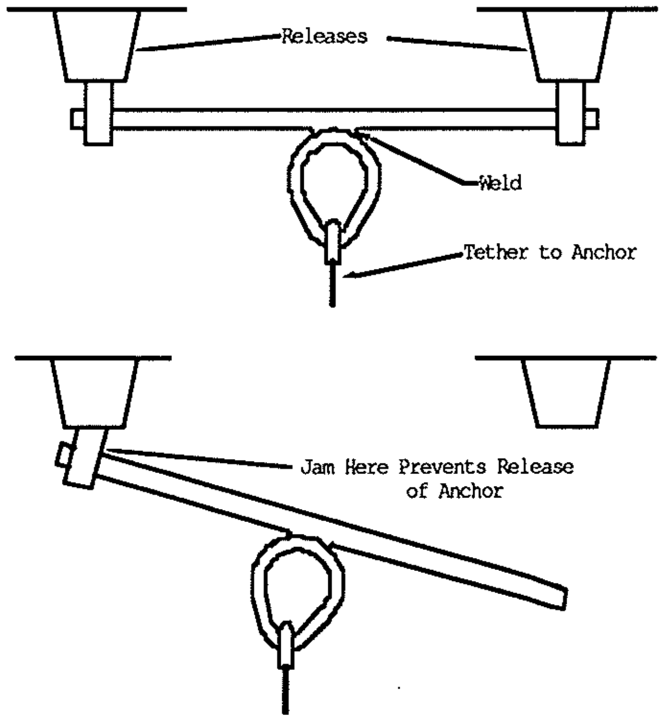
Although problems were minor, some changes should be made to the OBS frames to prevent reoccurrence:

Moving the frames around on deck with Johnson Bars, especially with anchors attached, puts a great deal of stress on the lower horizontal members. In two cases, the gussets used to attach the lower, end members failed. These gussets should be changed to a more robust design, and a diagonal brace added in order to control the torquing of the frame member which leads to failure of the gussets.

The aluminum tag line/tie down brackets are simply not up to the stress of repeated use during deployments, recoveries, and deck securing with aircraft straps. Several have broken in the past, and more failed during this cruise. They should all be replaced with stronger parts of different design or material.

Tethered Instrument

OBS #58 was deployed with a 1000 m tether between the instrument and the anchor. The tether was attached to a ring which was welded to the anchor drop bar. This design should not be used in the future since it eliminates the ability of the ring to slide off the drop bar, and makes release of the instrument dependent on the drop bar sliding out of the link on the unreleased transponder or necessitates both transponders being released. This was the experience on this cruise. The first release command was confirmed, but the instrument failed to rise until the second transponder was released.



The ring was welded to the drop bar in order to insure that it wouldn't slide to one end of the bar while deployed and cause potential release problems for that reason. A new design should assure that the ring stays centered, while allowing it the freedom to slide off the bar.

Acoustic Releases/Transponders

The EG&G Model 8242 releasing transponders continued their excellent performance during this experiment. No serious problems were experienced. Twenty-eight releases were brought on the cruise. All units were lowered to 1000 m on the hydro wire shortly after sailing, and given complete tests of all their acoustic commands. All twenty-eight responded to all their commands. Twenty-six were loaded onto the OBS frames, the other two being kept on deck as back-ups. In general, good communication was established with deployed instruments. On a few occasions, it was necessary to repeat commands, or change transducer depth. During the test deployment of OBS #55, the ship's position was changed slightly before a solid link was established. In these cases, poor communication seemed to be the result of ship noise or bad geometry, rather than any problem with the releases.

A savings in per/deployment cost was realized during this experiment by employing standard pear rings to replace the EG&G drop links in the release jaws. Since this piece of hardware is lost each time a unit is released at depth, the price difference of approximately $40.00 each is significant. Corrosion of the galvanized links wasn't a problem during the relatively short deployments on this cruise.

Two units have shown a similar problem during this experiment. Serial #14125, and Serial #14165 have both responded to disable commands with one-second timed ping sequences when they were not released. The one-second sequence is meant to indicate a unit in the released state. This problem indicates a microswitch on the release shaft is out of adjustment. In both cases the release mechanism itself responds properly to all commands, but the maladjusted switch causes wrong information to be sent. Several of the pressure housings need to be cleaned and repainted. Minor corrosion has occurred in areas in contact with sea water due to chipped or blistered paint. A peculiarity of the *Ewing* is an area directly under the aft "A" frame in which it is nearly impossible to communicate with our transponders. Frames have to be moved out of this area in order to perform pre-launch air acoustic tests.

APPENDIX 6: HOLE 504B OBS TEST DEPLOYMENT

Table A6-1 OBS Electronics Configuration for Hole 504B Test Deployment

OBS Frame S/N	Acq. S/N	Clock S/N	Rec. S/N	Geo. S/N	Hydro. S/N	Hydro. Preamp. S/N	Serial Cable S/N	Hydro. Preamp. Cable S/N	Hydro. Cable S/N	Geo. Cable S/N	Disk 1 (Bottom) S/N	Disk 2 (Top) S/N
55	51	17	32	13	1386	1	31	5	27	5	5260031	4237205

Table A6-2 OBS Frame Configuration for Hole 504B Test Deployment

OBS Frame S/N	EG&G.9 kHz Transducer S/N	EG&G 11 kHz Transducer S/N	Radio S/N	Radio Frequency (MHz)	Flasher #1 S/N	Flasher #2 S/N
55	14113	14164	18033	154.585	18078	18089

Table A6-3 Data Quality for Hole 504B Test Deployment

OBS Frame S/N	Data Recorded # Mbytes (# Blocks)	RSLI (degrees)	Comments
55	88.962 (20.094)	None 'cause deployment too shortß	All chnls. look ok

APPENDIX 7: HOLE 504B OBS DEPLOYMENT #1

Table 7A-1 Hole 504B OBS Deployment #1 Summary

OBS #	Location		Depth (m)	Deployment Time	Recovery Time
54	1° 14.071'N	83° 48.664'W	3447	2034Z 10 Nov.	0140Z 14 Nov.
60	1° 13.997'N	83° 48.107'W	3458	2201Z 10 Nov.	2339Z 13 Nov.
64	1° 13.998'N	83° 47.020'W	3458	2328Z 10 Nov.	2129Z 13 Nov.
52	1° 13.780'N	83° 45.934'W	3470	0048Z 11 Nov.	1915Z 13 Nov.
53	1° 13.764'N	83° 45.374'W	3468	0205Z 11 Nov.	1658Z 13 Nov.
61	1° 13.699'N	83° 44.847'W	3489	0324Z 11 Nov.	1455Z 13 Nov.
58*	1° 13.686'N	83° 43.808'W	3483	0530Z 11 Nov.	0235Z 18 Nov.
63	1° 13.581'N	83° 42.750'W	3477	0738Z 11 Nov.	1219Z 13 Nov.
56	1° 13.490'N	83° 42.213'W	3474	0859Z 11 Nov.	0955Z 13 Nov.
50	1° 13.462'N	83° 41.563'W	3473	1018Z 11 Nov.	0722Z 13 Nov.
57	1° 13.364'N	83° 40.621'W	3466	1141Z 11 Nov.	0513Z 13 Nov.
55	1° 13.262'N	83° 39.543'W	3430	1225Z 11 Nov.	0243Z 13 Nov.
59	1° 13.205'N	83° 39.016'W	3431	1314Z 11 Nov.	0030Z 13Nov.

* this instrument was tethered 1000 m above the bottom; the position and depth are at the location where the anchor was deployed

All instruments except OBS 58 were programmed to turn on at 2300Z on 11 November and turn off at 1900Z on 12 November. OBS 58 will turn off at 1000Z 16 November

Table A7-2 OBS Electronics Configuration for Hole 504B Deployment #1

OBS Frame S/N	Acq. S/N	Clock S/N	Rec. S/N	Geo. S/N	Hydro. S/N	Hydro. Preamp. S/N	Serial Cable S/N	Hydro. Preamp. Cable S/N	Hydro. Cable S/N	Geo. Cable S/N	Disk 1 (Bottom) S/N	Disk 2 (Top) S/N
60	13	30	26	7	GF-13	9	21	2	4	2	5234073	4236193
55	51	17	32	13	1386	1	31	5	27	5	5260031	4237205
61	23	18	2a	14	G-10	6	17	1	20	1	5247168	5235065
54	33	37	40	28	GF-14	11	3	7	18	7	1247043	5237071
52	17	31	38	32	GF-11	10	1	9	23	9	4234143	4265160
53	21	27	36	31	1	4	50	6	17	6	4228169	5261044
58	59	34	34		GF-8	31	9	13	21		5246168	1247050
56	11	32	42	20	1502	14	33	8	14	8	4261148	4261193
50	27	46	2e	24	2	7	11	4	25	4	5229066	4237171
59	15	28	3c	11	GF-7	8	25	3	15	3	5234068	5242005
57	53	20	2c	27	1328	5	15	10	19	10	5265056	4229213
63	31	51	3e	33	GF-15	15	29	12	24	12	5261046	4238087
64	55	29	30	15	1503	13	5	11	26	11	4243089	4234161

Table A7-3 OBS Frame Configuration for Deployment #1

OBS Frame S/N	EG&G 9 kHz Transducer S/N	EG&G 11 kHz Transducer S/N	Radio S/N	Radio Frequency (MHz)	Flasher #1 S/N	Flasher #2 S/N
60	14143	14148	18052	160.725	18080	18081
55	14113	14164	18033	154.585	18078	18089
61	14745	14157	18038	159.480	18094	18118
54	13653	14125	18054	160.785	18068	18121
52	14744	14160	18036	154.585	18077	18111
53	14748	14152	18048	160.725	1811?	18071
58	14118	14147	18053	160.725	18117	18123
56	14734	14127	18042	159.480	18107	18112
50	14511	14129	18060	160.785	18074	18102
59	13652	14156	18061	160.785	18063?	18090
57	14737	14153	18058	160.785	18098	18110
63	14738	14165	18046	160.725	18082	18106
64	14134	14150	18055	160.785	18065	18073

Table A7-4 Data Quality for Deployment #1

OBS Frame S/N	Mbytes Recorded # Mbytes (# Blocks)	RSLI (degrees)	Comments
54	88.962 (182,194)	~0	All chnls. look ok
60	88.962 (182,194)	~0	Chnl. 5 looks ratty
64	88.962 (182,194)	Two spots; Dark one on rim, less dark at center	Chnls. 1 & 3 poor; chnl. 2 has high frequencies (coupling ?); chnl. 4 ok
52	88.962 (182,194)	<< 15	All chnls. look ok
53	88.962 (182,194)	<< 15	Chnls. 1 and 2 have unusually high frequencies, (coupling ?); chnls. 3-5 ok
61	88.962 (182,194)	Rim	Chnls. 1 & 2 have high frequencies; chnl. 3 is poor; chnls. 4-5 ok.
58[1]		Not Applicable	
63	88.962 (182,194)	~0	All chnls. look ok
56	88.962 (182194)	~0	All chnls. look ok
50	88.962 (182,194)	~0	All chnls. look ok
57[2]	57.785 (118,343) 61.768 (126,501)	~15	All chnls. look ok.
55	88.962 (182,194)	~0	All chnls. look ok.
59	88.962 (182,195)	~15	All chnls. look ok.

[1]Source-monitoring instrument; not recovered at end of first deployment.

[2]During the debriefing, the contents of the 4 Mbyte memory in the recorder were written to disk. The LBA count in the third logical block was not updated.

APPENDIX 8: HOLE 504B OBS DEPLOYMENT #2

Table A8-1 Hole 504B OBS Deployment #2 Summary

OBS #	Location		Depth (m)	Deployment Time	Recovery Time
59	1° 08.119'N	83° 44.276'W	3412	1340Z 15 Nov.	1417Z 17 Nov.
57	1° 09.030'N	83° 44.200'W	3483	1407Z 15 Nov.	1619Z 17 Nov.
55	1° 10.491'N	83° 44.097'W	3445	1440Z 15 Nov.	1833Z 17 Nov.
63	1° 11.276'N	83° 44.091'W	3422	1509Z 15 Nov.	2037Z 17 Nov.
56	1° 12.258'N	83° 43.915'W	3481	1540Z 15 Nov.	2247Z 17 Nov.
64	1° 12.841'N	83° 43.937'W	3471	1604Z 15 Nov.	0051Z 18 Nov.
50	1° 14.742'N	83° 43.694'W	3456	1701Z 15 Nov.	0451Z 18 Nov.
52	1° 15.248'N	83° 43.631'W	3456	1722Z 15 Nov.	0707Z 18 Nov.
60	1° 15.782'N	83° 43.592'W	3464	1739Z 15 Nov.	0908Z 18 Nov.
61	1° 16.872'N	83° 43.525'W	3482	1817Z 15 Nov.	1124Z 18 Nov.
54	1° 17.817'N	83° 43.464'W	3459	1845Z 15 Nov.	1329Z 18 Nov.
53	1° 18.318'N	83° 43.389'W	3461	1916Z 15 Nov.	1538Z 18 Nov.

All instruments were programmed to turn on at 0800Z on 16 Nov. and turn off at 1200Z on 17 Nov.

Table A8-2 OBS Electronics Configuration for Deployment #2

OBS Frame S/N	Acq. S/N	Clock S/N	Rec. S/N	Geo. S/N	Hydro. S/N	Hydro. Preamp. S/N	Serial Cable S/N	Hydro. Preamp. Cable S/N	Hydro. Cable S/N	Geo. Cable S/N	Disk 1 (Bottom) S/N	Disk 2 (Top) S/N
60	13	30	26	7	GF-13	9	21	2	4	2	5234073	4236193
55	51	17	32	13	1386	1	31	5	27	5	5260031	4237205
61	23	18	2a	14	G-10	6	17	1	20	1	5247168	5235065
54	33	37	40	4	GF-14	11	3	7	18	7	1247043	5237071
52	17	31	38	32	GF-11	10	1	9	23	9	4234143	4265160
53	21	27	36	31	1	4	50	6	17	6	4228169	5261044
58	59	34	34		GF-8	31	9	13	21		5246168	1247050
56	11	32	42	20	1502	14	33	8	14	8	4261148	4261193
50	27	46	2e	24	2	7	11	4	25	4	5229066	4237171
59	15	28	3c	11	GF-7	8	25	3	15	3	5234068	5242005
57	53	20	24	27	1328	5	23	10	19	10	5265056	4229213
63	31	51	3e	33	GF-15	15	29	12	24	12	5261046	4238087
64	55	29	30	15	1503	13	5	11	26	11	4243089	4234161

Table A8-3. OBS Frame Configuration for Deployment #2

OBS Frame S/N	EG&G 9 kHz Transducer S/N	EG&G 11 kHz Transducer S/N	Radio S/N	Radio Frequency (MHz)	Flasher #1 S/N	Flasher #2 S/N
60	14143	14148	18052	160.725	18080	18081
55	14113	14164	18033	154.585	18078	18089
61	14745	14157	18038	159.480	18094	18118
54	13653	14125	18054	160.785	18068	18121
52	14744	14160	18036	154.585	18077	18111
53	14748	14152	18048	160.725	1811?	18071
58	14118	14147	18053	160.725	18117	18123
56	14734	14127	18042	159.480	18107	18112
50	14511	14129	18060	160.785	18074	18102
59	13652	14156	18061	160.785	18063?	18090
57	14737	14153	18058	160.785	18098	18110
63	14738	14165	18046	160.725	18082	18106
64	14134	14150	18055	160.785	18065	18073

Table A8-4 Data Quality for Deployment #2

OBS Frame S/N	Mbytes Recorded # Mbytes (# Blocks)	RSLI (degrees)	Comments
54	127.250 (260,607)	<< 15	All chnls. look ok
60	127.250 (260,608)	~0	Chnl. 5 noisy
64	127.376 (260,866)	~15	All chnls. ok. Missing ~9 mins. at start; ~30 mins. of junk in second half of disk
52	127.250 (260,608)	<< 15	All chnls. look ok
53	127.250 (260,608)	<< 15	Chnl. 1 is clipped at low counts (bad AGC board); Chnls. 2-5 look ok.
61	127.250 (260,608)	~0	All chnls. look ok.
58[1]	105.8 (216,679)	Not applicable	Hydrophone chnl. looks ok
63	127.250 (260,607)	~0	All chnls. look ok
56	127.250 (260,608)	~0	All chnls. look ok
50	127.250 (260,608)	~0	All chnls. look ok
57	127.250 (260,608)	<15	All chnls. look ok. Extra byte at two locations.
55	127.250 (260,608)	~0	All chnls. look ok.
59	136.952 (280,477)	<15	All chnls. look ok. Data written to both disks. Problem is at start of expt.

[1]Source-monitoring instrument, hydrophone channel only.; not recovered at end of first deployment.

APPENDIX 9: HOLE 504B OBS DEPLOYMENT #3

Table A9-1 Hole 504B OBS Deployment #3 Summary

OBS #	Location		Depth (m)	Deployment Time	Recovery Time
59	1° 09.502'N	83° 46.011'W	3470	0331Z 20 Nov.	0332Z 23 Nov.
57	1° 09.305'N	83° 44.237'W	3474	0407Z 20 Nov.	0115Z 23 Nov.
55	1° 09.007'N	83° 42.309'W	3470	0443Z 20 Nov.	2302Z 22 Nov.
64	1° 11.102'N	83° 42.155'W	3411	0518Z 20 Nov.	1023Z 23 Nov.
63	1° 11.285'N	83° 44.022'W	3410	0555Z 20 Nov.	0814Z 23 Nov.
52	1° 11.407'N	83° 45.829'W	3390	0629Z 20 Nov.	0605Z 23 Nov.
56	1° 12.391'N	83° 44.973'W	3470	0655Z 20 Nov.	1454Z 23 Nov.
50	1° 12.306'N	83° 42.888'W	3455	0734Z 20 Nov.	1235Z 23 Nov.
58	1° 12.918'N	83° 41.983'W	3475	0758Z 20 Nov.	2126Z 23 Nov.
60	1° 13.717'N	83° 43.805'W	3463	0833Z 20 Nov.	1930Z 23 Nov.
61	1° 13.242'N	83° 45.712'W	3485	0913Z 20 Nov.	1700Z 23 Nov.
54	1° 15.061'N	83° 44.826'W	3420	0945Z 20 Nov.	0144Z 24 Nov.
53	1° 14.865'N	83° 42.633'W	3439	1021Z 20 Nov.	2333Z 23 Nov.

Table A9-2 OBS Electronics Configuration for Hole 504B Deployment #3

OBS Frame S/N	Acq. S/N	Clock S/N	Rec. S/N	Geo. S/N	Hydro. S/N	Hydro. Preamp. S/N	Serial Cable S/N	Hydro. Preamp. Cable S/N	Hydro. Cable S/N	Geo. Cable S/N	Disk 1 (Bottom) S/N	Disk 2 (Top) S/N
60	13	30	26	7	GF-13	9	21	2	4	2	5234073	4236193
55	51	17	32	13	1386	1	31	5	27	5	5260031	4237205
61	23	18	2a	14	G-10	6	17	1	20	1	5247168	5235065
54	33	37	40	4	GF-14	11	3	7	18	7	1247043	5237071
52	17	31	38	32	GF-11	10	1	9	23	9	4234143	4265160
53	21	27	36	31	1	4	50	6	17	6	4228169	5261044
58	59	34	34	9	GF-8	31	9	13	21	16	5246168	1247050
56	11	32	42	20	1502	14	33	14	14	8	4261148	4261193
50	27	46	2e	24	2	7	11	4	25	4	5229066	4237171
59	15	28	3c	11	GF-7	8	25	3	15	3	5234068	5242005
57	53	20	24	27	1328	5	23	10	19	10	5265056	4229213
63	31	51	3e	33	GF-15	15	29	12	24	12	5261046	4238087
64	55	29	30	15	1503	13	5	11	26	11	4243089	4234161

Table A9-3 OBS Frame Configuration for Deployment #3

OBS Frame S/N	EG&G 9 kHz Transducer S/N	EG&G 11 kHz Transducer S/N	Radio S/N	Radio Frequency (MHz)	Flasher #1 S/N	Flasher #2 S/N
60	14143	14148	18052	160.725	18080	18081
55	14113	14164	18033	154.585	18078	18089
61	14745	14157	18038	159.480	18094	18118
54	13653	14125	18051	160.725	18068	18121
52	14744	14160	18036	154.585	18077	18111
53	14748	14152	18048	160.725	1811?	18071
58	14118	14147	18053	160.725	18117	18123
56	14734	14127	18042	159.480	18107	18112
50	14511	14129	18060	160.785	18074	18102
59	13652	14156	18061	160.785	18063?	18090
57	14737	14153	18058	160.785	18098	18110
63	14738	14165	18046	160.725	18082	18106
64	14134	14150	18055	160.785	18065	18073

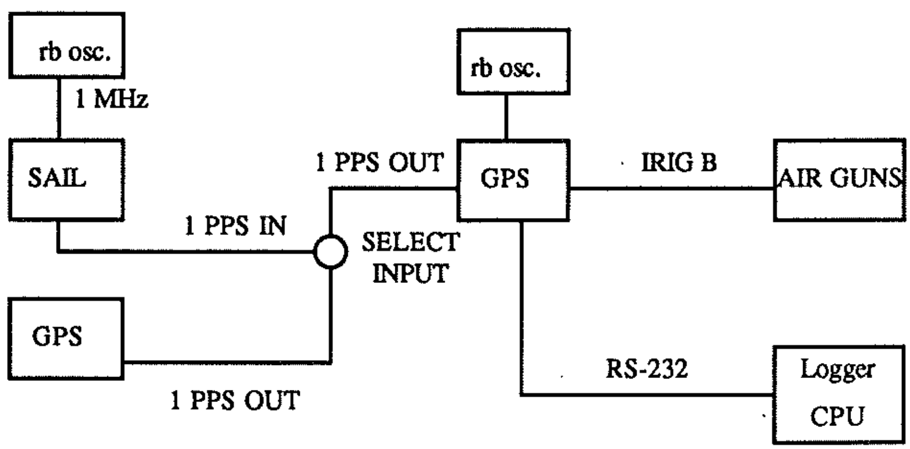
Table A9-4 Data Quality for Hole 504B Deployment #3

OBS Frame S/N	Data Recorded # Mbytes (# Blocks)	RSLI (degrees)	Comments
50	235.355 (482,007)	~5	All chnls. look ok
52	235.355 (482,008)	~5	All chnls. look ok
53	235.355 (482,008)	~0	All chnls. look ok
54	235.354 (482,006)	~0	Extra byte inserted every ~ 4 Mbytes; All chnls. look ok
55	235.355 (482,007)	~0	All chnls. look ok.
56	235.355 (482,007)	~0	All chnls. look ok
57	235.355 (482,007)	~0	All chnls. look ok. Extra byte at one location
58	235.355 (482,007)	~0	Chnl. 1 had very low counts; chnls. 2-5 look ok.
59	236.783 (484,931)	~0	All chnls. look ok. Garbage written to start of disk. Event header found; all data from that point are contiguous
60	235.355 (482,007)	~0	All chnls. look ok
61	235.355 (482,007)	~5	All chnls. look ok
63	235.355 (482,007)	~0	All chnls. look ok
64	235.355 (482,007)	~0	All chnls. look ok
59	236.783 (484,931)	~0	All chnls. look ok. Garbage written to start of disk. Event header found; all data from that point are contiguous

APPENDIX 10: CLOCKS AND CLOCK DRIFTS FOR EW 94-16

Clock Reference for Hole 504B OBS Experiment

The clock reference for this cruise consists of a TRAK 8810 GPS clock, a Seascan SAIL clock, and a rubidium oscillator. The GPS clock tracks time using signals from GPS satellites and achieves a correct UTC time to within a few nanoseconds. A one second pulse from the GPS clock is used to set the SAIL clock to correct time. The SAIL time is set to within 1 microsecond of GPS time. Once set, the SAIL clock runs from a rubidium oscillator. The SAIL clock running from the rubidium oscillator gains about 15 microseconds per day. On previous cruises, this drift was meticulously tracked and plotted and applied to the final time calculation. On this cruise, the SAIL clock was set back to GPS time before any instrument clocks were read. Thus eliminating any SAIL/GPS time error. A second GPS clock is used for the timing of the air-guns. A cable was run from the ship's GPS to the OBS GPS clock to facilitate measurement of the offset of either GPS clock to the SAIL clock, thus giving us a method of checking both GPS clocks for synchronous time.



Seascan and Bigtime Clock Tests for Hole 504B Deployments

The conventions to calculate the change in time during the deployment were established during the FARA cruises and are maintained here with one exception. The exception is that prior to each deployment and recovery the SAIL Clock was set to zero offset relative to the GPS Clock which was always acquiring at least four satelites and was always locked on. Thus the SAIL correction was always zero. To review the conventions:

First: The SAIL vs. Instrument Bigtime number. The Delta (both recovery and deployment) is formed by subtracting the Bigtime from the SAIL time.
Second: The SAIL vs. Seascan Clock time. The Delta (both recovery and deployment) is formed by subtracting the Seascan time from the SAIL time.
Third: The Total Drift during deployment is Total Delta during deployment.

Total Delta during deployment = Total recovery delta - Total Deployment Delta

Table A10-1 Seascan Clock Perfomance for Hole 504B OBS Deployment #1

OBS #		Deployment	Recovery	Bigtime Change	Seascan Change
	SAIL	315 01:13:42.981774	317 08:24:28.981164		
50	@ Bigt	784516423	784715069		
	Delta	-18.226	-18.836	-0.610	
	SAIL @	315 01:14:52.000078	317 08:25:11.999462		
	Seascan 46	315 01 14 52	317 08:25:12		
	Delta	+0.078	-0.538		-0.616
	SAIL	314 21:01:33.981246	317 19:24:08.964377		
52	@ Bigt	784501294	784754649		
	Delta	-18.754	-35.623	-16.869	
	SAIL @	314 21:02:49.999813	317 19:24:38.982945		
	Seascan 31	314 21 02 50	317 19 24 39		
	Delta	-0.187	-17.055		-16.868
	SAIL	314 21:25:28.981313	317 17:09:14.979042		
53	@ Bigt	784502729	784746555		
	Delta	-18.687	-20.958	-2.271	
	SAIL @	314 21:26:43.999874	317 17:09:44.997605		
	Seascan 27	314 21 26 44	317 17 09 45		
	Delta	-0.126	-2.395		-2.269
	SAIL	314 18:58:42.985168	318 01:53:43:.985725		
54	@ Bigt	784493923	784778024		
	Delta	-14.832	-14.275	+0.557	
	SAIL @	314 19:00:56.999785	318 01:54:15.000355		
	Seascan 37	314 19 00 57	318 01:54:15		
	Delta	-0.000215	+0.000355		+0.570
	SAIL	315 03:07:35.975749	317 02:56:35.975367		
55	@ Bigt	784523256	784695396		
	Delta	-24.251	-24.633	-0.382	
	SAIL @	315 03:08:33.990373	317 02:57:02.989992		
	Seascan 17	315 03 08 34	317 02 57 03		
	Delta	-9.627	-10.008		-0.381
	SAIL	315 03:40:12.013219	317 10:12:12.012858		
56	@ Bigt	784525212	784721532		
	Delta	+13.219	+12.858	-0.361	
	SAIL @	315 03:41:07.031477	317 10:12:51.031122		
	Seascan 32	315 03 41 07	317 10 12 51		
	Delta	+31.477	+31.112		-0.365
	SAIL	315 01:35:30.981474	317 05:23:45.981114		
57	@ Bigt	784517731	784704226		
	Delta	-18.526	-18.886	-0.360	
	SAIL @	315 01:36:41.000017	317 05:24:08.999657		
	Seascan 20	315 01 36 41	317 05 24 09		
	Delta	+0.017	-0.343		-0.360

Table A10-1 (continued) Seascan Clock Perfomance for Hole 504B OBS Deployment #1

OBS #		Deployment	Recovery	Bigtime Change	Seascan Change
	SAIL	315 00:24:46.985419	322 02:42:48.982402		
58	@ Bigt	784513487	785126569		
	Delta	-14.581	-17.598	-3.017	
	SAIL @	315 00:26:24.000050	322 02:43:12.997038		
	Seascan 34	315 00 26 24	322 02 43 13		
	Delta	+0.050	-2.962		-3.012
	SAIL	315 02:26:16.981585	317 00:52:40.982293		
59	@ Bigt	784520777	784687961		
	Delta	-18.415	-17.707	+0.708	
	SAIL @	315 02:27:16.000125	317 00:53:06.000838		
	Seascan 28	315 02 27 16	317 00 53 06		
	Delta	+0.125	+0.838		+0.713
	SAIL	314 19:32:19.981475	317 23:50:50.006974		
60	@ Bigt	784495940	784770650		
	Delta	-18.525	+6.974	25.499	
	SAIL 2	314 19:34:16.999833	317 23:51:32.994102		
	Seascan 30	314 19 34 17	317 23 51 33		
	Delta	-0.167	-5.898		-5.731
	SAIL	314 23:43:17.985422	317 15:08:38.985514		
61	@ Bigt	784510998	784739319		
	Delta	-14.578	-14.486	+0.092	
	SAIL @	314 23:44:18.000039	317 15:09:19.000130		
	Seascan 18	314 23 44 18	317 15 09 19		
	Delta	+0.039	+0.130		+0.091
	SAIL	315 04:21:31.995863	317 12:53:29.995977		
63	@ Bigt	784527692	784731210		
	Delta	-4.137	-4.023	+0.114	
	SAIL @	315 04:22:29.010487	317 12:54:01.010605		
	Seascan 51	315 04 22 29	317 12 54 01		
	Delta	+10.487	+10.605		+0.118
	SAIL	314 20:00:52.981354	317 21 43 12.982359		
64	@ Bigt	784497653	784762993		
	Delta	-18.646	-17.641	+1.007	
	SAIL @	314 20:02:01.999896	317 21:43:55.000893		
	Seascan 29	314 20 02 02	317 21 43 55		
	Delta	-0.104	+0.893		+0.997

Table A10-2 Seascan Clock Perfomance for Hole 504B OBS Deployment #2

OBS #		Deployment	Recovery	Bigtime Change	Seascan Change
	SAIL	319 13:49:52.984662	322 05:05:50.983364		
50	@ Bigt	784907393	785135151		
	Delta	-15.338	-16.636	-1.298	
	SAIL @	319 13:50:53.999052	322 05:06:41.997765		
	Seascan 46	319 13 50 54	322 05 06 42		
	Delta	-0.949	-2.235		-1.286
	SAIL	319 14:10:52.955235	322 07:19:33.938688		
52	@ Bigt	784908653	785143174		
	Delta	-44.765	-61312	-16.547	
	SAIL @	319 14:11:55.969897	322 07:19:58.953349		
	Seascan 31	319 14 11 56	322 07 19 59		
	Delta	-30.103	-46.651		-16548
	SAIL	319 15:36:37.983565	322 15:52:18.980509		
53	@ Bigt	784913798	785173939		
	Delta	-16.435	-19.491	-3.056	
	SAIL @	319 15:37:38.998218	322 15:52:42.995165		
	Seascan 27	319 15 37 39	322 15 52 43		
	Delta	-1.782	-4.835		-3.053
	SAIL	319 18:17:50.984482	322 13:40:50.984922		
54	@ Bigt	784923471	785166051		
	Delta	-15.518	-15.078	+0.440	
	SAIL @	319 18:18:42.999101	322 13:41:14.999550		
	Seascan 37	319 18 18 43	322 13 41 15		
	Delta	-0.899	-0.450		+0.449
	SAIL	319 03 17 43.969708	321 18:47:32.968906		
55	@ Bigt	784869464	785098053		
	Delta	-30.292	-31.094	-0.802	
	SAIL @	319 03 19 14.988239	321 18:47:58.987438		
	Seascan 17	319 03 19 15	321 18 47 59		
	Delta	-11.761	-12.562		-0.801
	SAIL	319 15:15:27.012492	321 22:55:57.011705		
56	@ Bigt	784912527	785112957		
	Delta	+12.492	+11.705	-0.787	
	SAIL @	319 15:16:28.030752	321 22:56:21.029968		
	Seascan 32	319 15 16 28	321 22 56 21		
	Delta	+30.752	+29.968		-0.784
	SAIL	319 03 40 04.984124	321 16:33:59.982727		
57	@ Bigt	784 870805	785090040		
	Delta	-15.876	-17.273	-1.397	
	SAIL @	319 03 41 25.998755	321 16:34:42.997366		
	Seascan 20	319 03 41 26	321 16 34 43		
	Delta	-1.245	-2.634		-1.389

Table A10-2 (continued) Seascan Clock Perfomance For Hole 504B OBS Deployment #2

OBS #		Deployment	Recovery	Bigtime Change	Seascan Change
	SAIL	319 02:48:50.981327	321 14:37:41.981641		
59	@ Bigt	784867731	785083062		
	Delta	-18.673	-18.359	+0.314	
	SAIL @	319 02:50:48.999869	321 14:38:06.000190		
	Seascan 28	319 02 50 49	321 14 38 06		
	Delta	-0.131	+0.190		+0.321
	SAIL	319 16:08:48.979285	322 09:35:18.005576		
60	@ Bigt	784915729	785151318		
	Delta	-20.715	+5.578	+26.293	
	SAIL @	319 16:09:45.993741	322 09:35:49.988791		
	Seascan 30	319 16 09 46	322 09 35 50		
	Delta	-6.259	-11.209		-4.95
	SAIL	319 14:33:44.982258	322 11:30:19.982162		
61	@ Bigt	784910025	785158220		
	Delta	-17.742	-17.838	-0.096	
	SAIL @	319 14:34:34.000776	322 11:30:50.000692		
	Seascan 18	319 14 34 34	322 11 30 50		
	Delta	+0.776	+0.692		-0.084
	SAIL	319 14:54:40.995488	321 20:47:53.995156		
63	@ Bigt	784911281	785105274		
	Delta	-4.512	-4.844	-0.332	
	SAIL @	319 14:54:34.010115	321 20:48:28.009780		
	Seascan 51	319 14 55 34	321 20 48 28		
	Delta	+10.115	+9.780		-0.335
	SAIL	319 13:17:21.981951	322 01:03:44.982466		
64	@ Bigt	784905442	785120625		
	Delta	-18.049	-17.534	+0.515	
	SAIL @	319 13:18:33.000480	322 01:04:36.001005		
	Seascan 29	319 13 18 33	322 01 04 36		
	Delta	+0.480	+1.005		+0.525

Table A10-3 Seascan Clock Perfomance for Hole 504B OBS Deployment #3

OBS #		Deployment	Recovery	Bigtime Change	Seascan Change
	SAIL	324 02:42:31.979066	327 13:01:59.977107		
# 50	@ Bigt	785299352	785595720		
	Delta	-20.934	-22.893	-1.959	
	SAIL @	324 02:43:39.997364	327 13:02:23.995410		
	Seascan 46	324 02 43 40	327 13 02 24		
	Delta	-2.636	-4.590		-1.954
	SAIL	324 02:17:08.921428	327 06:16:19.904006		
52	@ Bigt	785297829	785571380		
	Delta	-78.572	-95.994	-17.422	
	SAIL @	324 02:18:01.940000	327 06:16:50.922574		
	Seascan 31	324 02 18 02	327 06 16 51		
	Delta	-60.000	-77.426		-17.426
	SAIL	324 04:48:02.976360	327 23:40:58.972018		
53	@ Bigt	785306883	785634059		
	Delta	-23.640	-27.82	-4.180	
	SAIL @	324 04:49:18.994920	327 23:41:21.990583		
	Seascan 27	324 04 49 19	327 23 41 22		
	Delta	-5.080	-9.417		-4.337
	SAIL	324 03:56:39.979893	328 01:49:45.979232		
54	@ Bigt	785303800	785641786		
	Delta	-20.107	-20.768	-0.661	
	SAIL @	324 03:57:37.998415	328 01:50:08.997768		
	Seascan 37	324 03 57 38	328 01 50 09		
	Delta	-1.585	-2.232		-0.647
	SAIL	324 00:45:10.970959	326 23:19:02.969928		
55	@ Bigt	785292311	785546343		
	Delta	-29.041	-30.072	-1.031	
	SAIL @	324 00:46:08.985580	326 23:19:27.984556		
	Seascan 17	324 00 46 09	326 23 19 28		
	Delta	-14.420	-15.444		-1.024
	SAIL	324 01:57:42.015259	327 15:10:36.013591		
56	@ Bigt	785296662	785603436		
	Delta	+15.259	+13.591	-1.668	
	SAIL @	324 01:58:46.029617	327 15:11:02.027945		
	Seascan 32	324 01 58 46	327 15 11 02		
	Delta	+29.617	+27.945		-1.672
	SAIL	324 01:24:08.977927	327 01:28:20.975606		
57	@ Bigt	785294649	785554101		
	Delta	-22.073	-24.394	-2.321	
	SAIL @	324 01:25:03.996471	327 01:28:42.994149		
	Seascan 20	324 01 25 04	327 01 28 43		
	Delta	-3.529	-5.851		-2.322

Table A10-3 (continued) Seascan Clock Perfomance for Hole 504B OBS Deployment #3

OBS #		Deployment	Recovery	Bigtime Change	Seascan Change
	SAIL	324 07:25:15.978536	327 21:34:35.977294		
58	@ Bigt	785316316	785626476		
	Delta	-21.464	-22.706	-1.242	
	SAIL @	324 07:26:30.997068	327 21:34:58.995833		
	Seascan 34	324 07 26 31	327 21 34 59		
	Delta	-2.932	-4.167		-1.235
	SAIL	324 00:22:09.980667	327 03:42:51.980523		
59	@ Bigt	785290930	785562172		
		-19.333	-19.477	-0.144	
	SAIL @	324 00:23:20.999208	327 03:43:13.999075		
	Seascan 28	324 00 23 21	327 03 43 14		
		-0.792	-0.925		-0.133
	SAIL	324 03:17:23.969935	327 19:25:14.963121		
60	@ Bigt	785301444	785618715		
	Delta	-30.065	-37.879	-7.814	
	SAIL @	324 03:18:23.988477	327 19:25:36.981666		
	Seascan 30	324 03 18 24	327 19 25 37		
	Delta	-11.523	-13.313		-1.790
	SAIL	324 03:37:41.986687	327 17:10:20.986044		
61	@ Bigt	785302662	785610621		
	Delta	-13.313	-13.956	-0.643	
	SAIL @	324 03:38:28.001307	327 17:10:44.000663		
	Seascan 18	324 03 38 28	327 17 10 44		
	Delta	+1.307	+0.663		-0.644
	SAIL	324 01:04:52.990715	327 08:27:30.989791		
63	@ Bigt	785293493	785579251		
	Delta	-9.285	-10.209	-0.924	
	SAIL @	324 01:06:11.009244	327 08:28:01.008324		
	Seascan 51	324 01 06 11	327 08 28 01		
	Delta	+9.244	+8.324		-0.920
	SAIL	324 01:41:32.982094	327 10:32:51.982226		
64	@ Bigt	785295693	785586772		
	Delta	-17.906	-17.774	+0.132	
	SAIL @	324 01:42:23.000627	327 10:33:17.000765		
	Seascan 29	324 01 42 23	327 10 33 17		
	Delta	+0.627	+0.765		+0.138

APPENDIX 11: OBS BATTERY VOLTAGES FOR HOLE 504B EXPERIMENT

Table A11-1 Main Battery Voltages for Hole 504B OBS Deployment #1

Recorder #	Beginning of deployment #1			End of deployment #1		
	+18 V	-15 V	+28 V	+18 V	-15 V	+28 V
24						
26				16.2	-14.58	27.8
2A						
2C				16.8	-14.7	24.3
2E				16.8	-14.6	27.5
30				16.7	-14.63	27.6
32				17.0	-14.7	27.5
34						
36						
38				16.0	-14.5	27
3C				16.3	-14.5	26.7
3E				16.9	-14.59	27.4
40				16.51	-13.80	27.7
42				16.6	-13.07	27.5

Table A11-2 Main Battery Voltages for Hole 504B OBS Deployment #2

Recorder #	Beginning of deployment # 2			End of deployment # 2		
	+18 V	-15 V	+28 V	+18 V	-15 V	+28 V
24	18.48	-15.48	27.8	16.5	-14.5	27.1
26	18.87	-15.77	27.9	16.7	-14.6	27.5
2A				16.7	-14.4	27.3
2C						
2E				16.6	-14.5	27.4
30	18.82	-15.64	28.2	16.6	-14.6	27.4
32				16.6	-14.6	27.4
34				16.1	-14.5	27.0
36				16.4	-14.5	27.4
38				16.5	-14.6	27.5
3C				16.78	-14.4	26.9
3E	18.6	-15.4	27.9	16.7	-14.6	27.4
40	18.6	-15.5	27.9	16.6	-13.8	27.5
42	18.6	-15.4	27.9	16.6	-13.1	27.5

Table A11-3 Main Battery Voltages for Hole 504B OBS Deployment #3

Recorder #	Beginning of deployment # 3			End of deployment # 3		
	+18 V	-15 V	+28 V	+18 V	-15 V	+28 V
24	18.5	-15.4	27.8	16.2	-14.5	27.0
26	18.5	-15.5	27.9	16.26	-14.48	27.2
2A	18.6	-15.5	27.9	16.4	-14.4	27.3
2C						
2E	18.6	-15.5	28.0	16.2	-14.5	27.6
30	18.6	-15.4	27.9	16.7	-14.6	27.6
32	18.5	-15.5	27.7	16.4	-14.5	26.9
34	18.6	-15.5	27.8	15.9	-14.4	27.3
36				15.1	-14.3	27.2
38	18.6	-15.4	27.9	16.2	-14.4	26.2
3C	18.5	-15.4	27.9	16.27	-14.46	26.5
3E	18.6	-15.4	27.9	16.6	-14.6	27.6
40	18.6	-15.5	27.9	16.5	-13.8	27.2
42	18.6	-15.4	27.9	16.0	-12.5	27.2

Clock Battery Voltages

Batteries consisting of two sticks of twelve alkaline C cells in parallel were installed at various times beginning approximately two weeks prior to shipping and were completely installed by one week before shipping. The original voltages were measured but not recorded and averaged approximately 18.01 Volts. The battery voltages will be measured again when the instruments are returned to Woods Hole. The deployment batteries consisted of one stick of twelve C cells.

Table A11-4 Hole 504B Experiment Clock Battery Check

Acquisition No.	Clock shipping battery voltages at removal (Volts)	Clock deployment battery voltage at installation (Volts)	Clock deployment battery voltage at removal (Volts)	Clock shipping battery voltage at installation (Volts)
11	16.43	17.88	15.46	15.76
13	16.38	17.95	15.61	16.31
15	16.51	18.12	15.63	16.40
17	16.42	18.10	15.54	16.43
19	16.35	18.30	15.56	16.35
21	16.47	18.02	15.26	16.32
23	16.34	17.89	16.10	16.52
27	16.70	18.30	15.10	15.81
31	16.45	18.00	15.67	16.60
33	16.36	17.80	14.92	16.78
51	15.90	18.00	15.55	16.60
53	16.38	17.76	15.96	16.93
55	16.56	17.97	15.13	16.41
59	16.35	18.00	15.59	16.42

APPENDIX 12: HYDROPHONE PREAMP CHANGES FOR HOLE 504B EXPERIMENT

One hydrophone preamp was changed for the Hole 504B Experiment. The changed preamp was used on OBS 58 which was the tethered, mid-water instrument used for seismic source signature monitoring. The changes are outlined below.

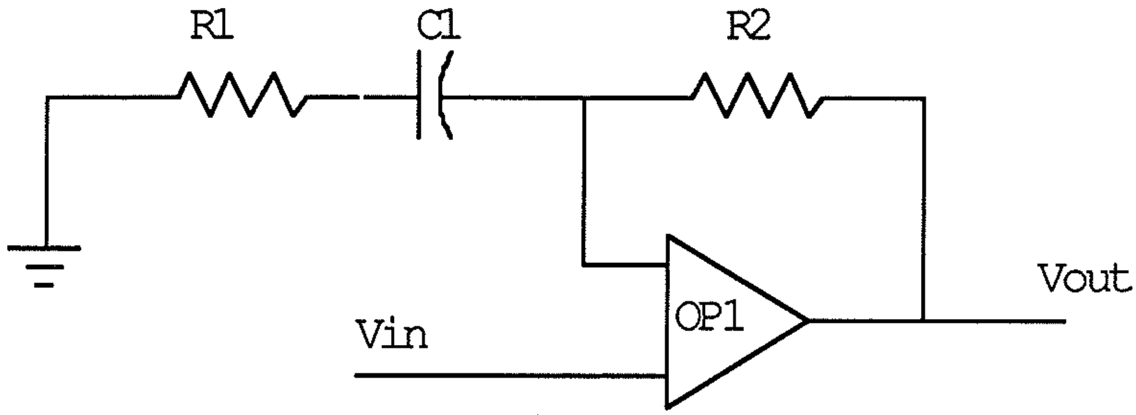


Figure 1

$$Vout = \frac{\left(R1 + R2 + \frac{1}{C1 * S}\right)}{R1 + \frac{1}{C1 * S}} * Vin$$

$$\frac{Vout}{Vin} = \frac{R1 + R2 + \frac{1}{C1 * S}}{R1 + \frac{1}{C1 * S}}$$

$$\frac{Vout}{Vin} = \frac{S * (R1 + R2) + \frac{1}{C1}}{S * R1 + \frac{1}{C1}}$$

$$\frac{Vout}{Vin} = \left(\frac{R1 + R2}{R1}\right) * \left(\frac{S + \frac{1}{(R1 + R2) * C1}}{S + \frac{1}{R1 * C1}}\right)$$

$$f_z = \frac{1}{2 * \Pi * (R1 + R2) * C1}$$

$$f_p = \frac{1}{2*\Pi*R1*C1}$$

For frequencies below f_z the gain of the amplifier is one. For frequencies above f_p the gain is $\frac{(R1+R2)}{R1}$.

The values of the circuit components before the modification are:

R1 = 10K
C1 = 10 uF
R2 = 1020K

The gain was 103

The values of the components after modification are:

R1 = 681K
C1 = 10 uF
R2 = 1020K

The gain is 2.5

Appendix 13: Summary of OBS Performance in Hole 504B Experiment

OBS 50:

OBS 50 passed the cold test, the shipboard 100 MByte Ewing test, and returned the appropriate amount of data for 504B lines 05 and 10. No flush command was at the end of the window for line 14. The clock drift for leg 04 was reasonable but seems to be erratic with a much larger drift on leg 10.

OBS 52:

OBS 52 passed the cold test, the shipboard 100 MByte Ewing test, and returned the appropriate amount of data for 504B lines 05, 10 and 14. The flush commands are problematical. The clock drift is extremely high.

OBS 53:

OBS 53 Passed the cold test but failed the 100 MByte Ewing test due to a confirmed bad Ramble Board. The Board was replaced and the OBS passed the Ewing 50 MByte test and returned the appropriate amount of data for 504B L05, L10, L14. The data in channel 1 was clipped for the L10 leg and channels 1 and 3 may be clipped in line 14 . The clock drift was larger than it should be.

OBS 54:

OBS 54 Passed the cold test but failed the 100 MByte Ewing test. The debriefing indicated the instrument had stopped collecting data part way through the second 100 Mbytes of the test. There were no error codes. The indication was that a reset had been sent to the Acquisition package. After initiating the Ewing 100 MByte test work was begun on setting up the ship board computer network. During this work the controlling computer had to be rebooted twice. The computer looses control of the OBS Loop when it is rebooted and it is felt a false reset was sent to this Acquisition during the reboot. The instrument was reprogrammed and passed the Ewing 50 MByte test as well as returning the appropriate amount of data for 504B line 05. Line L 10 was short by one LBA and the indication is that the recorder did not see the flush command after the window event. For line L 14 there is an additional byte every 45 mins. The clock drift was acceptable.

OBS 55:

OBS 54 passed the cold test, the shipboard 100 MByte Ewing test, and returned the appropriate amount of data for 504B lines 05, 10 and 14. The clock drift was marginal.

OBS 56:

OBS 56 passed the cold test, the shipboard 100 MByte Ewing test, and returned the appropriate amount of data for 504B lines 05, 10 and 14. The clock drift was erratic.

OBS 57:

OBS 57 passed the cold test, the shipboard 100 MByte Ewing test, but did not return the appropriate amount of data from 504B line 05. The data that was collected was contiguous from the beginning of the line until the data stopped. The data that was in the recorder memory was also contiguous with the data on the disk. This data was subsequently dumped to disk. The data in the acquisition memory indicated that the acquisition had acquired data up to the end of the window (this data was off loaded to a file). Therefore, it was assumed to be a serial link/ make up problem . The Par40 board and the Serial Link board in the acquisition were replaced by the boards from acq 19 and recorder 2c was replaced with recorder 24 although the disks from recorder 2c were installed in recorder 24.

The appropriate amount of data was returned from lines 10 and 14. The clock drift was erratic.

OBS 58:

OBS 58 was modified to be a single channel, hydrophone only, instrument prior to the first deployment. OBS 58 Passed the cold test but failed the 100 MByte Ewing test. The debriefing indicated the instrument had lost power shortly after beginning the test. The error codes gave a clear indication of a power cycle for this instrument. After initiating the Ewing 100 MByte test work was begun on setting up the ship board computer network. During this work the controlling computer had to be rebooted twice. The computer looses control of the OBS Loop when it is rebooted and it is felt a false power reset was sent to this instrument during the reboot. The instrument was reprogrammed and passed the Ewing 50 MByte test as well as returning the appropriate amount of data for 504B combination lines L05 and L10. The instrument was reconfigured to a five channel instrument and collected the appropriate amount of data for leg 504B L14. During the reconfiguration the hydrophone preamp gain was not changed to a gain of 100. The clock drift was acceptable.

OBS 59:

OBS 59 passed the cold test, the shipboard 100 MByte Ewing test, and returned the appropriate amount of data for line L05 but returned more than the appropriate amount of data for line L10. There were error codes for both disk 1 and disk 2 at the debriefing. The recorder had attempted to write to disk one and failed. It then attempted to write to disk 2 and failed. It continued by attempting to write to disk 1 and disk 2 until on the third attempt it wrote successfully to disk 1. It was able to continue for the rest of the line to write to disk 1. No data was lost but some additional data, which was the result of the failed attempts? or extraneous activity on the serial link?, was written to disk. Line L14 sheds additional light on this issue. During this line there were no error codes but additional bytes were written to the beginning of the disk. It would appear that the recorder is awakening prematurely and taking what ever noise is on the serial link as data and storing it away. This did not arise in the cold test or the Ewing 100 MByte test. During these tests the serial link cable is not disconnected. Possibly, for the deployment, the removal of the SAIL cable is causing a false make up to the recorder?

OBS 60:

OBS 60 passed the cold test, passed the Ewing 100 MByte test, and returned the appropriate amount of data for legs 504B L05, L10 and L14. Channel 5 looked noisy "ratty" on L05 and noisy on L10. First the obvious boards were changed, the HFD water wave board and the # 1 digital AGC board, with out success. A swap of all digital boards except the serial link board from acquisition 19 and the AtoD board made the noise go away and, it was hoped would address the dropped byte problem. The Clock drift was greater than expected and the acquisition lost 4 interrupts on each of legs L05 and L10. The acquisition lost 1 interrupt on line 14. AtoD board?

OBS 61:

OBS 61 passed the cold test, the shipboard Ewing 100 MByte test, and returned the appropriate amount of data for lines L05, L10 and L14. The clock drift was acceptable.

OBS 63:

OBS 63 passed the cold test, the 100 MByte Ewing test. And returned the appropriate amount of data from line L05. It returned one less LBA than expected in leg L10. Examination of the data showed that there was no padding with Fs at the end of the data window reducing the number of bytes dumped to disk. This implies that the recorder did not get the flush command. The recorder did flush after the calibration schedule. The clock drift was marginal

Table A13-1 Hole 504B OBS Performance Summary

OBS S/N	# Blocks Depl. 1	Clock Drift (ms)	Data	# Blocks Depl. 2	Clock Drift (ms)	Data	# Blocks Depl. 3	Clock drift (ms)	Data	Cold Room Test	100 Mbyte Test	50 Mbyte Test
50	182,194	-0.616	ok	260,608	-1.286	ok	482,007	-1.954	no flush	pass	fail	pass
52	182,194	-16.868	ok	260,608	-16.548	ok	482,008	-17.426	flush ok	pass	pass	
53	182,194	-2.269	coupl.?	260,608	-3.053	chnl. 1 clipped	482,008	-4.337	flush?	pass	fail	pass
54	182,194	+0.570	ok	260,607	+0.449	ok	482,006	-0.647	extra byte every 45 mins; no flushes	pass	fail	pass
55	182,194	-0.381	ok	260,608	-0.801	ok	482,007	-1.024	flush out of seq.	pass	pass	
56	182,194	-0.365	ok	260,608	-0.784	ok	482,007	-1.672	flush out of seq.	pass	pass	
57	118,343	-0.360	chgd. ser. & Par40	260,608	-1.389	2 extra bytes	482,007	-2.322	flush out of seq.; no flush; synch?	pass	pass	
58				216,679		ok	482,007	-1.235	flush seq. No flush	pass	fail	pass
59	182,195	+0.713	ok	280,477	+0.321	Data to 2 Disks	484931	-0.133	flush out of seq. extra bytes at start	pass	pass	
60	182,194	-5.731 missed 4 ints.	chnl. 5 Ratty	260,608	-4.95 missed 4 ints	chnl. 5 noisy	482,007	-1.790	flush out of seq.	pass	pass	
61	182,194	+0.091	coupl.?	260,608	-0.084	ok	482,007	-0.644	flush out of seq.	pass	pass	
63	182,194	+0.118	ok	260,607	-0.335	ok	482,007	-0.920	flush out of seq.	pass	pass	
64	182,194	+0.997	coupl.?	260,866	+0.525	9 min. missing; 30 min. junk	482,007	+0.138	flush out of seq.	pass	pass	

APPENDIX 14: SHIPBOARD COMPUTER FACILITIES ON EW 94-16

Hardware:

The computer facilities employed on EW94-16 included four SUN workstations, two Hewlett Packard workstations, two Hewlett Packard networked printers, one Macintosh computer and various peripheral devices supporting transcription, data reformatting, and data processing and display (see accompanying Table A14-1).

The computers were set up in the main lab (jade, alpamayo, orizaba and beavis) and in the analytical lab (lhotse, indigo, and obsmac). This physical separation corresponded to the division of tasks the systems were to perform: the analytical lab was the "transcription room", while the main lab served as the data analysis and display center. The Unix workstations and printers were linked via ethernet to the ship's "non-realtime" subnet and disk resources were shared among all workstations. In addition to the WHOI computer resources that were employed, the science party had access to certain *Ewing* computer facilities including a Power Macintosh with color scanner, networked laser printers and color plotters, and email service.

Networking:

The SUN and HP workstations were physically linked via ethernet and the standard suite of UNIX network services were available: automount, nfs (network file sharing), rlogin, RPC, ftp, email, etc. These services allow for sharing of system peripheral devices such as disks, tape drives a CD-ROM readers. The two printers were accessable from any of the UNIX workstations, using the standard "lp", "lpr" and "lprg" print commands. The PC's could not access the networked HP printers, and file printing from PC's had to be done by transferring the file to a SUN workstation via ftp, then logging in to the SUN and printing from there, a cumbersome method at best.

A common user account, "504b" was set up on the SUN workstations, and any work on the OBS data was done using this account, assuring consistent file ownership, access, and privileges, as well as establishing a common working environment.

Data Handling:

There were two main phases to the data handling: transcription and reformatting. The transcription was done using the C language program "obs_transcribe", which read the raw data from the "slotted OBS disks", performed some data quality assurance and transcription logging, and wrote the data out to exabyte tape. Two virtual copies of the disk data were transcribed for each instrument on each deployment. Subsequent to transcription, the data were reformatted using the C language program "obs2segy", which converted the raw OBS data to SEG-Y format. The SEG-Y formatted data could then be read using any standard seismic processing package, such as SIOseis, plotsegy, or SierraSeis. These SEG-Y files were then archived separately by deployment. A detailed description of the use of these programs is given below.

OBS_TRANSCRIBE

"obs_transcribe" command syntax is of the form:

obs_transcribe /dev/rsd1c /dev/rst1 2 118611 obs55_depl1.log

where:

/dev/rsd1c is the raw disk input device
/dev/rst1 is the tape output device
2 is the start Logical Block Address (LBA) to read from disk
118611 is the end LBA to read
obs55_depl1.log is the log file

While running, obs_transcribe checks the data for event and data headers, records its progress to the screen and to the log file, and notifies the user of any data inconsistencies. The program uses a 1 MByte data buffer for reads and writes for fast throughput, achieving roughly 10 Mbytes per minute data transfer rate. Reading the raw data from tape must be done using the same data buffer size, and obs_transcribe can be used, specifying the tape drive as the input device. Alternatively, the unix utility "dd" can be used, specifying an input block size of 2^^20.

OBS2SEGY

"obs2segy" command syntax is of the form:

obs2segy if=obs55_depl1.raw of=obs55_depl1.sgy tf=obs55_depl1.shots bs=0 td=3.0

where:

if=obs55_depl1.raw specifies the raw data input file
of=obs55_depl1.sgy specifies the SEG-Y output file
tf=obs55_depl1.shots contains the shot locations and times
bs=0 specifies the number of LBA's to skip into the raw data
td=3.0 designates a "deep water delay" to use before including data in the seismic trace.

"obs2segy" creates standard SEG-Y shot files, with a separate trace for each channel the OBS recorded, for each shot time given in the shottimes file. Trace headers are filled with shottime, deep water delay if specified, shot and receiver location, shot to receiver range, and receiver depth. Data trace length is specified by the user.

Recommendations

Although the computer facilities employed on EW94-16 proved adequate, and no insurmountable problems occured, some improvements are recommendated for future OBS refraction work:

- Memory upgrades for both "transcription" workstations should be made, with 32 MBytes of RAM a minimum configuration.
- PC-NFS should be employed on all PC computers, in order to facilitate data transfer, access and storage on the SUN disks, and to give the PC's access to the networked printers. On this trip, the one PC printer failed, and subsequent printing from the PC's had to be done by transferring the files from PC to SUN using ftp, then logging in to the SUN and using the standard UNIX print utility "lpr". This method, while workable, was cumbersome and time consuming, and eliminated the possibility of using PC application printer drivers.
- HP computers should have print spooling software installed, so they can spool directly to the printers. Currently, they must spool through the SUN workstations.
- Compiler licenses need to be made available on each machine on which program development will be done; licenses must be resident on each machine to ensure availability of compilers in the event of network problems. Currently, licenses are served across the net using the "flexlm" license manager.

Table A14-1: EW 94-16 Computer Resources

System/type	Function	Resources
indigo/SUN	OBS data transcription, reformatting; data QC	2 large data disk partitions (~ 2.4 GBytes) 1 Exabyte tape drive 1 two bay "garage" for obs "raw" data disks
lhotse/SUN	OBS data transcription reformatting; data QC	1 large data disk partitions (~600 MBytes) 1 Exabyte tape drive 1 two bay "garage" for obs "raw" data disks
jade/SUN	OBS data analysis & QC	3 large data disk partitions (~ 3.GBytes) 1 Exabyte tape drive
alpamayo/SUN	OBS data analysis & QC	1 large data disk partition (~ 600 MBytes) CD-ROM reader
orizaba/HP	MCS data processing OBS data display	1 large data disk partition (~ 1.4 GBytes) 1 Optical disk drive (~ 1.3 GBytes / platter) 1 Fujutsu 3480 Tape drive
beavis/HP	SCS data processing	1 large data disk partition (~ 1.0 GBytes)
pumori/HP printer	networked text and graphics printer	
k2/HP printer	networked text and graphics printer	
obsmac/Macintosh	text processing (cruise report, etc.) and data table preparation.	