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1 Instrumentation and QC System Description

System	Hardware	Description
Recording System System Controller	Syntrak 960-24 Bit Processor CPU Memory Disk Storage Input Voltage Frequency VME Link Graphics Display, High Res. Graphics Display, VGA Res.	Version 3.60B 80486DX4 32 Mbytes 1.0 Gigabyte 90-132 Vac or 180-264 Vac 47-63 Hz DSP-Controller, 55-mbps serial link Two 1280x1024 Graphic Card One 800x600 Graphic Card
Tape drives	IBM 3590 (10 Gb)	
Plotter	OYO 624 & 622	
Onboard QC	ProMAX	
Source Controller	GCS90 Processor DRAM Hard Disk	Version 4.76 Intel 486DX @ 33 MHz 32 Mb 40 Megabytes, IDE
Bird Controller	DigiSCAN Model 293 Processor DRAM Hard Disk	Version 2.72A Am5x86-P75-S @ 133 MHz 64 Mbytes 1.0Gigabyte
SAGE Gravity Data Acquisition System.	LaCoste & Romberg Gravity Meter / gyro stable platform. Hard Disk drive	
SeaSPY Marine Magnetometer	Proton Precession Marine Magnetometer Sensor	

2 Instrumentation and QC Test Start up Tests

At start of survey, a complete set of instrument tests were performed and all tests were well inside the manufacturer's specifications.

Date	DCR	CGA	HD	CMR	IR	CIO	CIE	HL	RMS	COMMENTS
01/01	OK	OK	OK	OK	OK	OK	OK	OK	OK	O.K

2.1 Daily and Monthly Tests

The daily test produced 9 files and the Monthly test 36 files.
Abbreviations used for test names in the test sequence tables:

- ✓**DCR** **DCO/Noise/Range**: Performs three tests. DC offset checks the value of the residual voltage remaining across the amplifier's output terminal when the input voltage is zero. Internal Noise Test checks the value of the internal noise level in the module with inputs grounded. Dynamic Range Test checks the ratio of the maximum to the minimum signal input power levels over which the amplifier can operate.

- ✓**CGA** **Channel Gain Accuracy** introduces a known square wave into the amplifier and compares the sampled output signal with the known input.

- ✓**HD** **Harmonic Distortion** test measures amplitude versus frequency characteristics and checks for any undesired harmonics introduced by the modules.

- ✓**CMR** **Common Mode Rejection** test provides synthesized sine waves to both inputs of the preamplifier and measures the rejection of this common signal by the amplifier. The amplitude of the sine wave is 0.8 full scale.

- ✓**IR** **Impulse Response** test measures the response of the system to the low-cut and high-cut as well as the mid-band pass.

- ✓**CIO** **Crosstalk Isolation** (Odd Channels are grounded) test measures the noise appearing in one signal path as the result of coupling from other signal paths.

- ✓**CIE** **Crosstalk Isolation** (Even Channels are grounded) – same as above.

- ✓**HL** **Hydrophone Leakage** test measures the electrical resistance in the phone.

- ✓**RMS** Checks the noise level in the streamer.

2.2 Daily Tests

Date	DCR	CGA	HD	CMR	IR	CIO	CIE	HL	RMS	COMMENTS
06/01	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K
07/01	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K
08/01	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K
10/01	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K

2.3 End of Job Test

Date	DCR	CGA	HD	CMR	IR	CIO	CIE	HL	RMS	COMMENTS
10/01	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K	O.K

2.4 Instrument Summary

The Recording instruments suffered no Technical down time during the survey.

Full System tests were carried out and recorded to tape at the start and finish of the contract. Further daily tests were carried out when the opportunity arose, to verify continued system performance. The tests showed that the Syntrak system was stable and well in specification throughout the contract.

Nominal streamer/gun offset distance was confirmed using a test shot from a single gun in the centre of the array. Distance to the centre of the first active group was near 75m. These measurements were made regularly to confirm consistent offset positioning throughout the survey.

As was previously mentioned the Recording system had no Technical Downtime. There were two occasions where the streamer displayed extraction errors for some shots while on line.

3 QC Products and Processing Sequence

3.1 General

The stand-alone proMAX system was used for QC purposes. The system was not connected on line. Therefore data for each sequence was read from the tapes. Two 3590 drives were used for this purpose. The processing sequence was followed in order to produce raw and brute stacks plots, near trace displays and RMS plots.

3.2 Raw/Brute Stacks

Raw and brute stacks were produced for each line. Paper plots of both stacks were made at the end of line.

3.3 Processing sequence for Raw Stack:

Input 1 cmp line per sail line:	*168 channels*
Data reduction	*Resampled from 2ms to 4ms; Marine Trace Decimation (2:1 trace summation)*
Edits:	*Exclude bad shots, noisy/spiking channels*
Filter:	*Single band-pass filter: Ormsby 4-8-90-120 Hz*
Gain recovery:	*Spherical divergence: 1dB/s from water bottom to 4.0 s*
Normal Move-out Correction:	*Velocities picked for each line every 4km and written to velocity database*
Pre-stack mute:	*Tied to water bottom times*
Stack:	*Mean method for trace summing*
Stack Root N scaling	*56 fold*
Bulk shift static	*9 ms*
Output:	*To disk file*
Method of scaling:	*Un-scaled*
Display:	*Paper plots: 12 cm/s, 20 traces/cm*

3.4 Processing Sequence for Brute Stack:

Input 1 cmp line per sail line:	*168 channels*
Data reduction	*Resampled from 2ms to 4ms; Marine Trace Decimation (2:1 trace summation)*
Edits:	*Exclude bad shots, noisy/spiking channels*
Filter:	*Band-pass filter:* *Ormsby 4-8-90-120 Hz*
Gain recovery:	*Spherical divergence: 1dB/sec from water bottom to 4.0 s*
Pre-stack mute:	*Pre-decon mute; Tied to water bottom times*
Minimum phase predictive deconvolution	*Operator length = 240 ms* *Operator prediction distance = 32 ms* *Deconvolution gate, tied to water bottom times*
Filter:	*Band-pass filter:* *Ormsby 4-8-90-120 Hz*
Normal Move-out Correction:	*Velocities picked for each line every 4km and written to velocity database*
Pre-stack mute:	*Post NMO mute;* *Tied to water bottom times*
Stack:	*Weighted method for trace summing, based on square root of offset*
Stack Root N scaling	*56 fold*
Bulk shift static	*9 ms*
Output:	*To disk file*
Method of scaling:	*AGC with operator of 1000ms*
Display:	*Paper plots:* 13.5 cm/s, 40 traces/cm

3.5 FK, FT and Spectral Analysis

This helped to identify noise sources and QC data. The analysis was performed in a window of 500-4000ms. Although FK and FT plots/displays were produced for a number of lines, the spectral analysis proved to be the most useful to determine the frequency range for noise and data.

3.6 RMS Analysis

3.6.1 RMS Window

RMS values from 3500ms to 4000ms of the record were calculated for every trace and each shot. These values were displayed for identification of noise sources and noisy traces. Filtered shot vs. trace RMS values were produced by applying a bandpass filter prior to the RMS calculation. Cable averaged RMS values were stored on disk for the later use.

3.6.2 Processing Sequence:

1. Data Input:	*All shots, all channels, window 3500-4000ms.*
2. Scaling:	*By 50 to convert amplitudes from millivolts to microbars.*
3. RMS analysis:	*RMS values calculated for each channel over the range of all shots.*
4. Output:	*To disk file.*
5. Band-pass Filter:	*Ormsby: 4-8-90-120 Hz*
6. Output:	*To disk file.*

3.7 Near Trace Displays, Offline Plots

Near trace data were displayed and annotated with direct arrival times.

1. Collect near traces:	*168 channels*
2. Display:	*0-4000 ms* *12.75 cm/s, 20 traces/cm.*

3.8 Attributes, Online Analysis

ProMAX was set up as an off-line system; therefore real-time data feed was not available.

4 Data Quality / Observations

4.1 Quality Control Summary

The ProMAX system proved to be extremely reliable for checking data quality. The content of all field tapes was checked for each line. Different types of noise were identified and noted in the Observer's Logs where appropriate.

- ✓Ship Noise
- ✓Spikes and noisy channels
- ✓Geological effects (water bottom multiples)
- ✓Swell Noise
- ✓Source problems (autofires, misfires, changes in gun volume)
- ✓Parities Problems

Earth Leakage