252001

AMG REFERENCE POINTS ADDED

OPERATIONS REPORT
MARINE SEISMIC SURVEY
SURVEY 40

BMR 82

for

BUREAU OF MINERAL RESOURCES
P.O. BOX 378
CANBERRA. A.C.T. 2601
CLIENT REPRESENTATIVES: J. BRANSON
D. RAMSAY

by

GEOPHYSICAL SERVICE INCORPORATED
P.O. BOX 106
NORTH RYDE. N.S.W. 2113
PARTY 2993: M/V "LADY VILMA"

RECORDING DATES: 14 MARCH, 1982 - 2 MAY, 1982.

TPR

GSI-709

OR_0250

252002

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LIST OF ILLUSTRATIONS

SECTION I

INTRODUCTION

A Marine Seismic Survey was conducted by Geophysical Service Incorporated using the M/V "Lady Vilma" in the Survey 40 area offshore Victoria for Bureau of Mineral Resources between 14 March - 2 May, 1982.

The survey consisted of 2936.362 kilometres of 48 fold and also 272.864 of 24 fold reflection coverage utilising a 3200 metre streamer under continuous tow in conjunction with a Pneumatic Acoustic Energy Source (Airguns). Operations were generally conducted 24 hours a day.

A total of 3113.597 kilometres of gravity and 3209.226 kilometres of magnometric data was also collected during this survey.

Recordings were made using one set of DFS V instruments with two 10 inch transports. Records were made on 12.7mm magnetic tape in 9 track, 1600 B.P.I. SEG B digital format (See Section II - Instruments).

The ship's location was determined by Maxiran (See Section II - Survey).

SECTION I

A. SURVEY VESSEL - M/V "Lady Vilma"

Flag	:	Australian
Homeport	:	Sydney
Trade	:	Foreign Going
Owners	:	Australian Offshore Services
Call Sign	:	VLVA
Length	:	57.9 metres L.O.A.
Breadth	:	13.2 metres
Depth	:	4.87 metres
Draft	:	4.20 metres
Official Number	:	355301
Gross Tonnage	:	1272.18
Net Tonnage	:	738.9
Main Engines	:	4 x 1095 BHP (8 Cyc. Diahatsu Diesels)
Electrical Power	:	2 x 200 KW, 415V, 50HZ, 3 Phase (Cat. D343 Main Drives)

SECTION I

B. KEY PERSONNEL

Client Representatives	:	J. Branson
		D. Ramsay
Party Managers	:	A. Welfare
		K. Webber
Vessel Controller	:	M. Otter
Instrument Engineers	:	A. Cairns
		S. Muller
		J. Jeffery
System Operators	:	D. Liddle
		T. Drew
		S. Miller
		S. Joyce
		M. Wilson
		D. Mason
		S. Gilbertson
		R. Jones
		D. Johnson
		S. Recoskie
Survey Operators	:	T. Hennessey
		C. Thiemann
Compressor Engineers	:	A. Cattle
		T. Hughes
Airgun Mechanics	:	R. Barnes
		K. Billington
		G. Stokes
		J. Vickery
		D. Trundle
		P. McCabe
		P. Gusterson
		F. Campbell
Masters	:	D. Rowett
		F. Ewell
Boat Manager	:	I. Taylor
Boat Administrator	:	C. Orr

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Survey 40 - Bass Strait - G.S.I. - Lady Vilma 14/3-2/5/82

The ship carried a sailing crew of 12:

master
1st mate
2 engineers
greaser
3 sailors
2 stewards
2 cooks

and a scientific crew of 15:

party manager
instrument engineer
8 system operators
2 survey operators (ONI personnel)
compressor engineer
5 airgun mechanics

and one or two client representatives.

Operations were in 2 shifts of 12 hours each.

Half the scientific crew were rotated every 5 weeks, giving 10 weeks duty and 5 weeks leave. Once a year the leave period was 10 weeks.

SECTION II

A. INSTRUMENTS

One Texas Instruments DFS V system consisting of two analog modules, a controller module and two 10 inch tape transports were used for this survey. Recordings were made in SEG B format (See plates 2 A, B, C.) at 1600 B.P.I.

Prior to the beginning of the survey on 10 March, 1982, a full calibration and set of instrument performance tests as recommended by Texas Instruments were performed by onboard G.S.I. personnel. These tests, recorded on both magnetic tape and paper camera records, were couriered to Perth for immediate analysis. The instrument tests included dynamic range determination, equivalent input noise, gain accuracy, harmonic distortion, crossfeed and skew. All tests met with Texas Instruments standards.

The DFS V instruments were calibrated for 96 channel, 2 m/second sampling rate with a 128 HZ @ 72 db/octave High Cut Filter and a 8 HZ @ 18 db/octave Low Cut Filter.

Instrument tests were performed each day and the results examined in analog form onboard. These tests consisted of dynamic range determination, amplifier noise, automatic gain control, pulse tests and skew checks.

Tapes recorded on each transport were frequently replayed on the other transport as a confirmation of readability.

SECTION II

A. INSTRUMENTS

All data was recorded on ½ inch, Scotch brand magnetic tape. No problems were encountered resulting from bad tapes.

On the following lines refraction data was collected. The refraction data was recorded on the DFS V auxiliary channel no. 4 using a 62HZ high cut filter and the low cut filter out. Refraction data was collected on lines 15(17), 11(8)A, 16(16), 18(11) and 11(8)B.

No problems were encountered with the DFS V instruments with constant monitoring of daily tests to ensure true calibration. High performance capabilities were maintained at all times.

SECTION II

A. INSTRUMENTS - Instrument Details

Recording System	:	DFS V, Serial Number 705
Tape Format	:	SEG B Phase Encoded, 1600 B.P.I.
Tape Speed	:	79.38 ips
No. Bytes/Data Scan	:	264
No. Words/Header (+16 from the extender header)	:	114 + 16
Channels (on tape)	:	96 seismic + 4 auxiliary Timing Word - Aux. Ch. 1 T.B. Lengthened - Aux. Ch. 2 Waterbreak - Aux. Ch. 3
Gain Control Mode	:	I.F.P.
Sample Period	:	2 m/seconds
Record Length	:	6 seconds
Recording Delay	:	Variable
Gain Constants	:	24 db
Final Gain	:	104 db
Dynamic Range	:	84 db (referred to input noise)
Filters - High Cut	:	128 HZ @ 72 db/octave
Low Cut	:	8 HZ @ 18 db/octave

SECTION II

B. ANCILLARY EQUIPMENT

SERVO PROFILER

Manufacturer	:	E.P.C. Labs.
Model	:	3210 S
Serial Number	:	355
Source	:	Trace Number 92
Record Length	:	4 seconds
Gain Mode (DFS V)	:	P.G.C.
Filters	:	Production Filters

SECTION II

B. ANCILLARY EQUIPMENT

FATHOMETER

Manufacturer	:	Simrad
Model	:	EA
Conversion Frequency	:	1478 m/sec
Transducer Position in Relation to Navigation Antenna	:	4 metres forward
Instrument Correction for Draft	:	4.5 metres
Calibrated	:	July, 1981 Port of Fremantle

The Fathometer data was collected on both analog chart and CMS navigation tape.

During some lines throughout the prospect, the sea bed depth was beyond the capabilities of the Fathometer. An approximate calculation was then taken from the Camera Monitor Records and logged.

The Fathometer gave no problems and performed well within its specifications.

SECTION II

B. ANCILLARY EQUIPMENT

CAMERA

Manufacturer	:	S.I.E.
Model	:	10C
Number of Channels	:	64
Polarity	:	G.S.I. Normal, Positive Pressure Downbreak

SECTION II

C. STREAMER

A G.S.I. manufactured 3183.5 metre (centre of group 96 to centre of group 1) streamer was utilised during this prospect. This streamer consisted of 48, 50 metre 'live' sections interspaced with 49, 16.6 metre 'extender' sections, all sections were connected together by quick coupling plugs. These groups were then connected at the instrument room patch panels to form 96, 33.3 metre 'live' groups. Each 'live' group contained 20 acceleration cancelling hydrophones connected in parallel.

Generally there were 6 nylon stretch sections located between group 96 and the vessel. These were used to attenuate the ship's generated noise. There were also 2 stretch sections connected between group 1 and the tailbuoy, these were used to attenuate tailbuoy 'jerk' noise. These stretch sections were connected to the tailbuoy by 250 metres of nylon rope.

Six depth transducers were positioned along the streamer at regular intervals. They were calibrated to the required streamer depth of 38 feet as the streamer was deployed.

Each transducer section contains a single hydrophone which is used as a waterbreak detector. Waterbreak returns from detector number six located between group 96 and the front end stretch, and waterbreak detector number five, located between groups 80 and 81 were recorded on both magnetic tape and camera records. The time measurement of the return was also recorded on the CMS tape and printer logs and was used to

SECTION II

C. STREAMER

calculate the streamer offset.

The streamer offset was also determined by the CMS streamer offset sensor. This sensor fired a single airgun located near the centre of the array between DFS records. The CMS measured the arrival time of this shot at waterbreaks five and six and used this time to calculate the streamer offset.

The streamer offset would change during the line by +/- several metres as a result of the varying sea states and currents which caused slight variations in the stretch length of the stretch sections. The average offset used during this survey was 327 metres.

The streamer depth control was maintained by proper ballasting and the use of remote control 'Cole' depth controllers. During the survey the streamer was controlled to an operating depth of 38 feet.

Tailbuoy bearings were checked and logged at regular intervals during each line.

Prior to commencement of the prospect the streamer was ballasted to stream at the correct specified recording depth. At 1200 hours on 15 March, the streamer snapped under strain at section number 44. The streamer was retrieved and re-laid by 1950 hours on 16 March. Four live sections and one stretch section were destroyed during this incident.

At 1230 hours on 18 March, while the streamer was being reeled in, the streamer became entangled in

SECTION II

C. STREAMER

the vessel's propeller. This necessitated the shut down of operations and the employment of divers to free the propellers. The streamer was retrieved and re-laid by 2300 hours on 17 April and one extender section was rendered unrepairable from the incident.

SECTION II

C. STREAMER (cont.)

STREAMER DETAILS

Length, Centre to Centre	:	3183.5 metres
Group Interval	:	33.3 metres
Live Section Length	:	50 metres
Extender Section Length	:	16.6 metres
Number of Hydrophones/ Group	:	20
Hydrophone Interval	:	1.67 metres
Hydrophone Type	:	T.I. - A.C.R.
Number of Stretch Sections - Front End	:	5
Tail End	:	4
Skin Type	:	Tropical
Location of Depth Transducers Between Groups	:	FE/96, 80/81, 60/61, 40/41 20/21, 1/2
Location of Depth Controllers	:	On All Depth Transducers
Location of Water-breaks	:	Number 6 - FE/96 Number 5 - 80/81
Near Group	:	Trace 96
Streamer Sensitivity	:	5.15 microvolts/microbars
Operating Depth	:	38 feet

SECTION II

D. ENERGY SOURCE

G.S.I. airguns fitted with Pnu-con (Pneumatic Conservation) chambers were used as the energy source during this survey. The airgun unit consists of an upper air chamber and a lower air chamber, connected by an air passage through a movable shuttle. Another air passage links the upper chamber with the underside of the upper flange of the shuttle and this air passage is controlled by a solenoid valve. Air, at a pressure of 2000 P.S.I. (13.8 MPa) enters the upper chamber through its inlet forcing the shuttle closed. The shuttle is held firmly closed because the area of its upper flange is greater than the area of its lower flange. The main volume of air passes through the channel in the shuttle into the lower chamber. To fire the airgun, a command from the airgun control unit activates the solenoid and retracts a plunger, this permits air to pass through a port hole to the underside of the lower shuttle. This neutralises the downward pressure on the shuttle leaving only the upward pressure in the lower flange from the lower air chamber to the exhaust ports. The rapid expulsion of air creates the bubble and resultant pulse.

The Pnu-con chambers save a good deal of the air in the chamber instead of releasing it all, as did standard airguns. The Pnu-con chamber was developed after a mathematical model revealed that the airgun produces maximum acoustic output long before all its air escapes. The Pnu-con gun drops from 2000 P.S.I. to about 1000 P.S.I. when fired instead of dropping all the way to 200 P.S.I. as do standard guns.

SECTION II

D. ENERGY SOURCE

The energy source used by the M/V "Lady Vilma" was a tuned airgun array of 4075 cubic inches total capacity. The array was designed for deep penetration and good resolution. This array has a broadband frequency output that extends below the normal low frequency band for seismic energy sources.

Attached, plates 5 A and B are the diagrams showing airgun utilisation, spacing and displays of the amplitude and energy spectra of the 4000 cubic inch Pnu-con gun array.

The array includes three low pressure open ended air lines each side of the array so that the depth of the array could be monitored by means of static air pressure at all times. The array was ballasted with the use of plastic buoys to ride at 21 feet, +/- 3 feet.

TIGER, the Texas Instrument automatic airgun controller, monitored the firing of each airgun in the array. Individual gun firing times were continuously controlled to give phasing within +/- one millisecond for maximum pulse amplitude and front to back ratio.

The TIGER also performed a quality control function, by indicating with individual gun L.E.D. displays, the status of a gun if it was not operating correctly, either self fire or no fire. The airgun performance was logged on both the CMS navigation tape and printer log. The TIGER operates in conjunction with the CMS II system.

SECTION II

D. ENERGY SOURCE

The airguns were maintained by G.S.I. personnel on line changes, so that throughout the survey the airgun array was up to specifications.

SECTION II

D. ENERGY SOURCE

4000 CUBIC INCH AIRGUN ARRAY

Operating Volume	:	4075 cubic inches
Total Spare Volume	:	770 cubic inches
Operating Pressure	:	1800-200 P.S.I.
Operatind Depth	:	21 feet, +/- 3 feet
Timing Control	:	TIGER
Firing Delay	:	51.2 m/seconds
Compressors	:	5 Chicago Pneumatic PB-44-300B 2 Sullair Screw Type
Setback (Distance from Maxiran Antenna to Centre of Gun)	:	63 metres
Distance from Stern to Centre of Array	:	33.5 metres

SECTION II

E. SURVEY

The prime navigation system used during the survey was Maxiran. A precise range to range system owned and operated by Offshore Navigation of Australia (O.N.A.).

The Maxiran equipment was calibrated onshore before the start of the prospect. The accuracy of the survey net was verified at sea by baseline crossings and three way fixes.

The Maxiran mobile monitor was interfaced to G.S.I.'s Configurable Marine System II (CMS II). The CMS system consisted of a Texas Instruments 980B computer, two Texas Instruments 990 computers, a system co-ordinator, Tiger airgun controller, satellite receiver, two Houston Instrument trackplotters (one each in the instrument roon and the bridge) and two digi-data, 800 B.P.I. ½ inch tape transports.

The CMS II function was survey control and navigation data recording. Shotpoint positioning was done in the 'distance' mode with the CMS II triggering the DFS V instruments and also the Tiger airgun controller unit to fire the airguns at every shotpoint interval of travel along the preplotted survey lines. Occasional changes to 'time' mode were made when the real time shotpoint became displaced with respect to the preplotted shotpoint.

The CMS II satellite navigation system was utilised as an onboard Q.C. check of the Maxiran positioning. This satellite data was record on the CMS navigation tape.

SECTION II

E. SURVEY

Navigation control was good throughout the prospect. Fixes were derived from ranges generated by the Maxiran system. Velocities were computed by the onboard VMS (Sonar) system.

O.N.A. will submit a separate navigation report.

SECTION II

E. SURVEY - Survey Details

Primary System	:	Maxiran
Type	:	Range to Range
Survey Company	:	O.N.A.
Operating Frequency	:	429 MHz
Ship's Antenna Height (above sea level)	:	23.62 metres (Stb) 25.12 metres (Port)
Antenna Location from Centre of Array	:	63 metres

BASE STATION LOCATIONS

Base 1 Everard Hill	Elev.	345
	Lat.	037 43 03.14S
	Long.	149 17 11.17E
Base 2 Seacombe	Elev.	28
	Lat.	038 07 59.47S
	Long.	147 27 51.55E
Base 3 Blackwarri	Elev.	640
	Lat.	038 24 15.07S
	Long.	146 38 49.24E
Base 4 Mt. Chapple	Elev.	550
	Lat.	038 39 49.92S
	Long.	143 27 01.07E

SECTION II

E. SURVEY

Base 5 Liptrap	Elev.	170
	Lat.	038 51 05.51S
	Long.	145 57 54.92E
Base 6 Council Hill	Elev.	86
	Lat.	039 45 59.92S
	Long.	144 03 37.88E
Base 7 Mt. Cameron West	Elev.	168
	Lat.	040 51 55.95S
	Long.	144 42 28.75E
Base 8 Mary	Elev.	131
	Lat.	039 58 30.06S
	Long.	143 55 24.48E
Base 9 Doctors Rocks	Elev.	22
	Lat.	041 01 01.50S
	Long.	145 46 54.77E
Base 10 - The Nut	Elev.	142.9
	Lat.	040 45 50.23S
	Long.	145 18 13.45E

SECTION II

F. GRAVITY

The La Coste and Romberg air sea gravimeter is essentially a spring gravimeter. Changes in the dial readings (analog gravity counter readings) are caused by changes in the elongation of the gravimeter spring induced by variations in acceleration from point to point. The differences in analog gravity are converted to units of acceleration (milligals) by multiplying the dial units change by a calibration constant. The calibration constant is determined by the manufacturer by reading the gravimeter on 'bases' where the absolute value of gravity has been previously determined (by falling body measurements, by observations of pendulum periods, or by differences in readings from previously calibrated gravimeters) and dividing the know difference in dial units to obtain a calibration factor (milligals/ dial unit).

The deduction of gravity at sea is made by making a measurement at a known location (the dock for instance), subtracting this reading from the reading at sea, multiplying the difference by the calibration factor to convert it to milligals and adding the difference in milligals algebraically to the known dock value.

A 'K check' and still gravity readings were taken before the survey commenced while the vessel was alongside the main wharf at Stoney Point and Port Lincoln. The gravity dock readings were as follows:

11 March, 1982
Stoney Point
Gravity: 10740.1
Position: 038 22.355 S
145 13.469 E

SECTION II

F. GRAVITY

4 May, 1982
Stoney Point
Gravity: 10741.5
Position: 038 22.355 S
145 13.460 E

19 May, 1982
Port Lincoln
Gravity: 10424.6
Position: 035 03 59.28 S
135 31 37.56 E

All gravity data was recorded on CMS tape at 10 second intervals and on analog strip chart recorders. Two analog strip chart recorders were utilised, one recording the acceleration forces (both along and across track) and the other recording gravity (green), spring tension (orange), cross coupling (red) and average beam position (black).

Gravity and spring tension readings along with the appropriate time (GMT) and shotpoints were logged on the stripcharts and CMS operators' logs at frequent intervals.

SECTION II

F. GRAVITY

GRAVIMETER

Manufacturer	:	La Coste & Romberg
Serial Number	:	S-48
Sample Period (onto tape)	:	10 seconds
Analog Time Marks	:	1 Minute Intervals
Analog Shotpoint Marks	:	10 Shotpoints

SECTION II

G. MAGNETICS

G.S.I. uses Proton Precession Magnetometers to make total force measurements at sea. Electrons spinning around an atomic nucleus have properties of circular electric current and each electron acts as a tiny magnet. The spin axis of the electrons around the nucleus is oriented by the ambient earth's field. If earth's ambient field is over-ridden by a strong, artifical field transverse to it, the axis will be deflected towards the artifical field. When the artifical field is removed, the electrons will precess back towards earth's ambient field. The precession frequency is $f = F/2$ where F is earth's field and 2 is the gyro-magnetic ratio. The source of protons is normally kerosene or JP-4 jet fuel, each having a high concentration of hydrogen nuclie (protons). The gyro-magnetic ratio of hydrogen is 23.4875 y/HZ.

Data was sampled every six seconds by the magnetometer and recorded onto CMS tape every ten seconds.

No analog strip chart was available for this survey but readings were logged at frequent intervals on the CMS operators' log showing shotpoint, time (GMT) and magnetometer reading during each line.

G.S.I. base magnetometer data was recorded at Toolinga, Victoria throughout the time spent on prospect.

SECTION II

G. MAGNETICS

MAGNETOMETER

Manufacturer	:	Varian
Model Number	:	V4970
Tuner Serial Number	:	909670
Distance from Stern to Sensor	:	270 metres

SECTION III

A. OPERATIONS DISCUSSION

This survey was conducted in three shooting periods, 14 - 29 March, 6 - 19 April and 27 April to 1 May, 1982. The intervals between these periods of production was caused by bad weather conditions, crew changes and the continuation of another client's survey work in the same area.

Typical Bass Strait seasonal weather conditions were experienced during this survey. Rough seas caused several delays in the shooting. Total weather downtime for the survey was 112 hours.

On 29 April the shotpoint interval was changed to 66.6 metres. This decision was made to allow the recording delay to be increased with the shooting speed maintained. The 24 fold lines recorded were 23(3)B, 24(4) and 23(3)C.

SECTION III

B. PROSPECT DETAILS

DATE	LINE	CHARGEABLE SP	CHARGEABLE KMS	COMMENTS
14 Mar	1(20)A	0776	25.867	Incomplete
	1(20)B	0113	03.767	Incomplete
	1(20)C	0618	20.600	Incomplete
	1(20)D	0229	07.633	Incomplete
	1(20)E	0997	33.233	Incomplete
15 Mar	2(19)	2290	76.333	Incomplete
16 Mar	3(18)	0577	19.234	Incomplete
17 Mar	2(19)A	2052	68.400	Complete
	4(12)	1021	34.033	Incomplete
18 Mar	5(22)	3062	102.067	Incomplete
20 Mar	6(21)	1237	41.233	Incomplete
	6(21)A	1207	40.233	Complete
21 Mar	5(22)A	1938	64.600	Complete
	7(23)	1784	59.467	Incomplete
	7(23)A	1176	39.200	Complete
23 Mar	1(20)F	0229	07.633	Incomplete
	1(20)G	2162	72.067	Complete
24 Mar	7(23)B	1712	57.067	Incomplete
	7(23)C	0523	17.433	Complete
	4(12)A	2575	85.833	Incomplete
25 Mar	4(12)C	0995	33.167	Incomplete
	4(12)D	3166	105.533	Complete
	8(12)	1544	51.467	Complete
26 Mar	9(15)	1375	45.833	Incomplete
	9(15)A	3113	103.767	Complete
27 Mar	10(9)	3828	127.600	Complete
28 Mar	11(8)	3321	110.700	Complete
	12(7)A	2551	85.033	Complete
	13(6)	1903	63.433	Incomplete
29 Mar	13(6)A	0335	11.167	Complete

SECTION III

B. PROSPECT DETAILS

DATE	LINE	CHARGEABLE SP	CHARGEABLE KMS	COMMENTS
29 Mar	14(1)A	0916	30.533	Incomplete
6 Apr	15(17)	1183	39.433	Incomplete
7 Apr	15(17)A	0825	27.500	Complete
8 Apr	11(8)A	3805	126.833	Incomplete
9 Apr	16(16)	4000	133.333	Complete
10 Apr	17(10)	3066	102.200	Complete
	18(11)	4440	148.000	Complete
11 Apr	19(13)	0793	26.433	Incomplete
	19(13)A	2526	84.200	Complete
12 Apr	16(16)A	1338	44.600	Complete
	11(8)B	2677	89.233	Incomplete
	11(8)C	0790	26.333	Complete
13 Apr	20(14)	3397	113.233	Incomplete
	20(14)A	1386	46.200	Complete
27 Apr	14(1)B	1976	65.867	Complete
28 Apr	22(2)	3021	100.699	Complete
29 Apr	23(3)B*	1551	103.399	Incomplete
30 Apr	24(4)*	2020	134.666	Complete
	21(5)A	3543	118.099	Complete
1 May	23(3)C*	0522	34.799	Complete

Note: Lines 23(3)B, 24(4) and 23(3)C were shot with 66.6 metre intervals at client's direction.

SECTION III

C. STATISTICS

First Recording Day	:	14 March, 1982
Last Recording Day	:	2 May, 1982
Number of Kilometres	:	3209.226
Number of Lines	:	50
Number of Shotpoints	:	92184
Total Number of Tapes Used	:	1962
Seismic Data Shipped To	:	Australian Archives
Navigation Data Shipped To	:	G.S.I. Dallas

SECTION III

D. PERMITTING

The Marine Operations Centre, Canberra was advised as to the ship's location throughout the survey to enable the necessary navigation warnings to be issued.

SECTION III

E. FIELD TAPE LOG INVENTORY

DATE	TAPE NO.	LINE NO.	SHOTPOINTS
14 MAR 82	636282	DO NOT PROCESS	
	636283		
	636284	1-(20)A	001-054
	636285		055-109
	636286		110-164
	636287		110-164
	636288		220-273
	636289		274-328
	636290		329-383
	636291		384-438
	636292		439-493
	636293		494-548
	636294		549-595
	636295		597-650
	636296		651-705
	636297		706-760
	636298		761-776
	636299	1-(20)B	715-768
	636300		769-823
	636301		824-882
	636302		885-926
	636303	1-(20)C	829-883
	636304		884-938
	636305		9390-993
	636306		994-1048
	636307		1049-1104
	636308		1108-1162
	636309		1163-1218
	636310		1219-1273
	636311		1274-1329

14 MAR	636312	1-(20)C	1330-1384
	636313		1385-1439
	636314		1440-1494
	636315		1495-1508
	636316	1-(20)D	1448-1501
	636317		1502-1556
	636318		1557-1611
	636319		1612-1667
	636320		1668-1722
	636321		1723-1737
	636322	1-(20)E	1677-1730
	636323		1731-1785
	636324		1786-1839
	636325		1840-1894
	636326		1895-1949
	636327		1950-2004
	636328		2007-2061
	636329		2062-2916
	636330		2117-2171
	636331		2172-2225
	636332		2226-2280
	636333		2281-2336
	636334		2337-2391
	636335		2392-2446
	636336		2447-2501
	636337		2502-2556
	636338		2557-2611
	636339		2612-2666
	636340		2667-2719
	636341		2720-2773

14 MAR	636342	DO NOT PROCESS	
15 MAR	636343	2(19)	2053-2106
	636344		2107-2161
	636345		2162-2216
	636346		2217-2271
	636347		2272-2327
	636348		2328-2382
	636349		2383-2438
	636350		2439-2493
	636351		2494-2548
	636352		2549-2603
	636353		2604-2659
	636354		2660-2714
	636355		2715-2769
	636356		2774-2828
	636357		2829-2884
	636358		2885-2939
	636359		2940-2994
	636360		2995-3049
	636361		3050-3104
	636362		3105-3159
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16 MAR	636385	3(18)	001-053
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17 MAR	636394		496-550
	636395		551-577
	636396	2(19)A	001-053
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	636460		275-329
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18 MAR	636462	5(22)	385-439
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20 MAR	636522	6(21)	604-658
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	636530		1046-1099
	636531		1100-1152
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	636534		1261-1261
	636535	6(21)A	1177-1228
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	636537		1283-1336
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	636560		2433-2444
	636561	5(22)A	3108-3158
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	636581		4182-4234

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21 MAR	636612	7(23)	2882-2934
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	636615		3042-3095
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21 MAR	636642	7(23)A	4313-4361
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23 MAR	636702	1(20)6	4991-5045
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	636730		844-790
	636731		789-735

24 MAR	636732	7(23)B	734-680
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	636736		514-467
	636737	7(23)C	564-511
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	636739		455-401
	636740		400-346
	636741		345-291
	636742		290-235
	636743		234-179
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	636745		123-069
	636746		068-014
	636747		013-9982
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24 MAR	636762	4(12)A	1730-1784
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	636804		3743-3797
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	636808		3963-4017
	636809		4018-4072
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25 MAR	636852	4(12)D	62886-6340
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	636876		7606-7660
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25 MARCH	636882	8(12)	218-272
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	636893		823-877
	636894		878-932
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	636906		1514-1545
26 MAR	636907	9(15)	001-052
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26 MAR	636912	9(15)	273-327
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	636941		1754-1808

26 MAR	636942	9(15)A	1809-1863
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26 MAR	636972	9(15)A	3396-3450
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27 MAR	636992	10(9)	001-052
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	636995		163-217
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	637001		493-547

27 MAR	637002	10(9)	548-602
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	637005		713-767
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	637007		823-877
	637008		878-933
	637009		934-988
	637010		989-1043
	637011		1044-1098
	637012		1099-1153
	637013		1154-1208
	637014		1209-1263
	637015		1264-1318
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	637031		2144-2198

27 MAR	637032	10(9)	2199-2253
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	637042		2749-2803
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	637052	10(9)	3299-3253
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	637061		3743-3797

27 MAR	637062	10(9)	3798-3828
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	637078		8036-8090
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	637082		8256-8310
	637083		8311-8365
	637084		8366-8420
	637085		8421-8475
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	637087		8531-8585
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	637090		8696-8750
	637091		8751-8805

27 MAR	637092	11(8)	8806-8860
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	637099		9191-9245
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	637102		9356-9410
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	637104		9466-9520
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	637107		9631-9685
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	637109		9741-9795
	637110		9796-9850
	637111		9851-9905
28 MAR	637112		9906-9960
	637113		9961-0015
	637114		0016-0070
	637115		0071-0125
	637116		0126-0180
	637117		0181-0235
	637118		0236-0290
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	637121		0401-0455

28 MAR	637122	11(8)	0456-0510
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	637133		388-442
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	637135		498-552
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	637138		663-716
	637139		DO NOT PROCESS
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	637146		1049-1103
	637147		1104-1158
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	637150		1269-1323
	637151		1324-1378

28 MAR	637152	12(7)A	1379-1433
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	637161		1874-1928
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	637163		1984-2038
	637164		2039-2093
	637165		2094-2148
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	637167		2204-2258
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	637169		2314-2368
	637170		2369-2423
	637171		2424-2478
	637172	12(7)A	2479-2533
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	637176		108-162
	637177		163-217
	637178		218-272
	637179		273-327
	637180		328-382
	637181		383-437

28 MAR	637182	12(7)A	438-492
	637183		493-547
	637184		548-602
	637185		603-657
	637186		658-712
	637187		713-767
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	637207		1813-1867
	637208		1868-1922
	637209		1923-1977
	637210		1978-203
	637211		2033-2079


29 MAR	637212	13(6)A	1844-1895
	637213		1896-1950
	637214		1951-2005
	637215		2006-2060
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	637220	14(1)	DO NOT PROCESS
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	637224		164-218
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	637226		274-328
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	637228		384-438
	637229		439-493
	637230		494-548
	637231		549-603
	637232	14(1)A	604-658
	637233		659-713
	637234		714-768
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	637239		989-1010

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6 APR	637351	15(17)	001-054
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	637356		275-329
	637357		330-384
	637358		385-439
	637359		440-494
	637360		495-549
	637361		550-604
	637362		605-660
	637363		661-715
	637364		716-771
	637365		772-827
	637366		828-882
	637367		883-938
	637368		939-994
	637369		995-1049
	637370		1050-1104
	637371		1105-1159
	637372		1160-1214
	637373		1215-1243
	637374	15(18)A	1124-1175
	637375		1176-1231
	637376		1232-1286
	637377		1287-1342
	637378		1343-1397
	637379		1398-1453
	637380		1454-1508

7 APRIL	637381	15(17)A	1509-1564
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	637383		1621-1676
	637384		1677-1732
	637385		1733-1788
	637386		1789-1844
	637387		1845-1900
	637388		1901-1955
	637389		1956-2008
8 APR	637390	11(8)A	7213-7161
	637391		7160-7106
	637392		7105-7051
	637393		7050-6995
	637394		6994-6939
	637395		6938-6883
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	637398		6770-6715
	637399		6714-6659
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	637401		6602-6548
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	637404		6436-6381
	637405		6380-6326
	637406		6325-6271
	637407		6270-6216
	637408		6215-6161
	637409		6160-6106
	637410		6105-6051

8 APRIL	637411	11(8)A	6050-5996
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	637433		4831-4776
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8 APR	637441	11(8)A	4384-4329
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	637453		3716-3661
	637454		3660-3605
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9 APR	637459	16(16)	1339-1391
	637460		1392-1447
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	637462		1504-1559
	637463		1560-1615
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	637469		1894-1949
	637470		1950-2005

9 APR 82	637471	16(16)	2006-2061
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	637488		2953-3008
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	637495		3344-3399
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	637499		3568-3623
	637500		3624-3678

9 APR	637501	16(16)	3679-3734
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	637504		3846-3901
	637505		3902-3957
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	637528		5187-5242
	637529		5243-5299
	637530		5300-5338

9 APR	637531	17(10)	001-053
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	637534		166-220
	637535		221-276
	637536		277-332
	637537		333-388
	637538		389-444
	637539		445-500
	637540		501-556
10 APR	637541		557-612
	637542		613-668
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	637544		725-780
	637545		781-836
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	637547		893-948
	637548		949-1004
	637549		1005-1060
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10 APR	637561	17(10)	1675-1730
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	637589		166-221
	637590		222-277

10 APR	637591	18(11)	278-333
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	637594		446-501
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	637598		670-725
	637599		726-781
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	637619		1846-1901
	637620		1902-1956

10 APR	637621	18(11)	1957-2011
	637622		2012-2066
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	637646		3343-3398
	637647		3399-3454
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	637650		3566-3621

10 APRIL	637651	18(11)	3622-3677
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	637653		3733-3788
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	637660		4126-4181
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	637662		4238-4293
	637663		4294-4349
	637664		4350-4405
	637665		4406-4440
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	637669		166-221
	637670		222-277
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	637672		334-389
	637673		390-445
	637674		446-501
	637675		502-556
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	637679		725-780
	637680		781-794

11 APR	637681	19(13)A	1734-786
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11 APR	637711	19(13)A	2402-2457
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	637726		3242-3297
	637727		3298-3319
	637728	16(16)A	001-053
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	637731		166-221
	637732		222-277
12 APR	637733		278-333
	637734		334-389
	637735		390- 445
	637736		449-504
	637737		505-560
	637738		561-616
	637739		618-672
	637740		673-728

12 APR	637741	16(16)A	729-783
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12 APR	637771	11(8)B	2528-2474
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	637791		1410-1355
	637792		1354-1299
	637793		1298-1243
	637794		1242-1187
	637795		1186-1131
	637796		1130-1075
	637797		1074-1019
	637798		1018-963
	637799		962-907
	637800		906-851

12 APR	637801	11(8)B	850-795
	637802		794-739
	637803		738-728
	637804	11(8)C	791-739
	637805		738-683
	637806		682-628
	637807		627-573
	637808		572-518
	637809		517-463
	637810		462-408
	637811		407-353
	637812		352-298
	637813		297-242
	637814		241-186
	637815		185-130
	637816		129-74
	637817		73-19
	637818		18-9964
	637819	11(8)C	9963-9942
	637820	20(14)	001-053
	637821		054-108
	637822		109-163
	637823		164-218
	637824		219-274
	637825		275-330
	637826		331-386
	637827		387-442
	637828		443-498
	637829		499-554
	637830		555-609

13 APRIL	637831	20(14)	610-665
	637832		666-721
	637833		722-777
	637834		778-833
	637835		834-888
	637836		889-944
	637837		945-1000
	637838		1001-1056
	637839		1057-1112
	637840		1113-1168
	637841		1169-1224
	637842		1225-1280
	637843		1251-1336
	637844		1337-1392
	637845		1393-1448
	637846		1449-1503
	637847		1504-1559
	637848		1560-1615
	637849		1616-1671
	637850		1672-1727
	637851		1728-1783
	637852		1784-1839
	637853		1840-1895
	637854		1896-1951
	637855		1952-2007
	637856		2008-2062
	637857		2063-2118
	637858		2119-2174
	637859		2175-2230
	637860		2231-2286

13 APRIL	637861	20(14)	2287-2342
	637862		2343-2398
	637863		2399-2454
	637864		2455-2509
	637865		2510-2565
	637866		2566-2621
	637867		2622-2677
	637868		2678-2733
	637869		2734-2789
	637870		2790-2845
	637871		2846-2901
	637872		2902-2957
	637873		2958-3013
	637874		3014-3069
	637875		3070-3125
	637876		3126-3181
	637877		3182-3237
	637878		3238-3293
	637879		3294-3349
	637880		3350-3405
	637881		3406-3427
	637882	20(14)A	3338-3390
	637883		3391-3446
	637884		3447-3502
	637885		3503-3558
	637886		3559-3614
	637887		3615-3670
	637888		3671-3726
	637889		3727-3783
	637890		3784-3839

13 APR	637891	20(14)A	3840-3895
	637892		3896-3951
	637893		3952-4007
	637894		4008-4063
	637895		4064-4119
	637896		4120-4175
	637897		4181-4236
	637898		4240-4295
	637899		4300-4355
	637900		4360-4413
	637901		4416-4470
	637902		4474-4528
	637903		4534-4589
	637904		4593-4647
	637905		4650-4704
	637906		4709-4763
	637907		4766-4783

DATE	TAPE NO.	LINE NO.	SHOTPOINTS
18 APRIL 82	646501	21(5)	DO NOT PROCESS
	646502		
	646503		
	646504		
	646505		
	646506		
	646507		
	646508		
	646509		
	646510		
	646511		
	646512		
	646513		
	646514		
	646515		
	646516		
	646517		
	646518		
	646519		
	646520		
	646521		
	646522		
	646523		
	646524		
	646525		
	646526		
	646527		
	646528		
	646529		
18 APR	646530	21(S)	DO NOT PROCESS

18 APR	646531	21(5)	DO NOT PROCESS
	646532		
	646533		
	646534		
	646535		
	646536		
	646537		
	646538		
	646539		
	646540		
	646541		
	646542		
	646543		
	646544		
	646545		
	646546		
	646547		
	646548		
	646549		
	646550		
	646551		
	646552		
	646553		
	646554		
	646555		
	646556		
	646557		
	646558		
	646559		
18 APR	646560	21(S)	DO NOT PROCESS

19 APRIL	646561	21(5)	DO NOT PROCESS
	646562		
	646563		
	646564		
	646565		
	646566		
	646567		
	646568		
	646569		
	646570		
	646571		
	646572		
	646573		
	646574		
	646575		
	646576		
	646577		
	646578		
	646579		
	646580		
	646581		
	646582		
	646583		
	646584		
	646585		
	646586		
	646587		
	646588		
	646589		
19 APR	646590		DO NOT PROCESS

27 APR	646700	14(1)B	DO NOT PROCESS
	646701		
	646702		
	646703		
	646704		
	646705		
	646706		
	646707		
	646708		
	646709		
	646710		
	646711		
	646712		
	646713		
	646714		
	646715		
	646716		
	646717		
	646718		
	646719		
	646720		
	646721		
	646722		
	646723		
	646724		
	646725		
	646726		
	646727		
	646728		
	646729		

27 APR	646730	14(1)B	DO NOT PROCESS
	646731		
	646732		
	646733		
	646734		
	646735		
	646736		DO NOT PROCESS
28 APR	646737	22(2)	001-055
	646738		056-111
	646739		112-167
	646740		168-223
	646741		224-279
	646742		280-335
	646743		336-391
	646744		392-446
	646745		247-502
	646746		503-557
	646747		558-613
	646748		614-668
	646749		669-724
	646750		725-780
	646751		781-836
	646752		837-892
	646753		893-948
	646754		949-1004
	646755		1005-1060
	646756		1061-1115
	646757		1116-1170
	646758		1171-1224
	646759		1225-1279

28 APR	646760	22(2)	1280-1333
	646761		1334-1388
	646762		1389-1428
	646763		1429-1483
	646764		1484-1537
	646765		1538-1591
	646766		1592-1645
	646767		1646-1700
	646768		1701-1754
	646769		1755-1808
	646770		1809-1862
	646771		1863-1918
	646772		1919-1971
	646773		1972-2026
	646774		2027-2080
	646775		2081-2134
	646776		2135-2188
	646777		2189-2242
	646778		2243-2296
	646779		2297-2350
	646780		2351-2404
	646781		2405-2458
	646782		2459-2512
	646783		2513-2567
	646784		2568-2681
	646785		2622-2674
	646786		2675-2729
	646787		2730-2781
	646788		2784-2837
	646789		2838-2893

28 APRIL	646790	22(2)	2794-2947
	646791		2948-2993
	646792		2994-3021
	646793	23(3)	DO NOT PROCESS
	646794	23(3)A	
	646795		
	646796		
	646797		
	646798		
	646799		
	646800		
	646801		
	646802		
	646803		
	646804		
	646805		
	646806		DO NOT PROCESS
	646807	23(3)B	493-546
	646808		547-600
	646809		601-654
	646810		655-708
	646811		709-767
	646812		763-816
	646813		817-870
	646814		871-924
	646815		925-978
	646816		979-1032
	646817		1033-1086
	646818		1087-1140
	646819		1141-1194

29 APR	646820	23(3)B	1195-1248
	646821		1249-1302
	646822		1303-1355
	646823		1356-1408
	646824		1409-1462
	646825		1463-1516
	646826		1517-1570
	646827		1572-1624
	646828		1625-1677
	646829		1678-1730
	646830		1731-1783
	646831		1787-1840
	646832		1841-1893
	646833		1894-1947
	646834		1948-2000
	646835	24(4)	2001-2043
	646836	↓	001-050
	646837		054-108
	646838		110-163
	646839		164-217
	646840		218-270
	646841		271-324
	646842		325-377
	646843		378-430
	646844		431-484
	646845		485-537
	646846		538-591
	646847		592-645
	646848		646-698
	646849		699-752

30 APRIL	646850	24(4)	753-806
	646851		807-860
	646852		861-914
	646853		915-968
	646854		969-1022
	646855		1023-1076
	646856		1077-1130
	646857		1131-1184
	646858		1185-1238
	646859		1239-1292
	646860		1293-1346
	646861		1347-1400
	646862		1401-1454
	646863		1455-1508
	646864		1509-1562
	646865		1563-1616
	646866		1617-1670
	646867		1671-1724
	646868		1725-1778
	646869		1779-1832
	646870		1833-1886
	646871		1887-1940
	646872		1941-1994
	646873		1995-2020
	646874	21(5)A	001-050
	646875		051-
	646876		064-118
	646877		119-152
	646878		154-208
	646879		209-262

30 APR	646880	21(5)A	263-317
	646881		318-371
	646882		372-426
	646883		427-480
	646884		481-534
	646885		535-588
	646886		580-642
	646887		643-696
	646888		697-751
	646889		752-806
	646890		807-861
	646891		862-917
	646892		918-971
	646893		972-1025
	646894		1026-1079
	646895		1080-1134
	646896		1135-1188
	646897		1189-1242
	646898		1243-1926
	646899		1297-1350
	646900		1351-1404
	646901		1405-1459
	646902		1460-1459
	646903		1514-1568
	646904		1569-1622
	646905		1623-1677
	646906		1678-1732
	646907		1733-1788
	646908		1789-1843
	646909		1844-1898

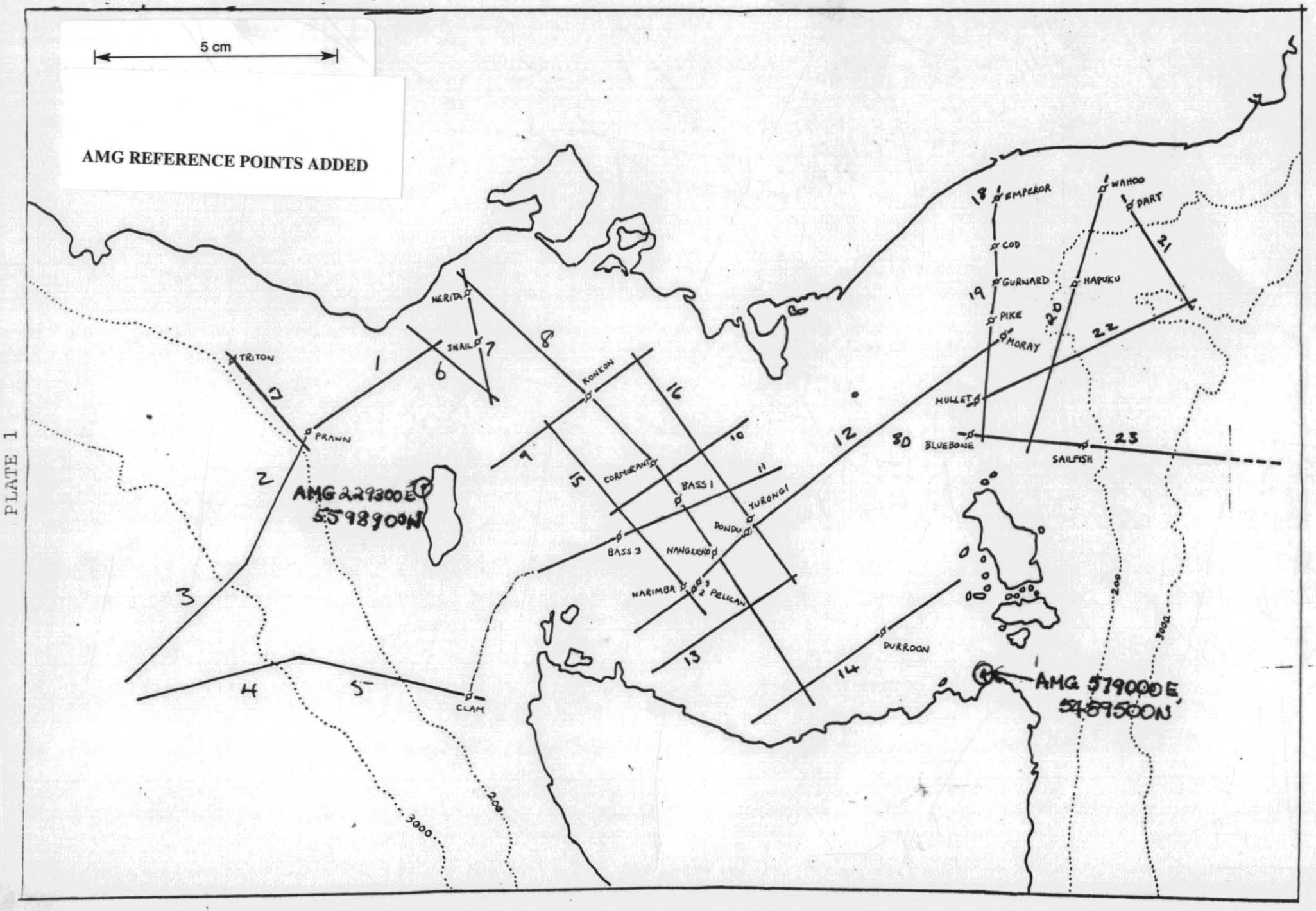
30 APR	646910	21(5)A	1899-1953
	646911		1954-2008
	646912		2009-2063
	646913		2064-2118
	646914		2119-2174
	646915		2175-2229
	646916		2230-2284
	646917		2285-2339
	646918		2340-2394
	646919		2395-2449
	646920		2450-2505
	646921		2506-2560
	646922		2561-2615
	646923		2616-2670
	646924		2671-2726
	646925		2727-2781
	646926		2782-2836
	646927		2837-2981
	646928		2892-2923
	646929		2928-2981
	646930		2982-3037
	646931		3040-3095
	646932		3099-3154
	646933		3157-3212
	646934		3215-3270
	646935		3271-3325
	646936		3326-3380
	646937		3381-3436
	646938		3437-3492
	646939		3493-3543

1 MAY	646941	23(3)C	493-443
	646942		442-390
	646943		389-336
	646944		335-283
	646945		282-229
	646946		228-176
	646947		175-122
	646948		121-68
	646949		67-14
	646950		13-9972
2 MAY	646951	14(1)C	2833-2781
	646952		2780-2725
	646953		2724-2669
	646954		2668-2613
	646955		2612-2557
	646956		2556-2501
	646957		2500-2445
	646958		2444-2389
	646959		2388-2333
	646960		2332-2277
	646961		2276-2221
	646962		2220-2165
	646963		2164-2109
	646964		2108-2053
	646965		2051-1996
	646966		1992-1937
	646967		1936-1881
	646968		1880-1825
	646969		1824-1770
	646970		1769-1714

2 MAY	646971	14(1)C	1713-1658
	646972		1657-1602
	646973		1599-1544
	646974		1543-1488
	646975		1485-1430
	646976		1429-1375
	646977		1374-1320
	646978		1319-1265
	646979		1260-1205
	646980		1199-1145
	646981		1144-1090
	646982		1089-1035
	646983		1034-780
	646984		979-924
	646985		923-868
	646986		867-812
	646987		811-808

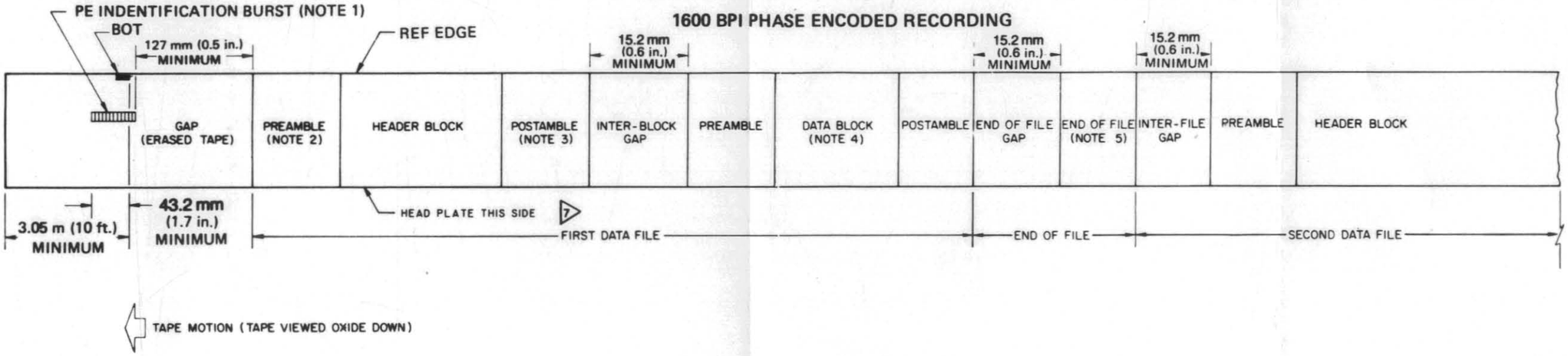
252100

PLATE 1

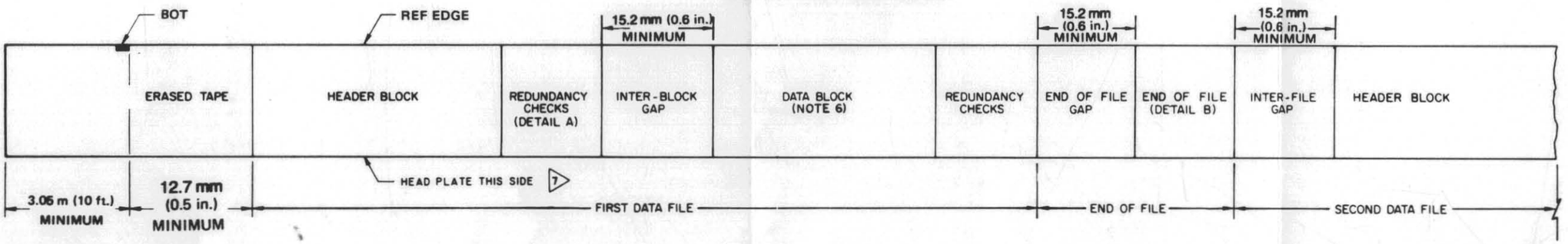


252101

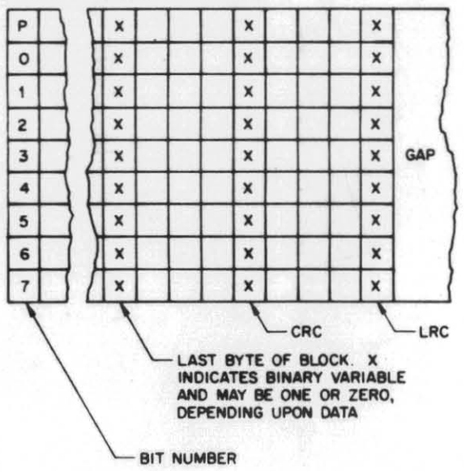
1600 BPI PHASE ENCODED RECORDING



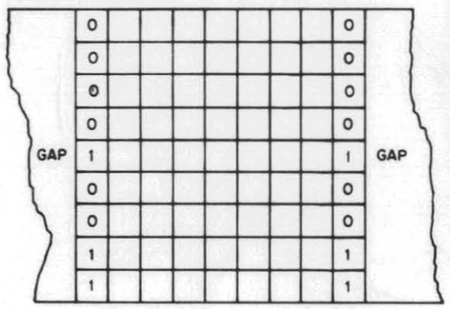
800 BPI NRZI RECORDING



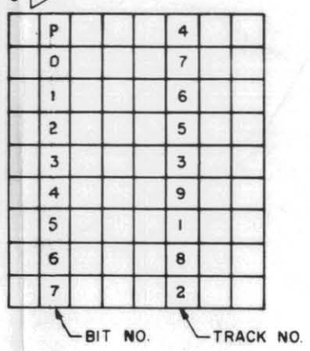
A NRZI REDUNDANCY CHECKS



B. NRZI END OF FILE



C 7



NOTES

1 - PE identification burst consists of 1600 flux reversals per inch in track P, all other tracks dc erased.

2 - Preamble consists of forty characters with 0-bits in all tracks followed by one character with 1-bits in all tracks. (Includes the parity track).

3 - Postamble consists of one character with 1-bits in all tracks followed by forty characters with 0-bits in all tracks. (Includes the parity track.)

4 - Synchronous recording, inter-block gap is extended until timebreak is received. Data is stored in a buffer memory while the preamble is being written. First start of scan is written immediately after the preamble.

5 - PE end of file consists of 80 flux reversals at 3200 FCI in bits P, 0, 2, 5, 6, and 7. Bits 1, 3, and 4 are dc-erased.

6 - Synchronous data recording: inter-block gap is erased until timebreak. First start of scan is then written.

7 Order and location of tracks on tape, direction of magnetization and all other applicable specifications in accordance with IBM file S360-19, form A22-6862-4. The track number for each bit is shown in detail C. Track numbers are the same for 800 BPI NRZI and 1600 BPI PE. Tracks are numbered consecutively with track 1 the maximum distance from the head plate and track 9 adjacent to the head plate. See C below.

LEGEND

F_1-F_4 File number - 4 BCD digits

Y_1-Y_4 Format Code - 4 BCD digits 0200 for SEG–B (with no header extension)

K_1-K_{12} General constants entered from panel switches - 12 BCD digits

B_1-B_3 Bytes per multiplexer scan in data block - 3 BCD digits. Bytes per scan = 2.5 x no. of channels +14

M_3-M_8 Instrument serial number - 6 BCD digits.

R_1,R_2 Record length in multiples of 1.024 seconds. 00 if manual stop is selected.

J Amplifier gain control mode -1001 is recorded to designate floating point gain control system.

LC_1,LC_2 Low-cut filter frequency (Hz) - 2 BCD digits. 00 (out), 03, 05, 08, 12, 18, or 27.
NOTE: 03 is actually 3.56Hz.
05 is actually 5.33Hz.

LS Low-cut filter slope in multiples of 6 dB/octave - 1 BCD digit. Normally 3, (18dB octave) for DFS-V.

S_1,S_2 Notch (rejection) filter frequency - 2 BCD digits. 00 (out) 50, or 60 (for 60 or 16 2/3).

A Alias filter frequency:
1 - 256Hz 4 - 64Hz
2 - 128Hz 8 - 32Hz

D Channel identification code:

BIT 0	1	2	TYPE CHANNEL
0	0	0	Unused channel
1	0	0	Waterbreak channel
0	1	0	Timebreak channel
0	0	1	Seis channel
0	1	1	Uphold channel
1	0	1	Time counter
1	1	1	Other

Z Record type:
8 - normal shot 4 } Not used
2 - test record 1 }

W_N Ones recorded for normal field timebreak recording. Zeros record if system operated from internal timebreak.

T_1-T_{14} 14 bit binary timing word

T_{14} - 1 millisecond

T_1 - 8,192 seconds

Q_N Digitized output of A/D converter

Q_s - sign (note 4)

Q_1 - 4096 millivolts

Q_{14} - 0.50 millivolt

G_N Binary gain code for channel N. Least significant bit (6dB) is always 0 for quaternary coded IFP gain.

P Vertical (byte) parity. Bit P is one if bits 0 - 7 of the same byte contains an even number of ones.

CH Number of channels. Bit 6 of the four sync group bytes, indicates number of seismic data channels.

BYTE	1	2	3	4
24 CH	0	0	0	0
36 CH	0	1	0	0
48 CH	0	0	0	1
Other	1	1	1	1

See B, bytes per scan.

No. of data channels =

$$\frac{\text{Bytes per scan-14}}{2.5}$$

Format conforms to the SEG standard specific values shown, such as filter settings, etc, are those of the DFS–V.

I Sample interval recorded according to the following table:

BIT 4	5	6	7	SAMPLE INTERVAL
0	0	0	1	1 millisecond
0	0	1	0	2 milliseconds
0	1	0	0	4 milliseconds
1	0	0	0	8 milliseconds
1	0	0	1	0.5 milliseconds
1	0	1	0	1 millisecond
1	1	0	0	2 milliseconds

All zeros for other sample intervals

GC Gain constant (fixed gain) recorded as a 4 - bit binary code. The most significant bit has a gain value of 2^3 (48dB): the least significant bit has a gain value of 2^1 (6dB). The least significant bit is recorded as a zero for the DFS–V.

GW Gain word recorded as a 4-bit binary code. 0000 is recorded when operating in floating point gain control. When operating in manual gain control, the most significant bit has a gain value of 2 (48dB) and the least significant bit has a gain value of 2^1 (6dB). The least significant bit is recorded as a zero for the DFS–V.

NOTES

1 - Auxiliary channel identification code assignments are as follows unless otherwise specified:
AUX 1 will always be the timing counter.

28 or 60 Seis channels	Number of seis Channels other than 28 or 60
AUX 2 unused •	AUX 2 uphole
AUX 3 unused •	AUX 3 timebreak
AUX 4 uphold	AUX 4 unused
AUX 5 timebreak	AUX 5 unused

• These AUX channels are not available for data and will always be recorded as zero in the data record.

2 - Additional externally supplied digital data may be recorded in the header block following byte 36+2n.

3 - Negative values are recorded in 1's complement code (standard) or 2's complement (optional).

HEADER BLOCK

BIT NUMBER (SCHEMATIC)				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24					24 + 2n																36 + 2n (NOTE 3)
P			P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
0			8	F_1	F_3	Y_1	Y_3	K_1	K_3	K_5	K_7	K_9	K_{11}	B_1	B_3	0	M_3	M_5	M_7	R_1	J	LC_1	LS	0	0	S_1	A	0	0	0	0	0	0	0	1	0	D	0	D	0	D	0	D	0	0	0
1			4	F_1	F_3	Y_1	Y_3	K_1	K_3	K_5	K_7	K_9	K_{11}	B_1	B_3	0	M_3	M_5	M_7	R_1	J	LC_1	LS	0	0	S_1	A	0	0	0	0	0	0	0	0	0	D	0	D	0	D	0	D	0	0	0
2			2	F_1	F_3	Y_1	Y_3	K_1	K_3	K_5	K_7	K_9	K_{11}	B_1	B_3	0	M_3	M_5	M_7	R_1	J	LC_1	LS	0	0	S_1	A	1	0	1	0	1	0	1	0	1	0	D	0	D	0	D	0	D	0	0	0
3			1	F_1	F_3	Y_1	Y_3	K_1	K_3	K_5	K_7	K_9	K_{11}	B_1	B_3	1	M_3	M_5	M_7	R_1	J	LC_1	LS	0	0	S_1	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4			8	F_2	F_4	Y_2	Y_4	K_2	K_4	K_6	K_8	K_{10}	K_{12}	B_2	I	0	M_4	M_6	M_8	R_2	Z	LC_2	0	0	0	S_2	0	GC	GW	GC	GW	GC	GW	GC	GW	0	0	0	0	0	0	0	0	0	0	0	0	0
5			4	F_2	F_4	Y_2	Y_4	K_2	K_4	K_6	K_8	K_{10}	K_{12}	B_2	I	1	M_4	M_6	M_8	R_2	Z	LC_2	0	0	0	S_2	0	GC	GW	GC	GW	GC	GW	GC	GW	0	0	0	0	0	0	0	0	0	0	0	0	0
6			2	F_2	F_4	Y_2	Y_4	K_2	K_4	K_6	K_8	K_{10}	K_{12}	B_2	I	0	M_4	M_6	M_8	R_2	Z	LC_2	0	0	0	S_2	0	GC	GW	GC	GW	GC	GW	GC	GW	0	0	0	0	0	0	0	0	0	0	0	0	0
7			1	F_2	F_4	Y_2	Y_4	K_2	K_4	K_6	K_8	K_{10}	K_{12}	B_2	I	1	M_4	M_6	M_8	R_2	Z	LC_2	0	0	0	S_2	0	GC	GW	GC	GW	GC	GW	GC	GW	0	0	0	0	0	0	0	0	0	0	0	0	0

GENERAL CONSTANTS

BYTES/SCAN (B) SAMPLE INTERVAL (I)

TEXAS INSTRUMENTS IDENTIFICATION (15)

INSTRUMENT SERIAL NUMBER

RECORD LENGTH (R) GAIN MODE (J) RECORD TYPE (Z)

LOW-CUT FILTER

RESERVED FOR HIGH-CUT FILTER

NOTCH FILTER (S) ALIAS FILTER (A)

SEIS CHANNEL 1 FIXED & EARLY GAIN (NOTE 1) (F) (E)

SEIS CHANNEL 2 GAIN

SEIS CHANNEL n-1 GAIN

SEIS CHANNEL n GAIN

AUXILIARY CHANNEL 1 TIMING COUNTER (NOTE 1)

AUXILIARY CHANNEL 2 (NOTE 1)

AUXILIARY CHANNEL 3 (NOTE 1)

AUXILIARY CHANNEL 4 (NOTE 1)

AUXILIARY CHANNEL 5 (NOTE 1)

ZERO DATA 2 BYTES

FILE NUMBER

FORMAT CODE

TYPICAL PACKED BCD VALUE

DATA BLOCK

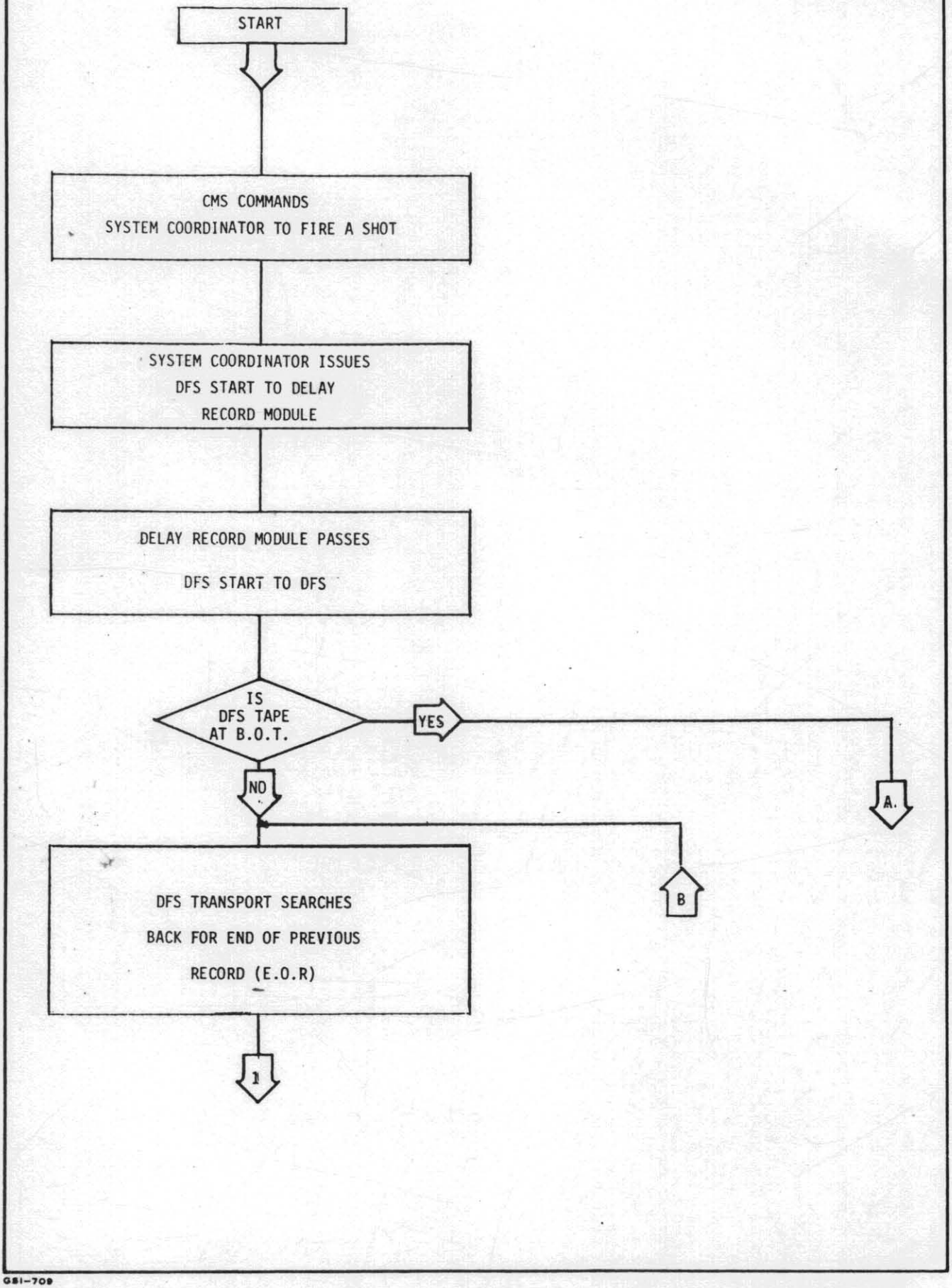
BIT NUMBER (SCHEMATIC)		TYPICAL DATA VALUE																																																
P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
0		S	2^6	W_1	W_3	W_5	W_7	T_1	T_8	Q_S	Q_8	Q_S	Q_8	Q_S	Q_8	Q_S	Q_8	G_1	G_3	Q_S	Q_8	Q_S	Q_8	Q_S	Q_8	Q_S	Q_8	G_5	G_7	Q_S	Q_8	Q_S	Q_8	W_1	W_3	W_5	W_7	T_1	T_8	Q_S	Q_8	W_1	W_3	W_5	W_7	Q_S	Q_8
1		2^{13}	2^5	W_1	W_3	W_5	W_7	T_2	T_9	Q_1	Q_9	Q_1	Q_9	Q_1	Q_9	Q_1	Q_9	G_1	G_3	Q_1	Q_9	Q_1	Q_9	Q_1	Q_9	Q_1	Q_9	G_5	G_7	Q_1	Q_9	Q_1	Q_9	W_1	W_3	W_5	W_7	T_2	T_9	Q_1	Q_9	W_1	W_3	W_5	W_7	Q_1	Q_9
2		2^{12}	2^4	W_1	W_3	W_5	W_7	T_3	T_{10}	Q_2	Q_{10}	Q_2	Q_{10}	Q_2	Q_{10}	Q_2	Q_{10}	G_1	G_3	Q_2	Q_{10}	Q_2	Q_{10}	Q_2	Q_{10}	Q_2	Q_{10}	G_5	G_7	Q_2	Q_{10}	Q_2	Q_{10}	W_1	W_3	W_5	W_7	T_3	T_{10}	Q_2	Q_{10}	W_1	W_3	W_5	W_7	Q_2	Q_{10}
3		2^{11}	2^3	W_2	W_4	W_6	W_8	T_4	T_{11}	Q_3	Q_{11}	Q_3	Q_{11}	Q_3	Q_{11}	Q_3	Q_{11}	G_1	G_3	Q_3	Q_{11}	Q_3	Q_{11}	Q_3	Q_{11}	Q_3	Q_{11}	G_5	G_7	Q_3	Q_{11}	Q_3	Q_{11}	W_2	W_4	W_6	W_8	T_4	T_{11}	Q_3	Q_{11}	W_2	W_4	W_6	W_8	Q_3	Q_{11}
4		2^{10}	2^2	W_2	W_4	W_6	W_8	T_5	T_{12}	Q_4	Q_{12}	Q_4	Q_{12}	Q_4	Q_{12}	Q_4	Q_{12}	G_2	G_4	Q_4	Q_{12}	Q_4	Q_{12}	Q_4	Q_{12}	Q_4	Q_{12}	G_6	G_8	Q_4	Q_{12}	Q_4	Q_{12}	W_2	W_4	W_6	W_8	T_5	T_{12}	Q_4	Q_{12}	W_2	W_4	W_6	W_8	Q_4	Q_{12}
5		2^9	2^1	W_2	W_4	W_6	W_8	T_6	T_{13}	Q_5	Q_{13}	Q_5	Q_{13}	Q_5	Q_{13}	Q_5	Q_{13}	G_2	G_4	Q_5	Q_{13}	Q_5	Q_{13}	Q_5	Q_{13}	Q_5	Q_{13}	G_6	G_8	Q_5	Q_{13}	Q_5	Q_{13}	W_2	W_4	W_6	W_8	T_6	T_{13}	Q_5	Q_{13}	W_2	W_4	W_6	W_8	Q_5	Q_{13}
6		2^8	2^0	0	0	0	0	T_7	T_{14}	Q_6	Q_{14}	Q_6	Q_{14}	Q_6	Q_{14}	Q_6	Q_{14}	G_2	G_4	Q_6	Q_{14}	Q_6	Q_{14}	Q_6	Q_{14}	Q_6	Q_{14}	G_6	G_8	Q_6	Q_{14}	Q_6	Q_{14}	CH	CH	CH	CH	T_7	T_{14}	Q_6	Q_{14}	CH	CH	CH	CH	Q_6	Q_{14}
7		2^7	0	1	1	1	1	0	0	Q_7	0	Q_7	0	Q_7	0	Q_7	0	G_2	G_4	Q_7	0	Q_7	0	Q_7	0	Q_7	0	G_6	G_8	Q_7	0	Q_7	0	1	1	1	1	0	0	Q_7	0	1	1	1	1	Q_7	0

SYNC GROUP (NOTE 6) | AUX 1 | AUX 2 | AUX 3 | AUX 4 | AUX 5 | GAIN 1-4 | SEIS 1 | SEIS 2 | SEIS 3 | SEIS 4 | GAIN 5-8 | SEIS 5 | SEIS n | SYNC GROUP | AUX 1 | SEIS n | SYNC GROUP | SEIS n

FIRST DATA SCAN — SECOND DATA SCAN — LAST DATA SCAN

252104

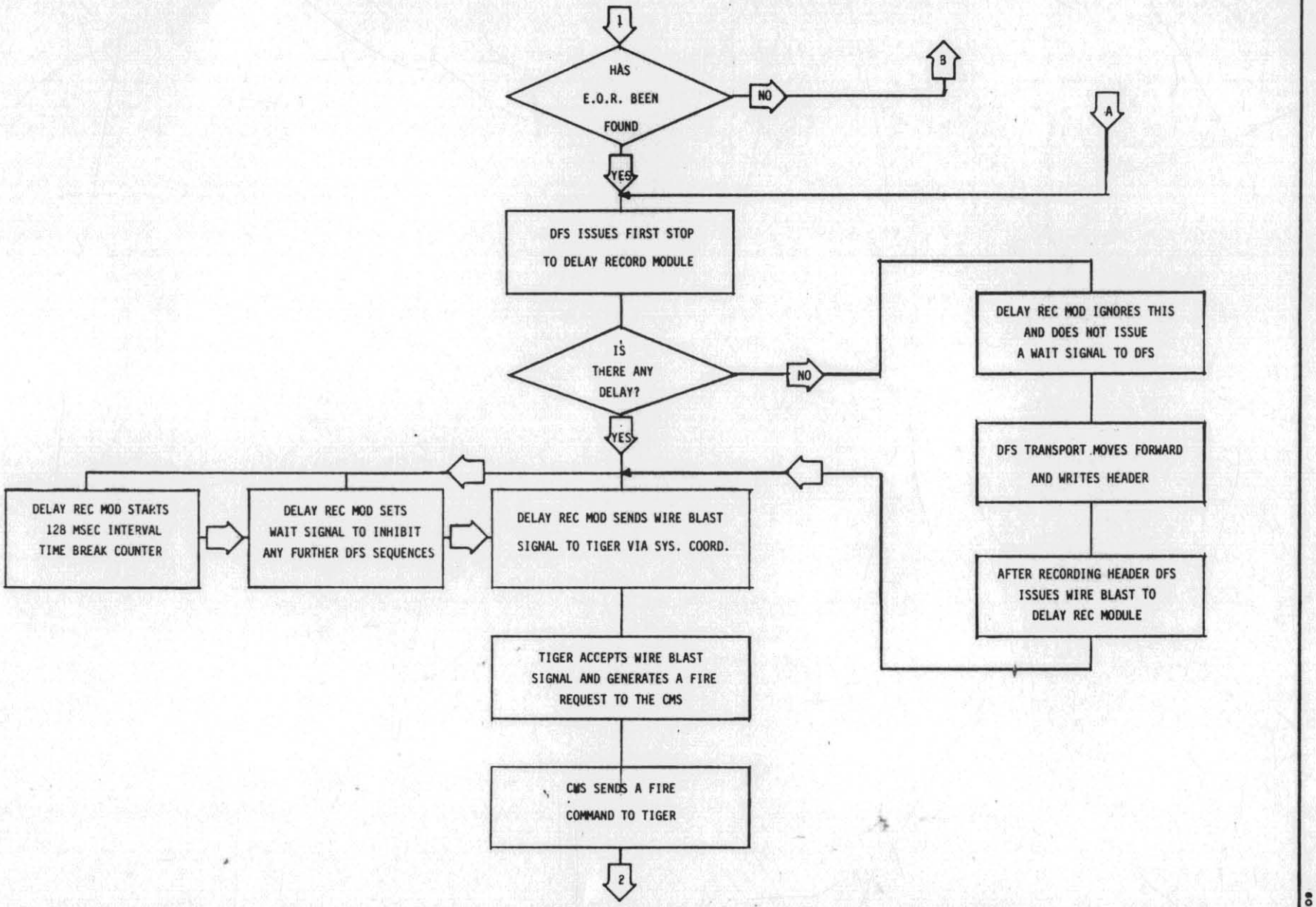
PLATE 3A



GSI-709

252105

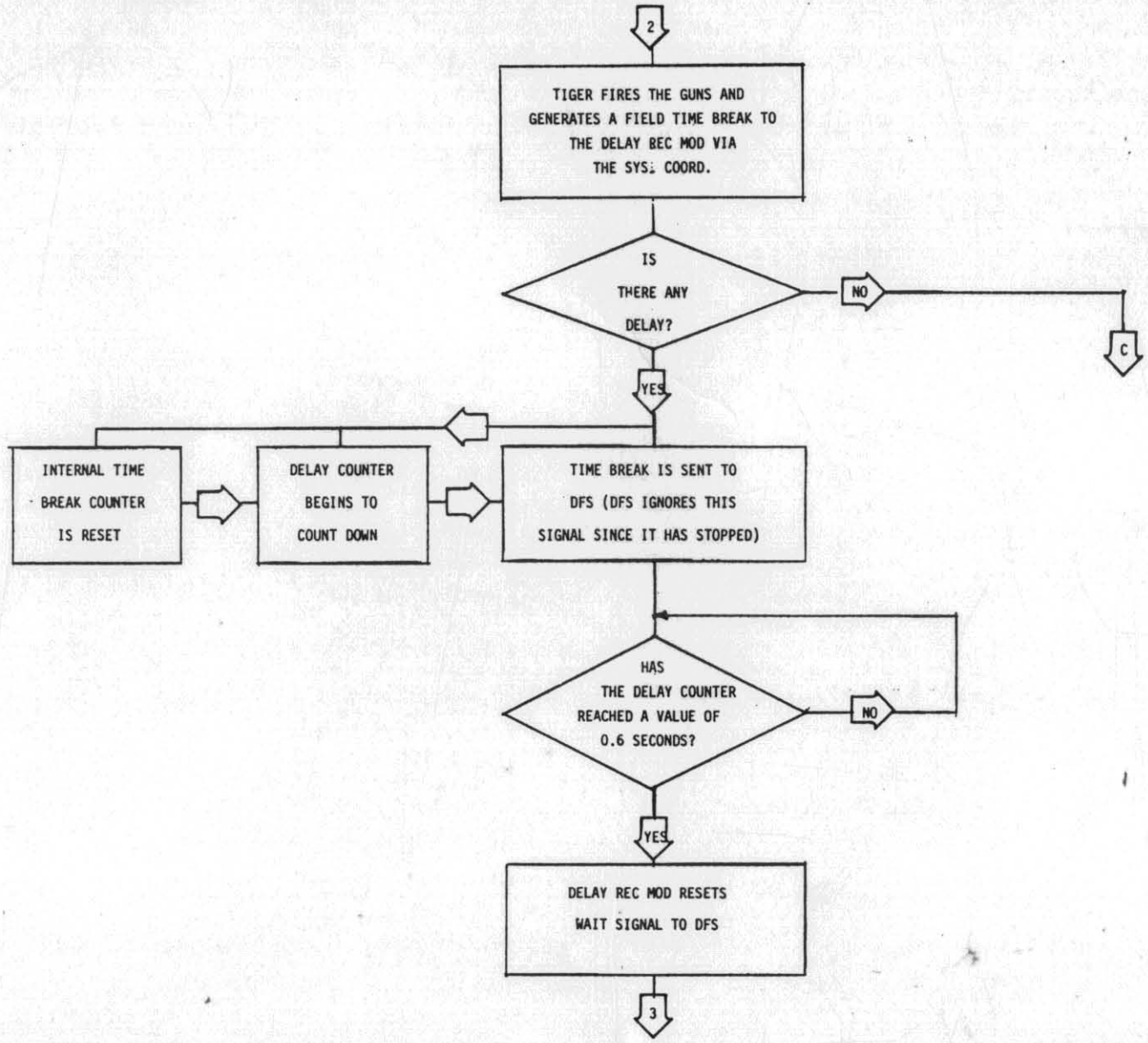
PLATE 3B



GSI-709

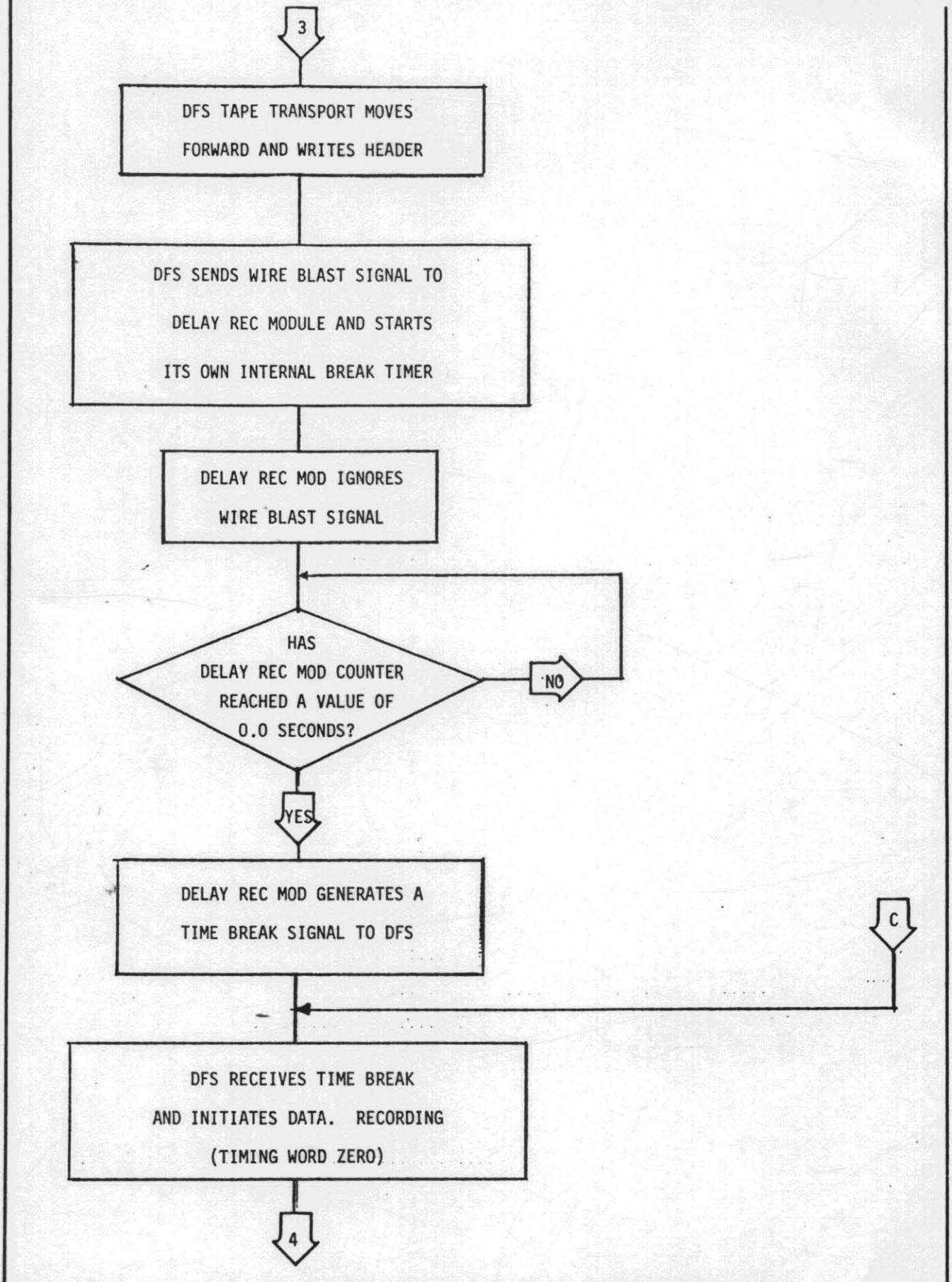
252106

PLATE 3C



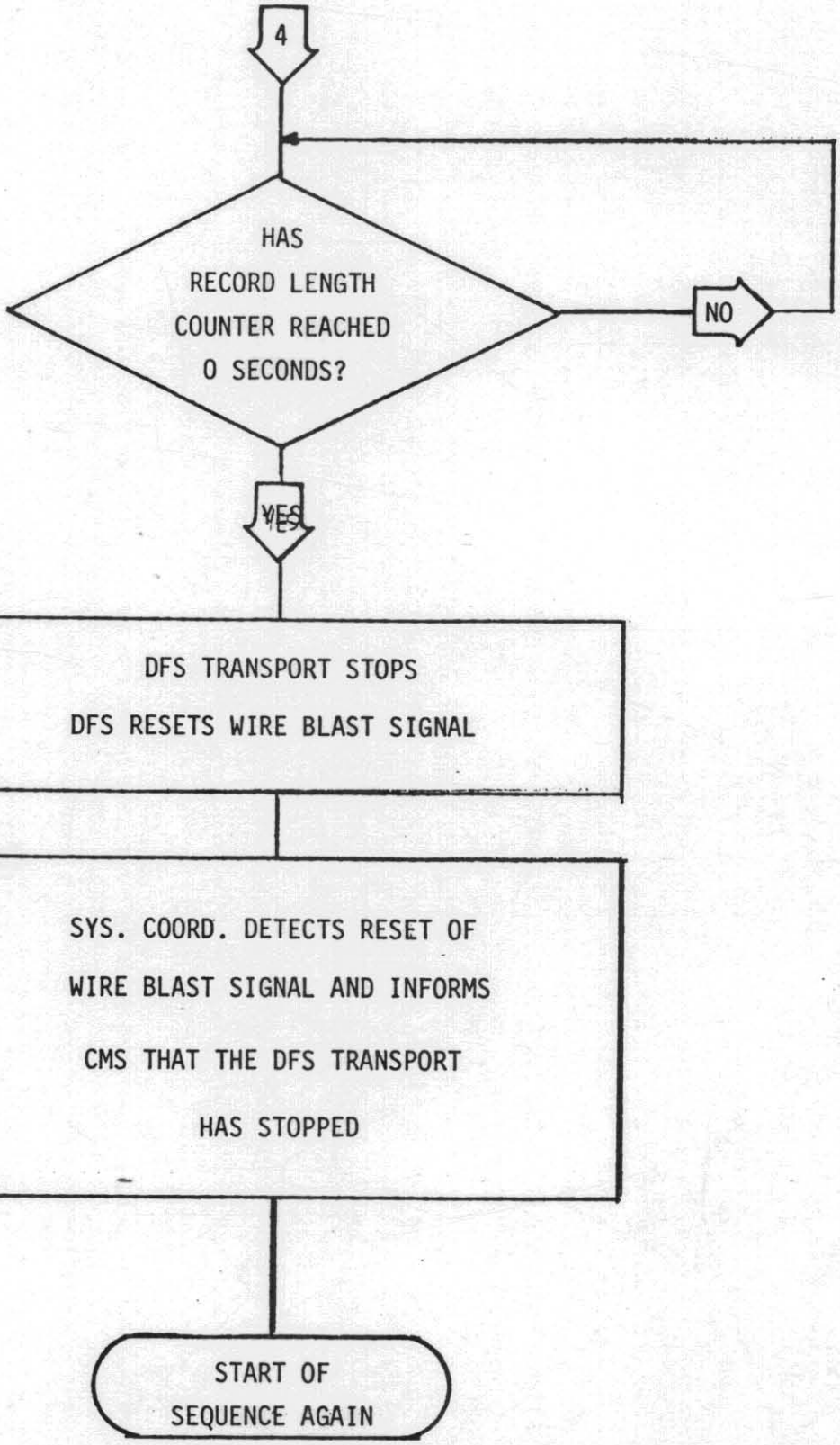
GSI-709

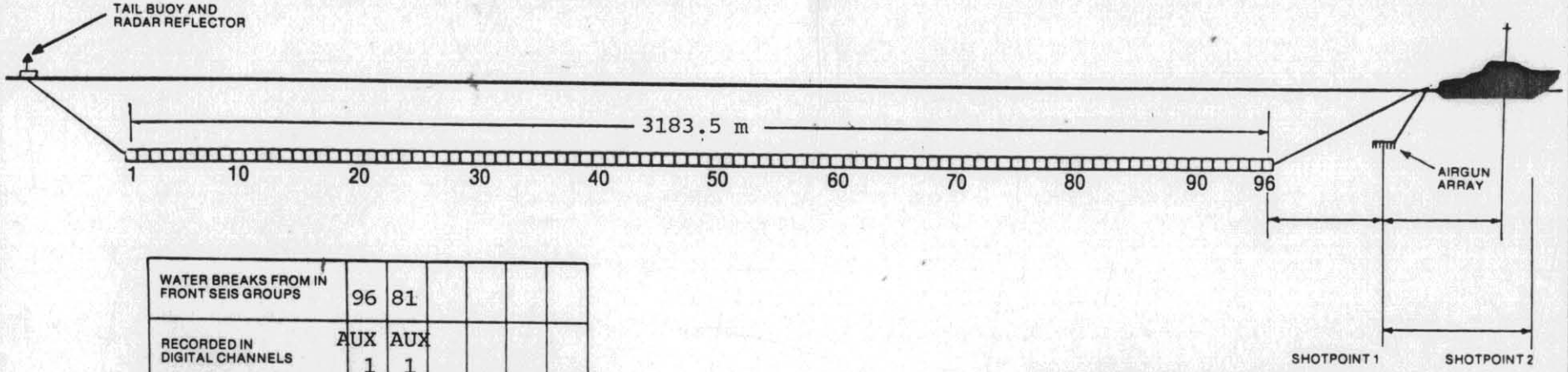
252107



GSI-709

252108


4
HAS
RECORD LENGTH
COUNTER REACHED
0 SECONDS?
NO
YES
DFS TRANSPORT STOPS
DFS RESETS WIRE BLAST SIGNAL
SYS. COORD. DETECTS RESET OF
WIRE BLAST SIGNAL AND INFORMS
CMS THAT THE DFS TRANSPORT
HAS STOPPED
START OF
SEQUENCE AGAIN



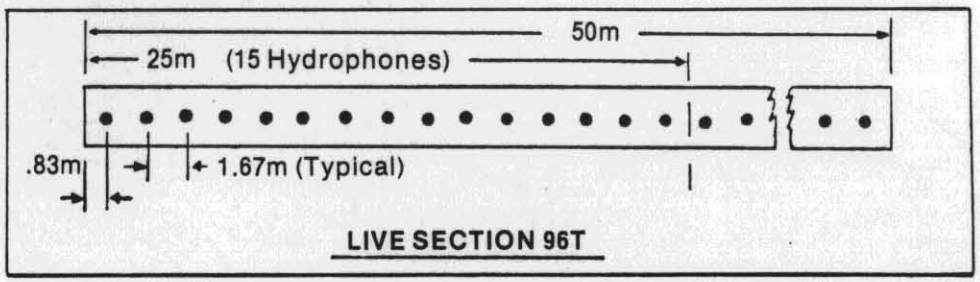
WATER BREAKS FROM IN FRONT SEIS GROUPS	96	81				
RECORDED IN DIGITAL CHANNELS	AUX 1	AUX 1				
DISPLAYED ON SEISMOGRAPH TRACES	61	61				

DEPTH TRANSDUCER NUMBERS	6	5	4	3	2	1
AT/NEAR SEIS GROUP NUMBERS	FES 96	82 81	62 61	42 41	22 21	3 2
DEPTH CONTROLLER AT SEIS GROUP NUMBERS						

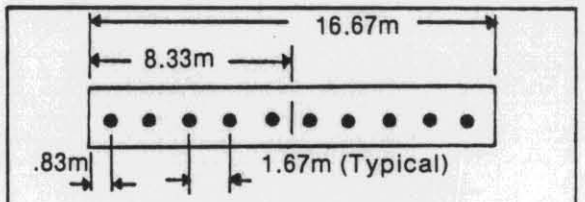
Located on All Depth Transducers

NYLON STRETCH	6 Front End
PIG SECTIONS	None

6 TRANSDUCER SECTIONS 4M LONG



LIVE SECTION 96T



EXTENDER SECTION 96T

MARINE CABLE DIAGRAM

3200 METRES

(OFFEND SPREAD — 96 GROUPS)

G.S.I. PARTY: 2993

SHIP: M/V "LADY VILMA"

CLIENT: BUREAU OF MINERAL RESOURCES

AREA: BASS STRAIT

DATE: 14 MARCH - 2 MAY, 1982

5 cm

PLATE 4

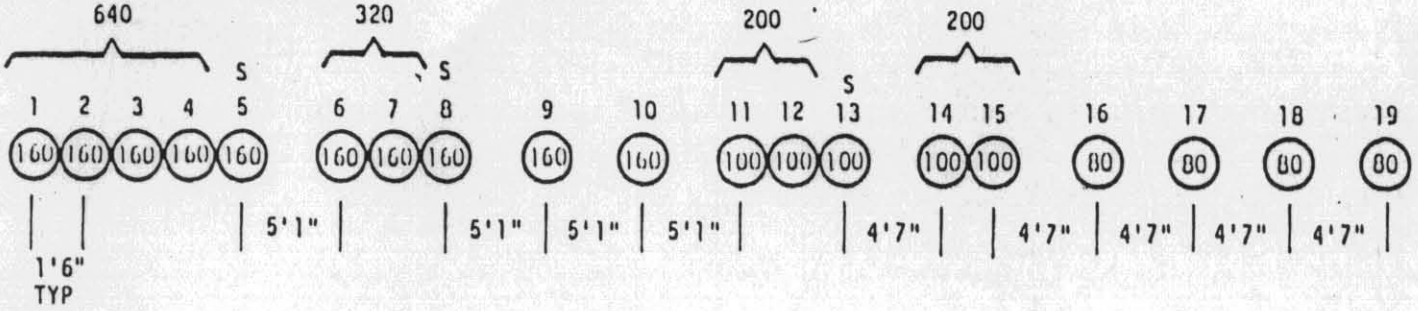
2521109

GSI-708

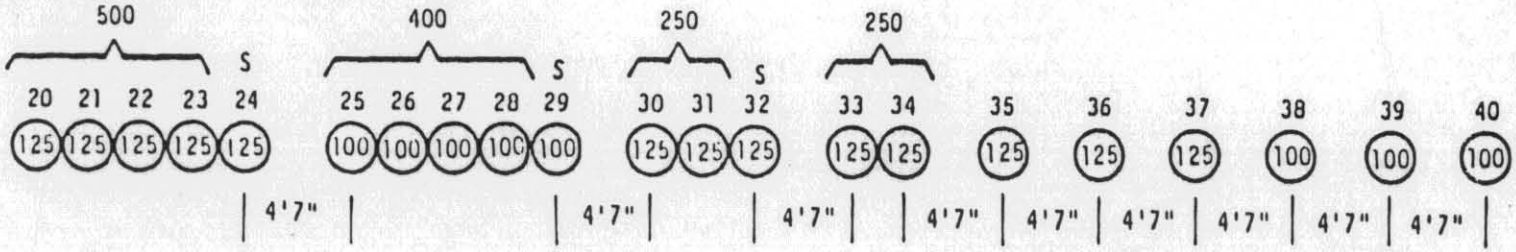
252110

4000-CUBIC-INCH AIR GUN ARRAY

STARBOARD STRING (56'9",19 GUNS)



PORT STRING (57'9", 21 GUNS)



25'-30'

PLATE 5

NOTES:

1. GUN SIZE IN CUBIC INCHES
2. GUN SPACING IN FEET AND INCHES; CENTERLINE-TO-CENTERLINE SPACING OF ALL COALESCED GUNS IS 1'6"
3. SPARE GUNS DENOTED BY "S"
4. GUNS 1-10 ARE MOD III PC, GUNS 11-40 ARE MOD II PC
5. MEASURED AVERAGE PERFORMANCE:

   P_a = 80 BAR-M (P-P, 0-125 HZ)

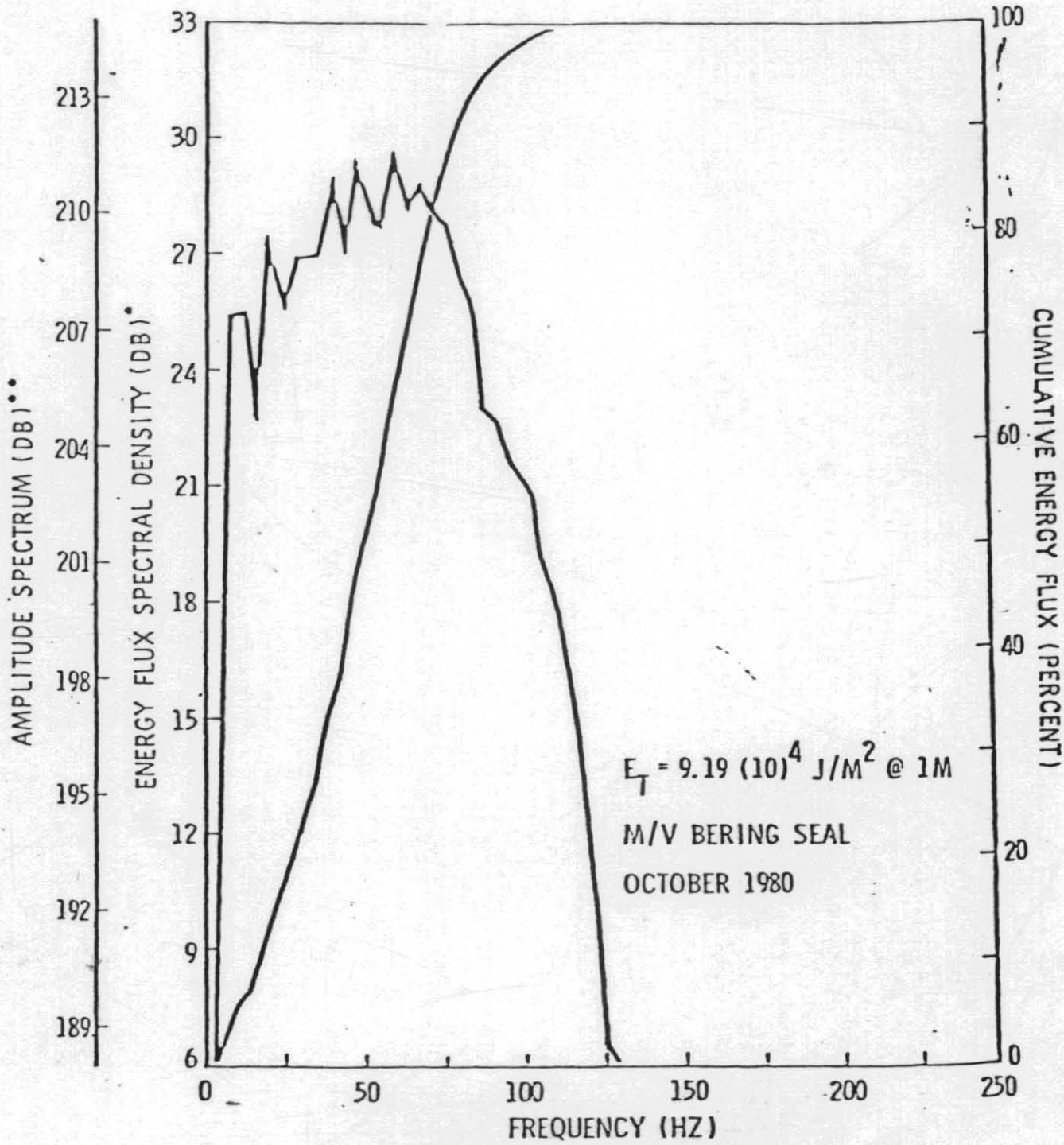
   P_a/P_b = 10

ARRAY COMPOSITION

1 X 640	2 X 160
1 X 500	2 X 125
1 X 400	2 X 100
1 X 320	770 SPARE
2 X 250	
2 X 200	
2 X 160	
3 X 125	
3 X 100	
4 X 80	
4075 ACTIVE	

252111

PLATE 5A



• DB REFERRED TO 1 JOULE/M•• 2/HZ AT 1 METER

•• DB REFERRED TO 1 MICROPASCAL/HZ AT 1 METER

Amplitude and Energy Spectra of 4000 PNU-CON Array

5 cm

252112

OFFSET DETERMINATION (SEE NOTE)

PHYSICAL MEASUREMENT

1.	Length of stretch sections with 9% stretch factor (6 x 50) x 9% (measured from stern) :	327 metres
2.	Total length of transducer section in front of Group no. 96 :	4 metres
3.	One half of group no. 96 (33 metre groups) :	16.5 metres
4.	Distance from stern to centre of array :	33.5 metres
5.	Offset (1 + 2 + 3)-4 :	314 metres

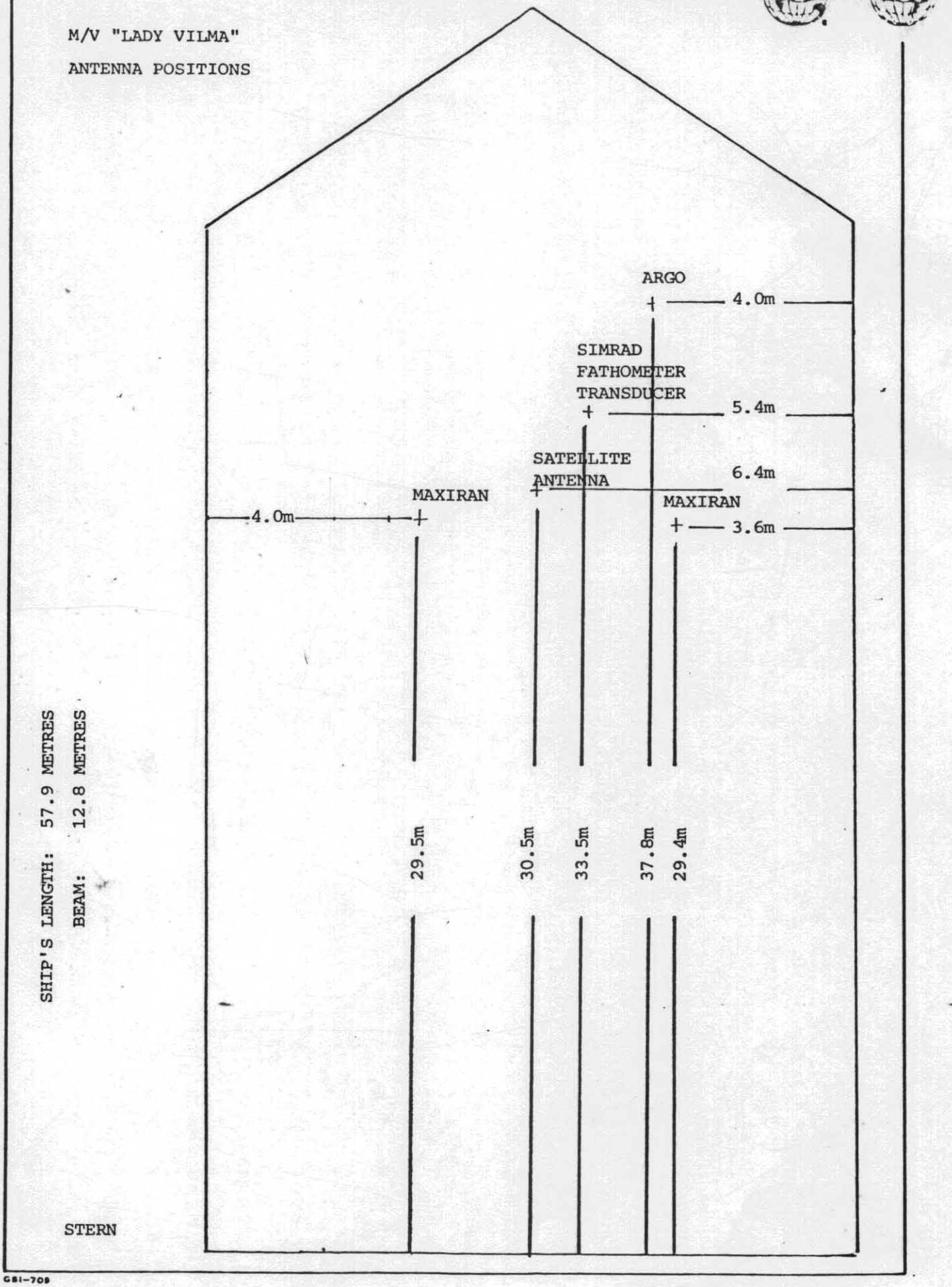
NOTE: This example is unrelated to production covered by this report and is intended only to show the components of the offset measurements.

252113

PLATE 7

M/V "LADY VILMA"

ANTENNA POSITIONS

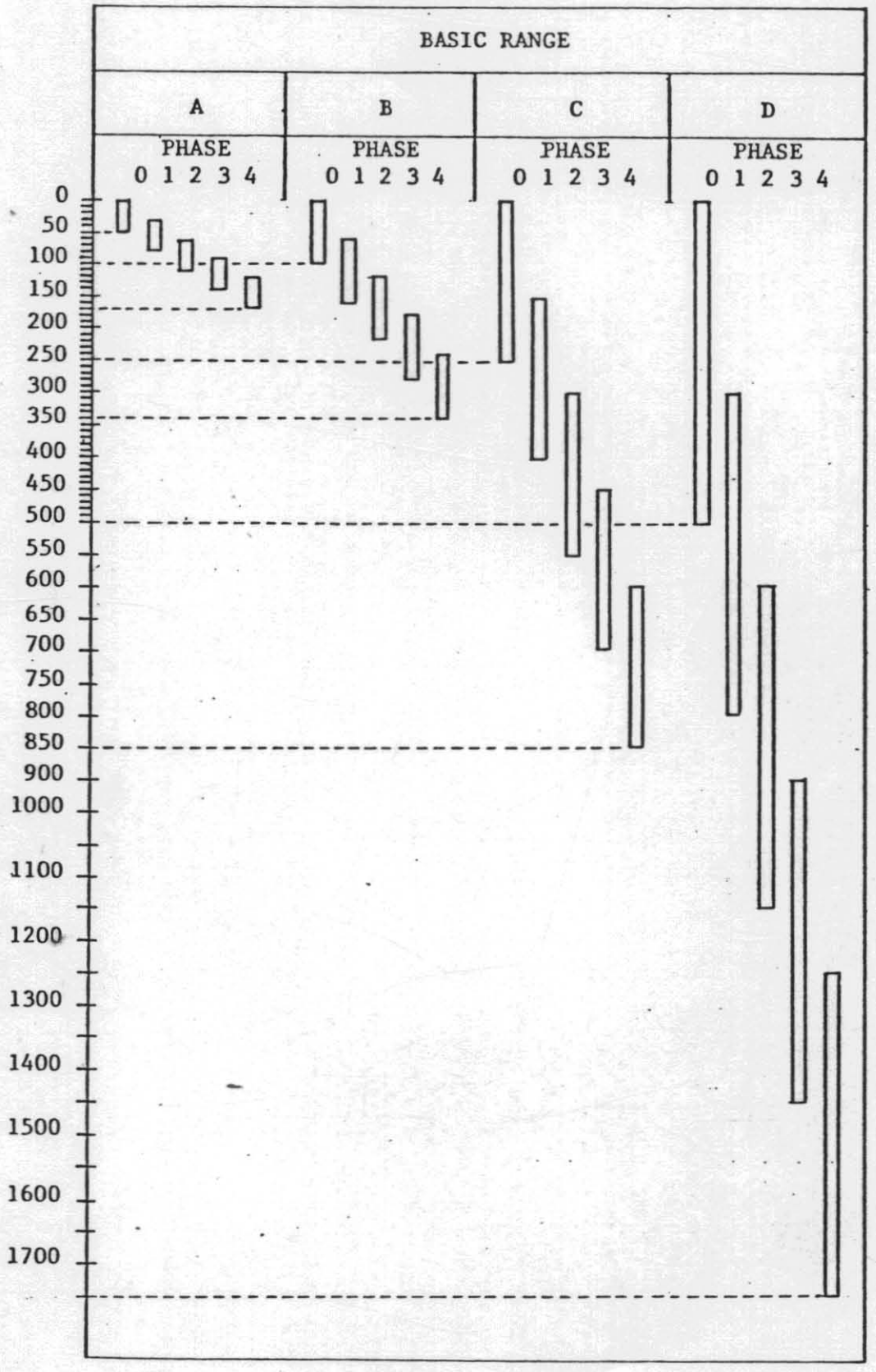


GSI-709

5 cm

252114

SIMRAD MODEL EA FATHOMETER SCALE



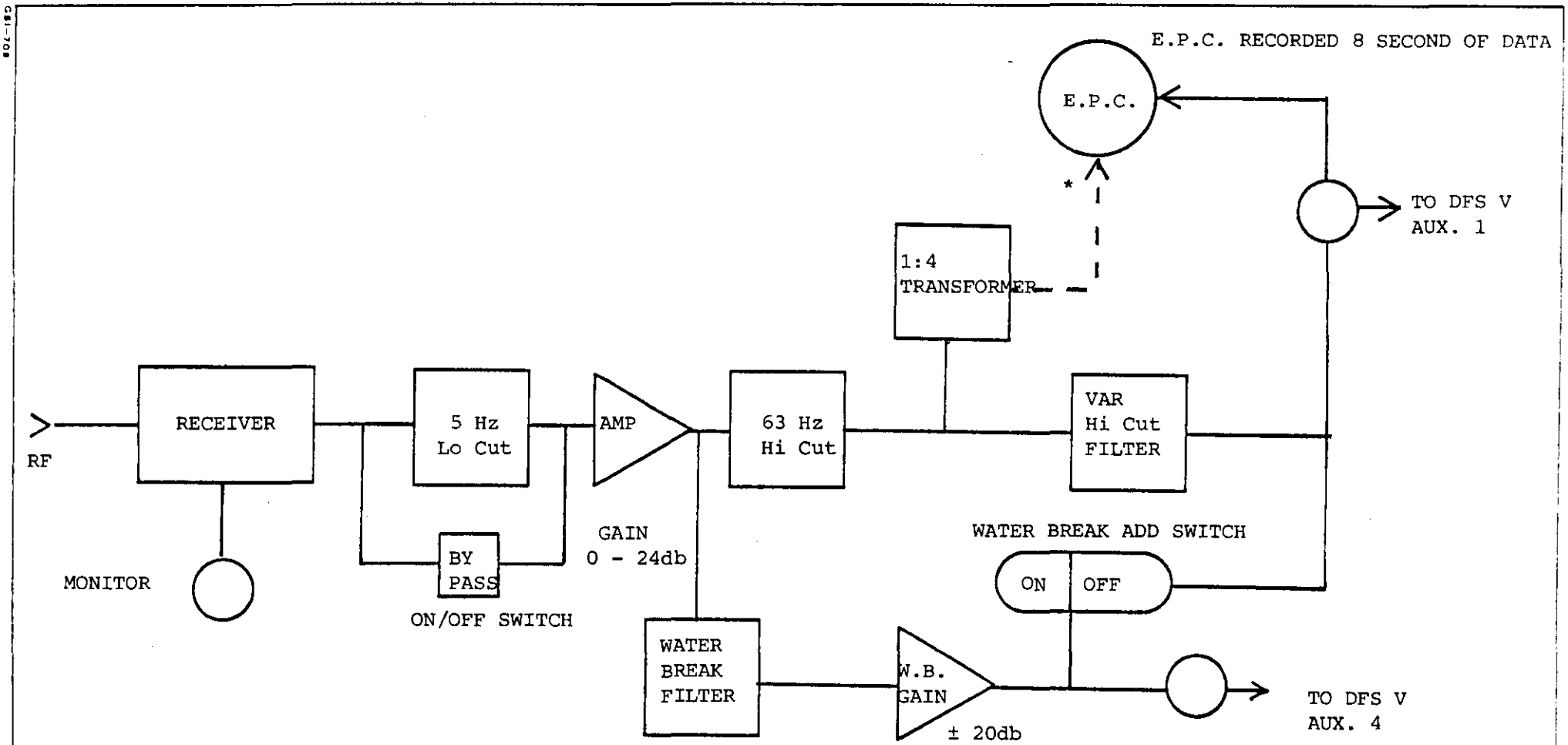
GSI-709

5 cm

APPENDICES

APPENDIX	TITLE
A	REFRACTION DIAGRAM AND LOGS

APPENDIX A



* ON LINE 15(17) ONLY

E.P.C. DRIVEN BY 1:4 TRANSFORMER

REMAINDER OF SURVEY E.P.C. DRIVEN BY OUTPUT OF VARIABLE HI CUT FILTER

REFRACTION INSTRUMENT SETUP FOR BMR SURVEY 40

202213

REFRACTION LOG

CLIENT : BMR
PROSPECT : SURVEY 40
VESSEL : "LADY VILMA"
PARTY : 2993

6 April, 1982

31 March - Telseis Receiver, Antenna and 10 Sonobuoys (5 x Ch#20, 5 x Ch#40) brought on board.

Initial set up - E.P.C. being driven by output of 1:4 transformer in receiver (printing on positive voltage) out put of the "VAR Hi Cut" Filter to the DFS - Auxilary Channel #1 via the shotpoint seis (SPS) AMP in analog module #1.

23:45 Line #15(17) FSP 001 DIR 320°

SP#47 - Sonobuoy in the water - port side.
Channel 40 AMP gain = 0db, Hi cuts = 62 Hz, Lo Cut = 5 Hz
SP #408 gain = 6db
SP #444 gain = 12db
SP #578 gain = 18db
SP #620 no longer recording on DFS (useful data coming after 6 second records).
Note: DFS overdrives were on water path pulse - not the part of interest.

Note: Changed system so that E.P.C. Now driven from same output as DFS (O/P from VAR Hi cut).

8 April, 1982

09:03 Line # 11(8)A FSP 7213

09:15 SP #7140 First buoy thrown over - starboard side.
Channel 20. AMP gain = 0db, Hi cuts = 62 Hz, Lo cut = 5 Hz.
Gain in DFS adjusted regularly to reduce overdrives due water path pulse.
RCVR gain increased to 12db, Lo cuts out and Hi cuts to 20 Hz in attempt to nullify water path pulse.

11:30 SP #6400 second buoy thrown in - port side.
Channel 40. AMP gain = 6db, Hi cuts = 20 Hz, Lo cut bypassed.
SP #6295 - Hi cuts changed to 62 Hz
SP #6086 - AMP gain = 12db
SP #5980 - Overdrives at start of DFS records due to water path pulse.
SP #5820 - Stopped receiving from Buoy #2.

13:30 SP #5780 Third buoy thrown in - starboard side.
Channel #20. AMP gain = 0db, Hi cuts = 62 Hz, Lo cuts bypassed.
SP #5378 - Gain = 6db
SP #5300 - Overdrives in DFS due to water path pulse from previous shot - does not affect the data of interest.

15:45 SP #5100 Fourth buoy thrown in - starboard side.
Channel 40. AMP gain = 0db, Hi cuts = 62 Hz, Lo cuts bypassed.
SP #4737 - Gain = 6db
SP #4680 - Input overdrives at beginning of records.

17:45 SP #4440 Fifth buoy thrown in - starboard side
Channel #20. AMP gain = 0db, Hi cuts = 62 Hz, Lo cuts bypassed.
SP # 3862 - Gain - 6db

9 April, 1982

Line # 16(16) DIR 323°

09:00 SP 4210 First sonobuoy thrown - port side
Channel #40. AMP gain = 0db, Hi cuts = 62 Hz, Lo cuts out.
SP #4474 - AMP gain = 6db
SP #4680 - No signal evident on E.P.C. - DFS still recording.

10 April, 1982

Line # 18(11) DIR 246°

21:13 SP #3500 First sonobuoy thrown - port side
Channel #40. AMP gain = 0db, Hi cuts = 62 Hz, Lo cuts out.
SP #4329 - AMP gain = 6db

12 April, 1982

Line # 11(8)B DIR 146°

06:40 SP #3450 First sonobuoy thrown (sixth buoy in all for line #8).
Channel #20. AMP gain = 0db, Hi cuts = 62 Hz, Lo cuts out.
Thrown on starboard side.
SP #2910 - first break no longer on tape (6 seconds)

11:00 SP #1930 Second sonobuoy thrown
Channel #20. AMP gain = 0db, Hi cuts = 62 Hz, Lo cuts out.
Thrown starboard side.
Note: Previous sonobuoy had not yet sunk when this one thrown (still receiving at low signal strength).

252121

12 April, 1982

12:49 SP 1170 - Gain to 6db

REFRACTION FINISHED (NO MORE BUOYS)