096001

OPERATIONS REPORT
MARINE SEISMIC SURVEY
OFFSHORE FLINDERS ISLAND
T-13P

for

UNION TEXAS AUSTRALIA INC.
6TH FLOOR, RATU PLAZA OFFICE TOWER
JALAN JENDRAL SUDIRMAN
JAKARTA
INDONESIA

by

GEOPHYSICAL SERVICE INCORPORATED
P.O. BOX 106
NORTH RYDE. N.S.W. 2113

PARTY 2931: M/V "EUGENE McDERMOTT II"

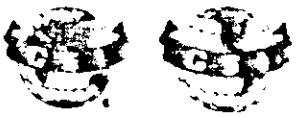
RECORDING DATES: 28 - 30 NOVEMBER, 1982

UTP82-

GSI-709

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS



SECTION I

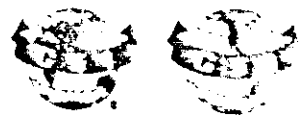
INTRODUCTION

A 2D marine seismic survey was conducted by Geophysical Service Incorporated using the M/V "Eugene McDermott II" in T-13P offshore Flinders Island for Union Texas Australia Inc. between 28 - 30 November, 1982.

The survey consisted of 183.475 kilometres of 48 fold reflection coverage utilising a 2400 metre streamer under continuous tow in conjunction with a Pneumatic Acoustic Energy Source (Airguns). Operations were generally conducted 24 hours a day.

Recordings were made using one set of DFS V instruments with two 10 inch tape 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 Syledis radio positioning system or sat/sonar used in conjunction with a Texas Instruments Configurable Marine System. (See Section II - Survey).



A. SURVEY VESSEL

M/V "Eugene McDermott II"

Flag	:	Panama
Homeport	:	Panama
Trade	:	Foreign Going Seismic Exploration
Owners	:	Geophysical Service Incorporated
Call Sign	:	HO 9376
Length	:	52.73 metres L.O.A.
Breadth	:	12.19 metres
Depth	:	4.27 metres
Draft	:	3.05 - 3.24 metres
Official Number	:	7062-PEXT-1
Gross Tonnage	:	929.89 tonnes
Net Tonnage	:	249.09 tonnes
Electrical Power	:	2 x 250 KVA CAT "D"

B. KEY PERSONNEL

Party Manager	:	P. Miller
Technical Co-ordinator	:	L. Williams
Instrument Engineer	:	T. Rogers
System Operators	:	A. Welfare
		M. Wilson
		S. Stanimirovic
Survey Operators	:	T. Rogers
		W. Lloyd
Quality Control	:	M. van Kampen
		R. George
Compressor Engineers	:	M. Trigg
		T. Hughes
Airgun Mechanics	:	R. Barnes
		A. Temmen
Master	:	M. Gusterson
First Mate	:	G. Nilsen
Boat Manager	:	D. Brown
Boat Administrator	:	W. Lee

SECTION II

EQUIPMENT

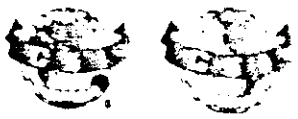
A. INSTRUMENTS

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 2A, 2B and 2C) at 1600 B.P.I.

The DFS V instruments were calibrated for 96 channel, 2 m/second sampling rate with a 128 Hz at 72 db/octave high cut filters and 8 Hz at 18 db/octave low cut filters.

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 test and skew checks. At the termination of each line, a recording of "all ones" was carried out, these recordings are on the last tape designated for each line. Tapes recorded on each transport were frequently replayed on the other transport as a confirmation of readability.

All data was recorded on ½ inch, Indel-Davis Extraseis brand magnetic tape.



A. INSTRUMENTS

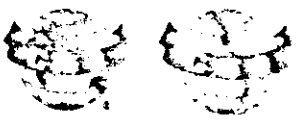
Instrument Details

Recording System	:	DFS V, Serial Number 306
Tape Format	:	SEG B phase encoded, 1600 B.P.I.
Tape Speed	:	79.36 ips
No. Bytes/Data Scan	:	254
No. Words/Header (+ 16 from the Extender Header):		260
Channels (on tape)	:	96
		Timing Word - Aux.Ch.3
		T/B Lengthened - Aux.Ch.2
		Waterbreak - Aux.Ch.1
Gain Control Mode	:	I.F.P.
Sample Period	:	2 m/seconds
Record Length	:	6 seconds
Recording Delay	:	0 seconds
Gain Constants	:	36 db
Final Gain	:	120 db
Dynamic Range	:	84 db (referred to input noise)
Filters - high cut	:	128 Hz at 72 db/octave
- low cut	:	8 Hz at 18 db/octave
Trip Delay & Mode	:	PGC Mode with Variable Delay

B. ANCILLARY EQUIPMENT

Servo Profiler

Manufacturer	:	EPC Labs.
Model	:	4600
Serial Number	:	371
Source	:	Trace Number 94
Record Length	:	4 seconds
Gain Mode (DFS V)	:	P.G.C.
Filters	:	Production Filters

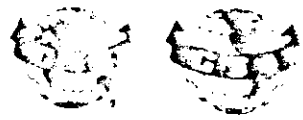


B. ANCILLARY EQUIPMENT

Fathometer

Manufacturer	:	Simrad
Model	:	EA
Conversion Frequency	:	1478 m/sec
Operating Frequency	:	38 KHz
Transducer Position in Relation to Navigation Antenna	:	6.6m Fwd
Instrument Correction for Draft	:	3.4m
Calibrated	:	4 May, 1981

The Fathometer data was collected on both analog chart and CMS navigation tape. The fathometer's scale ratio was kept to a minimum to allow the best definition of the sea floor. Because of the widely varying water depth the scale was changed during most lines, at these times the shotpoint and new scale was marked on the chart display.



B. ANCILLARY EQUIPMENT

Camera

Manufacturer	:	S.I.E.
Model	:	ERC-10C
Number of Channels	:	64 (only 48 + 4 aux. used)
Polarity	:	G.S.I. Normal, Positive Pressure Downbreak

All camera records have a one hundred hertz pipper trace displayed by auxiliary four. The pipper trace is generated by an independent frequency standard located in the camera. The pipper trace is used as a reference to check the DFS V system clock and the tape transport speed while on-line.

C. STREAMER

A G.S.I. manufactured 2400 metre streamer was utilised during this prospect. This streamer consisted of 48, 50 metre 'live' sections, connected together with quick coupling plugs. Each 'live' section consisted of two independent 25 metre length groups. (See plate 4) Each 'live' group contained 15 acceleration cancelling hydrophones connected in parallel.

Generally there were 5 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 130 metres of nylon rope.

Six depth transducers were positioned along the streamer at regular intervals. They were calibrated to the required streamer depth of 12 metres as the streamer was deployed.

Each transducer section contains a single hydrophone which is used as a waterbreak detector. Waterbreak returns from detector number 6 located between group 96 and the front end stretch and waterbreak number 5, located between groups 81 and 80 are used by the streamer offset card in the CMS 1/0 expansion unit to determine offset from centre of gun array to each waterbreak. Offset to waterbreak 6 is also checked by performing a manual offset shot. Return from waterbreak 6 is recorded on DFS V auxiliary channel 1 and replayed on camera record to compare with SOS calculated distance.

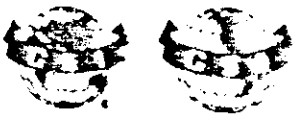
C. STREAMER

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 stretched length of the stretch sections. On occasion, where noted on all observer logs, the offset had to be changed between lines in order to maintain correct streamer ballast. The offset used during this survey varied between a maximum of 214 to a minimum of 169 metres.

The streamer depth control was maintained by proper ballasting and the use of individually addressable remote controlled "Cole" cable levellers.

Traces 80 and 36 were intermittently noisy for several lines and were terminated where necessary.

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



C. STREAMER

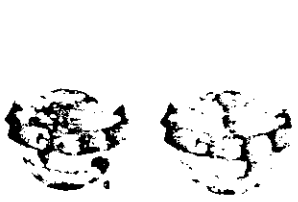
Streamer Details

Length, Centre to Centre	:	2387 metres
Group Interval	:	25 metres
Live Section Length	:	50 metres
Number of Hydrophones/ Group	:	15
Hydrophone Interval	:	1.67 metres
Hydrophone Type	:	T.I. - A.C.R.
Number of Stretch Sections		
- Front End	:	5
- Tail End	:	2
Skin Type	:	Tropical
Location of Depth Transducers Between Groups	:	FS/96, 80/81, 60/61, 40/41, 20/21, 1/TS
Location of Depth Controllers	:	On All Depth Transducers
Location of Waterbreaks	:	Number 6 - FS/96 Number 5 - 80/81
Near Group	:	Trace 96
Streamer Sensitivity	:	5.15 mv/mbar

D. ENERGY SOURCE

An Electro-Pneumatic Acoustic Energy Source known as airguns was used for reflection work. An airgun has only two moving parts, a shuttle and solenoid. The airgun consists of an upper air chamber and a lower air chamber, connected by an air passage through a moveable 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. The rapid expulsion of air creates the bubble and resultant pulse. The air bubble collapses in a manner similar to that caused by explosives except that its period is controlled and is placed in the desired seismic frequency band.

The energy source used by the "McDermott" 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.



D. ENERGY SOURCE

Attached, plates 5A, 5B and 5C are the diagrams showing airgun utilisation, spacing and displays of the amplitude and energy spectra of the 4075 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 Instruments 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.

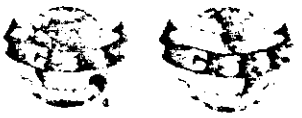
The TIGER also performed a quality control function, by indicating with individual gun L.E.D. displays, the status of a gun if it was not operating correctly, either self fire or no fire. The airgun performance was logged on both the CMS navigation tape and printer log. The TIGER operates in conjunction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

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

D. ENERGY SOURCE

4075 Cubic Inch Airgun Array

Operating Volume	:	4075 cubic inches
Total Spare Volume	:	770 cubic inches
Operating Pressure	:	1600 - 2000 P.S.I.
Operating Depth	:	21 feet, +/- 3 feet
Timing Control	:	TIGER
Firing Delay	:	51.2 m/seconds
Compressors	:	3 Norwalk (2 in use)
		3 Le Roi (2 in use)
Setback (Distance from Syledis Antenna to Centre of Array)	:	54.34 metres
Distance from Stern to Centre of Array	:	29.04 metres



E. SURVEY

The primary navigation system used during the survey was Syledis, a precise range/range system operated by G.S.I. The syledis 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 990 computers, a system co-ordinator, TIGER airgun controller, satellite receiver, two Houston Instrument trackplotters (one each in the instrument room 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 25 metres of travel along the preplotted survey lines.

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

Prior to the "McDermott" reaching the prospect area the Syledis equipment had been calibrated onshore to determine the delays for each station. No baseline crossings were possible as all the baselines were across land. The accuracy of the Syledis navigation was confirmed by taking three way fixes prior to the commencement of the survey.

E. SURVEY

The following mobile and beacons were calibrated with the resulting delay settings.

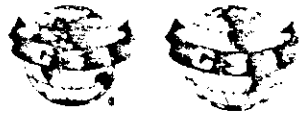
Beacon	Station	Position	Delay
03	Vinegar Hill	040 12 15.35S 148 14 47.38E	3953
04	Furneaux Lookout	040 00 33.27S 148 06 00.77E	3952
05	Holloway Point	039 43 45.58S 147 57 40.00E	3952

CMS software version 602-25 and smart QC version 1.1 were used for all of the prospect.

Syledis was used as the primary navigation system, acting both as a fix system and a velocity system when excessive water depths prohibited use of the sonar.

On occasions when weather conditions did not permit the use of Syledis, a combination of satellite positioning with sonar or manual velocities was implemented.

Due to poor weather conditions at the commencement of the survey, problems with the Syledis navigation system were experienced. At times it was necessary to navigate using satellite positioning with either manual or sonar velocities depending on the water depth (the sonar loses bottom tracking in approximately 200 metres of water).



E. SURVEY

The poor signal quality resulted in the occasional missed shotpoint (the guns failing to fire when the shotpoint position is reached). The weather improved on the afternoon of 29 November along with the Syledis signal strength. No further navigation related problems were encountered.

E. SURVEY

Survey Details

Primary System	:	Syledis
Type	:	Range/Range
Survey Company	:	G.S.I.
Operating Frequency	:	427.0921 MHz
Ship's Antenna Height (above sea level)	:	21.5m
Antenna Location from Stern	:	25.3m

SECTION III

OPERATIONS

A. OPERATIONS DISCUSSION

Moderate weather and sea conditions prevailed for the majority of this survey. Strong currents running down the east coast of Australia off the continental shelf often caused steering difficulties and large feather angles on lines that ran into deep water.

Poor Syledis navigation signals were responsible for a large number of missed shotpoints during line T13P-22.

B. PROSPECT DETAILS

DATE	LINE NO.	SHOTPOINTS	KMS	COMMENTS
28 Nov	T13P-16	0001-0600	15.000	To Be Continued
29 Nov	T13P-21	0001-0728	18.200	Complete
	T13P-22	0001-1025	25.625	Complete
	T13P-23	-	-	To Be Reshot
	T13P-23A	0001-0430	10.750	Complete
	T13P-16A	0001-0282	7.050	Complete
	T13P-21A	0001-0934	23.350	Complete
30 Nov	T13P-20	0001-0740	18.500	Complete
	T13P-19	0001-0870	21.750	Complete
	T13P-18	0001-0716	17.900	Complete
	T13P-17	0001-1014	25.350	Complete

C. STATISTICS

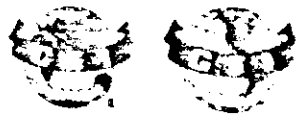
First Recording Day	:	28 Novmeber, 1982
Last Recording Day	:	30 November, 1982
Number of Lines	:	11
Number of Kilometres	:	183.475
Number of Shotpoints	:	7338
Average Kilometres per Recording Day	:	61.158
Seismic Data To	:	G.S.I., Perth
Navigation Data To	:	Wescom, Perth

D. PERMITTING

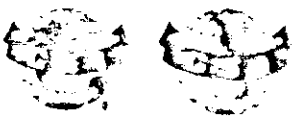
The Marine Operations Centre, Canberra, was advised as to the ship's location throughout the survey to enable the necessary navigation warnings to be issued.

E. FIELD TAPE LOG INVENTORY

DATE	TAPE NO.	LINE NO.	SHOTPOINTS
28 NOV 82	700256	T13P-16	001 - 66
	700257		067 - 136
	700258		137 - 205
	700259		206 - 273
	700260		274 - 340
	700261		341 - 409
	700262		410 - 477
	700263		478 - 546
	700264		547 - 619
	700265		620 - 696
	700266		698 - 768
	700267		769 - 848
	700268		849 - 925
	700269		826 - 938
29 NOV	700270	T13P-21	001 - 070
	700271		071 - 140
	700272		141 - 211
	700273		212 - 288
	700274		289 - 362
	700275		363 - 439
	700276		440 - 510
	700277		511 - 592
	700278		593 - 675
	700279		676 - 728
	700280	T13P-22	001 - 080
	700281		082 - 166
	700282		167 - 246
	700283		247 - 327



29 NOV	700284	T13P-22	328 - 406
	700285		407 - 494
	700286		495 - 569
	700287		570 - 645
	700288		646 - 718
	700289		719 - 792
	700290		793 - 864
	700291		865 - 938
	700292		939 - 1014
	700293	T13P-22	1015 - 1024
	700294	T13P-23	DO NOT PROCESS
	700295	T13P-23A	001 - 069
	700296		070 - 142
	700297		143 - 214
	700298		215 - 288
	700299		289 - 358
	700300		360 - 382
	700301		383 - 430
	700302	T13P-16A	001 - 066
	700303		067 - 135
	700304		136 - 203
	700305		204 - 272
	700306		273 - 340
*	700307	NO DATA	DO NOT PROCESS
	700308		345 - 407
	700309	T13P-21A	001 - 066
	700310		067 - 134
	700311		135 - 202
	700312		203 - 271
	700313		272 - 339
	700314		340 - 408
	700315		409 - 477



29 NOV	700316	T13P-21A	478 - 546
	700317		547 - 614
	700318		615 - 683
	700319		684 - 751
	700320		752 - 820
	700321		821 - 888
	700322		889 - 934
30 NOV	700323	T13P-20	001 - 066
	700324		067 - 082
	700325		083 - 150
	700326		151 - 219
	700327		220 - 288
	700328		289 - 357
	700329		358 - 425
	700330		426 - 494
	700331		495 - 562
	700332		563 - 631
	700333		632 - 699
	700334	T13P-20	700 - 740
	700335	T13P-19	001 - 066
	700336		0067 - 0135
	700337		136 - 204
	700338		205 - 273
	700339		274 - 341
	700340		342 - 410
	700341		411 - 477
	700342		478 - 547
	700343		548 - 615
	700344		616 - 684
	700345		685 - 752

30 NOV	700346	T13P-19	753 - 821
	700347		822 - 870
	700348	T13P-18	001 - 066
	700349		067 - 135
	700350		136 - 203
	700351		204 - 272
	700352		273 - 340
	700353		341 - 409
	700354		410 - 477
	700355		478 - 546
	700356		547 - 614
	700357		615 - 683
	700358		684 - 716
	700359	T13P-17	001 - 066
	700360		067 - 135
	700361		136 - 204
	700362		205 - 273
	700363		274 - 345
	700364		346 - 414
	700365		415 - 482
	700366		483 - 550
	700367		551 - 619
	700368		620 - 687
	700369		688 - 755
	700370		756 - 822
	700371		823 - 891
	700372		892 - 959
	700373		960 - 1014

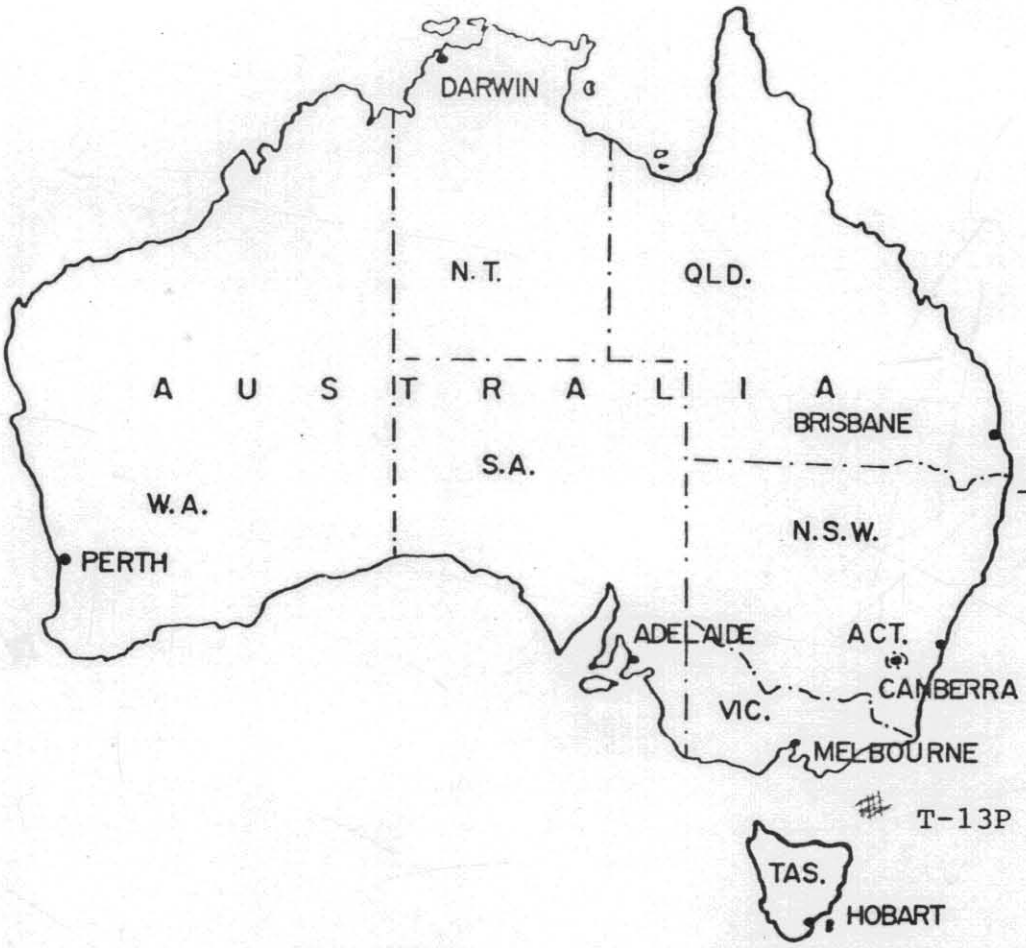
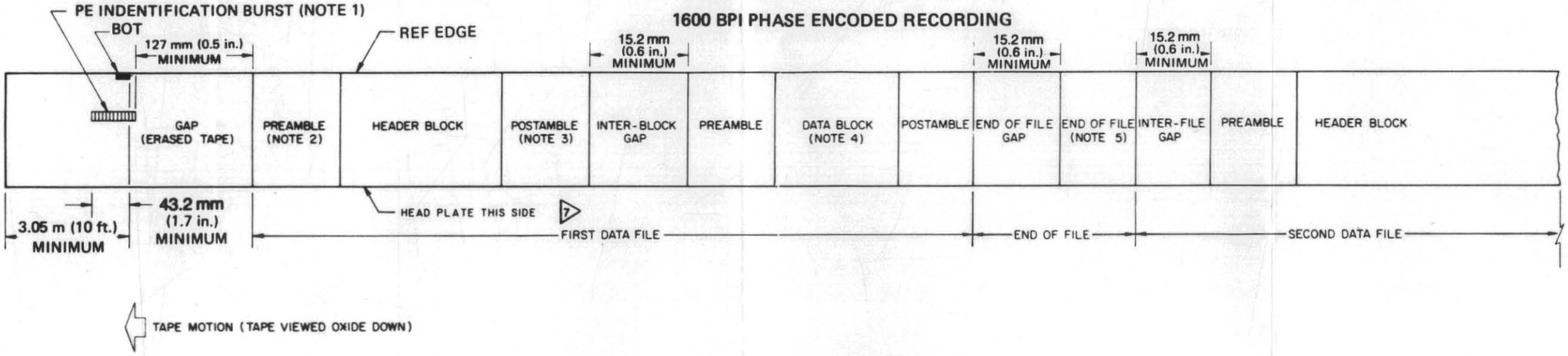


PLATE - LOCATION OF PROSPECT

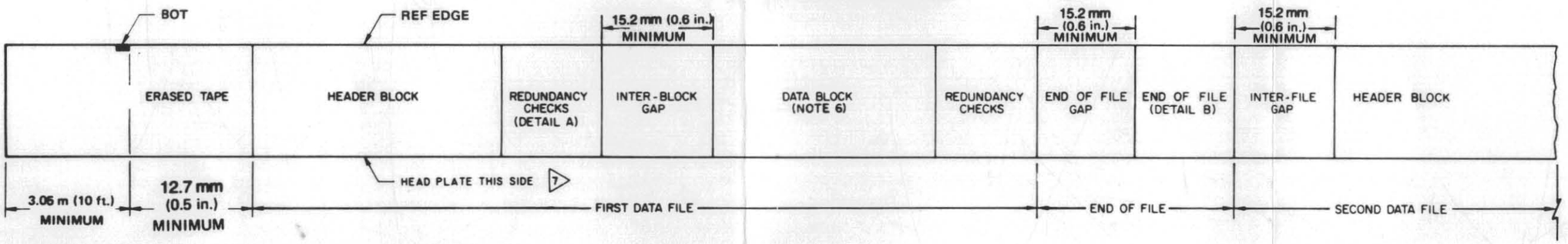
5 cm

GSI-709

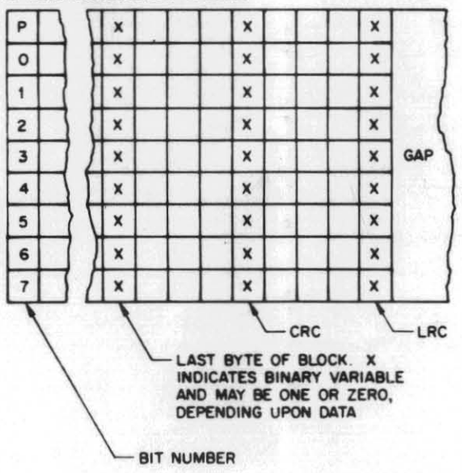
1600 BPI PHASE ENCODED RECORDING



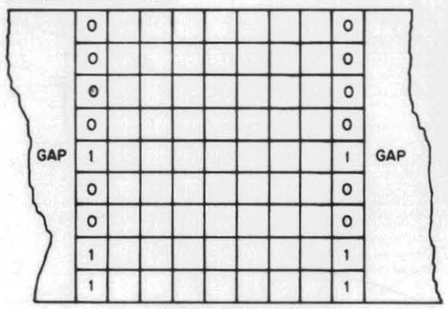
800 BPI NRZI RECORDING



A NRZI REDUNDANCY CHECKS



B. NRZI END OF FILE



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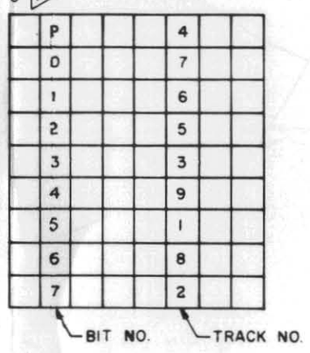


5 cm

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.

096032

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_1-M_6 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)			TYPICAL PACKED BCD VALUE
P			P
0			8
1			4
2			2
3			1
4			8
5			4
6			2
7			1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24				
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
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
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
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
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
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
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
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
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
FILE NUMBER		FORMAT CODE		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	

			24 + 2n												36 + 2n (NOTE 3)
P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
0	0	0	0	1	0	D	0	D	0	D	0	D	0	0	0
0	0	0	0	0	0	D	0	D	0	D	0	D	0	0	0
1	0	1	0	1	0	D	0	D	0	D	0	D	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GC	GW	GC	GW	0	0	0	0	0	0	0	0	0	0	0	0
GC	GW	GC	GW	0	0	0	0	0	0	0	0	0	0	0	0
GC	GW	GC	GW	0	0	0	0	0	0	0	0	0	0	0	0
GC	GW	GC	GW	0	0	0	0	0	0	0	0	0	0	0	0
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	

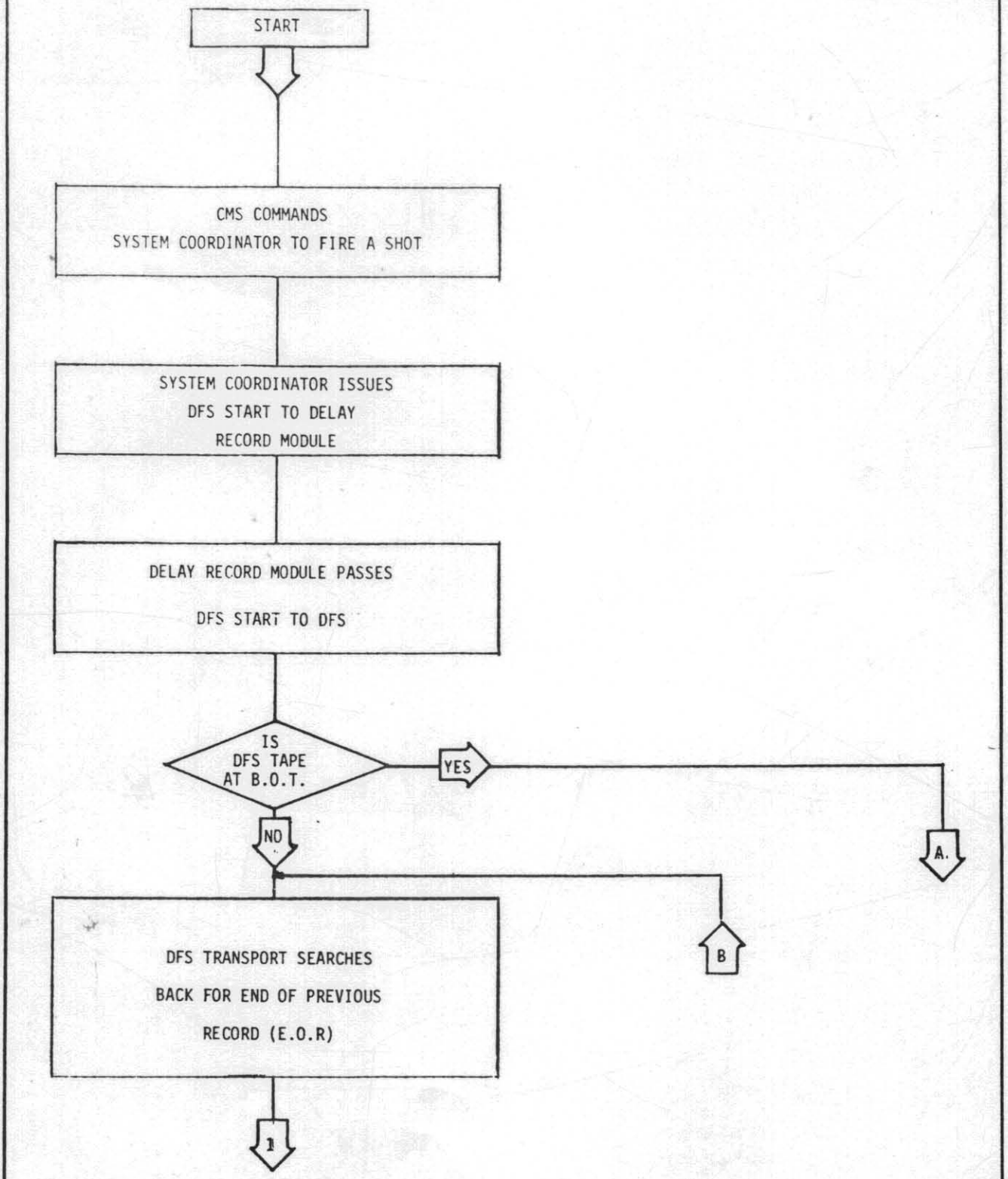
DATA BLOCK

BIT NUMBER (SCHEMATIC)		TYPICAL DATA VALUE	
P		P	P
0		S	2^6
1		2^{13}	2^5
2		2^{12}	2^4
3		2^{11}	2^3
4		2^{10}	2^2
5		2^9	2^1
6		2^8	2^0
7		2^7	0

FIRST DATA SCAN

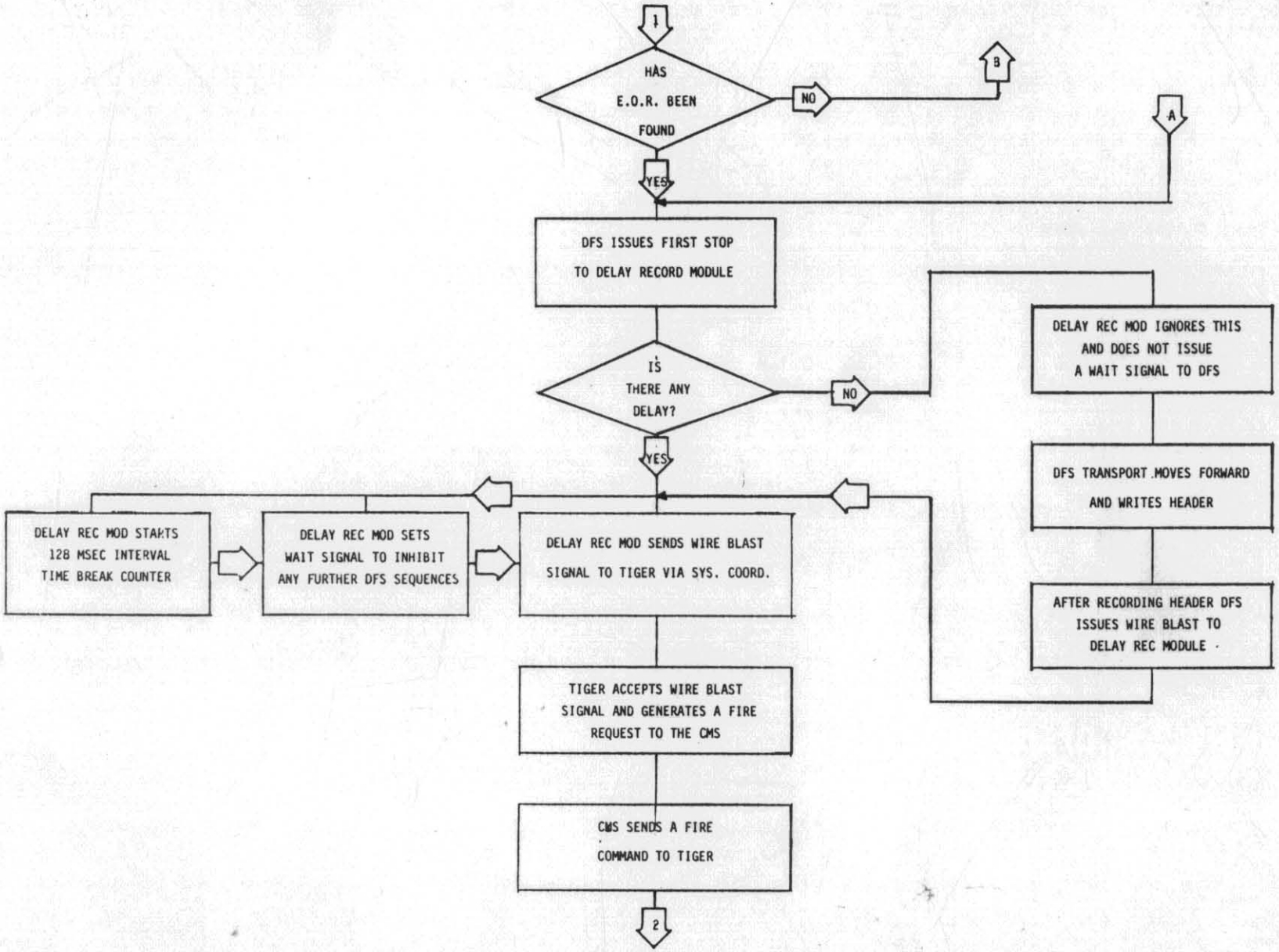
P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
W_1	W_3	W_5	W_7	T_1	T_8	Q_S	Q_8	Q_S	Q_8	Q_S	Q_8	Q_S	Q_8	G_1	G_3	Q_S	Q_8	Q_S	Q_8	Q_S	Q_8	Q_S	Q_8	G_5	G_7	Q_S	Q_8
W_1	W_3	W_5	W_7	T_2	T_9	Q_1	Q_9	Q_1	Q_9	Q_1	Q_9	Q_1	Q_9	G_1	G_3	Q_1	Q_9	Q_1	Q_9	Q_1	Q_9	Q_1	Q_9	G_5	G_7	Q_1	Q_9
W_1	W_3	W_5	W_7	T_3	T_{10}	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}
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}
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}
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}
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}
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
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	

P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
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
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
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}
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}
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}
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}
Q_6	Q_{14}	CH	CH	CH	CH	T_7	T_{14}	Q_6	Q_{14}	CH	CH	CH	CH			Q_6	Q_{14}
Q_7	0	1	1	1	1	0	0	Q_7	0	1	1	1	1			Q_7	0
SEIS n		SYNC GROUP				AUX 1		SEIS n		SYNC GROUP						SEIS n	
FIRST DATA SCAN		SECOND DATA SCAN								LAST DATA SCAN							


START
CMS COMMANDS
SYSTEM COORDINATOR TO FIRE A SHOT
SYSTEM COORDINATOR ISSUES
DFS START TO DELAY
RECORD MODULE
DELAY RECORD MODULE PASSES
DFS START TO DFS
IS
DFS TAPE
AT B.O.T.
YES
NO
A.
B
DFS TRANSPORT SEARCHES
BACK FOR END OF PREVIOUS
RECORD (E.O.R)
1

GSI-709

PLATE 3B



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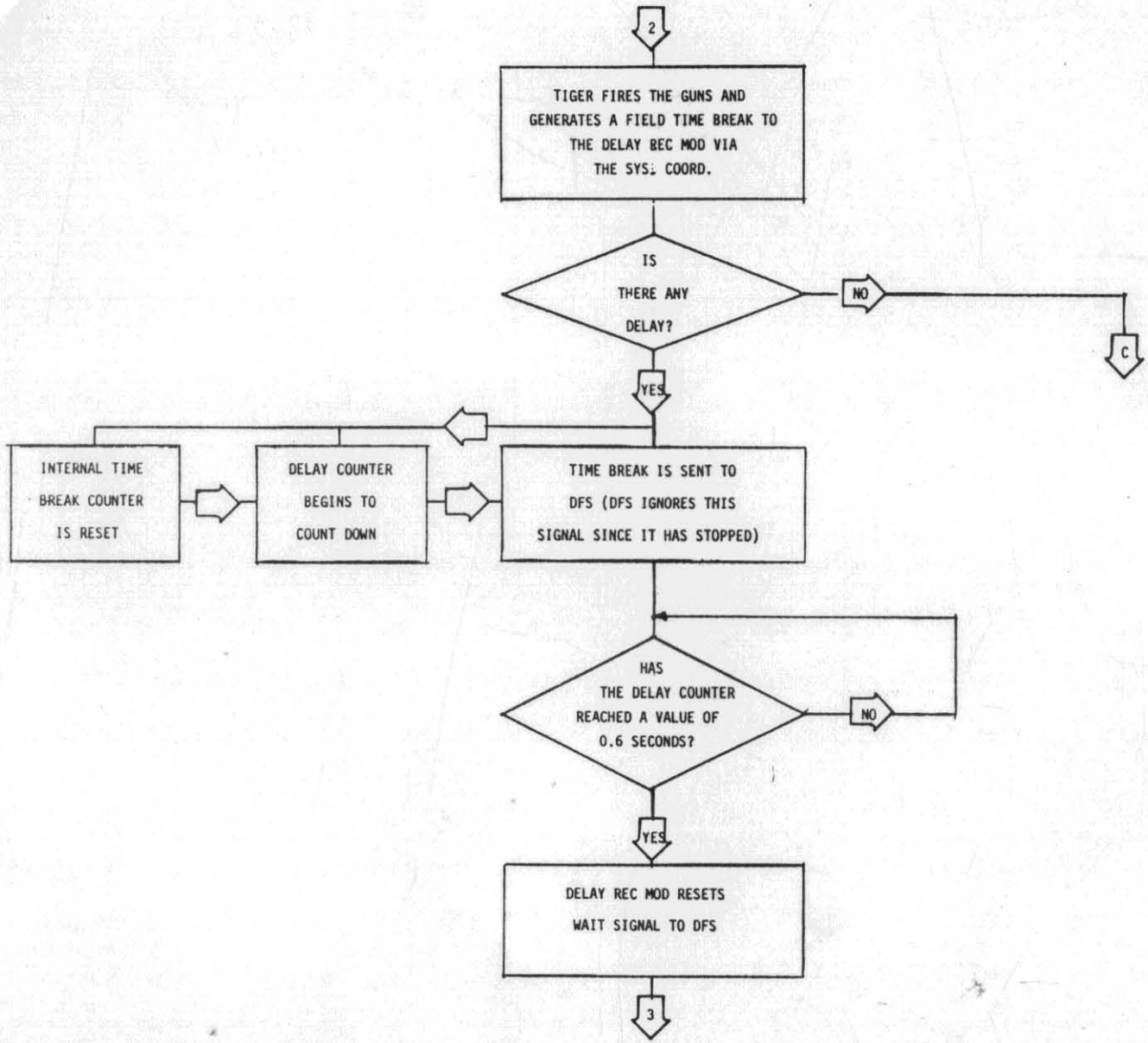
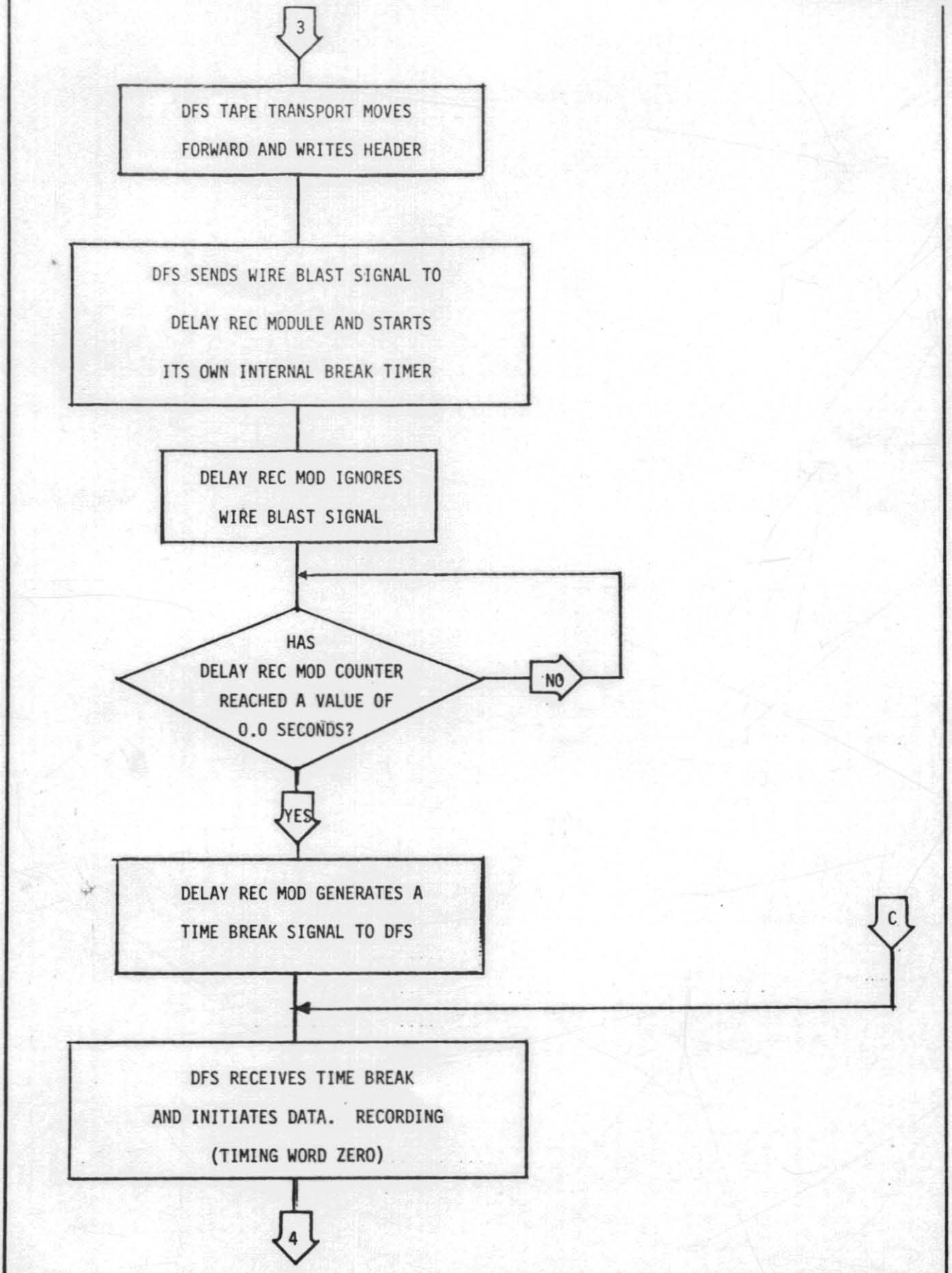
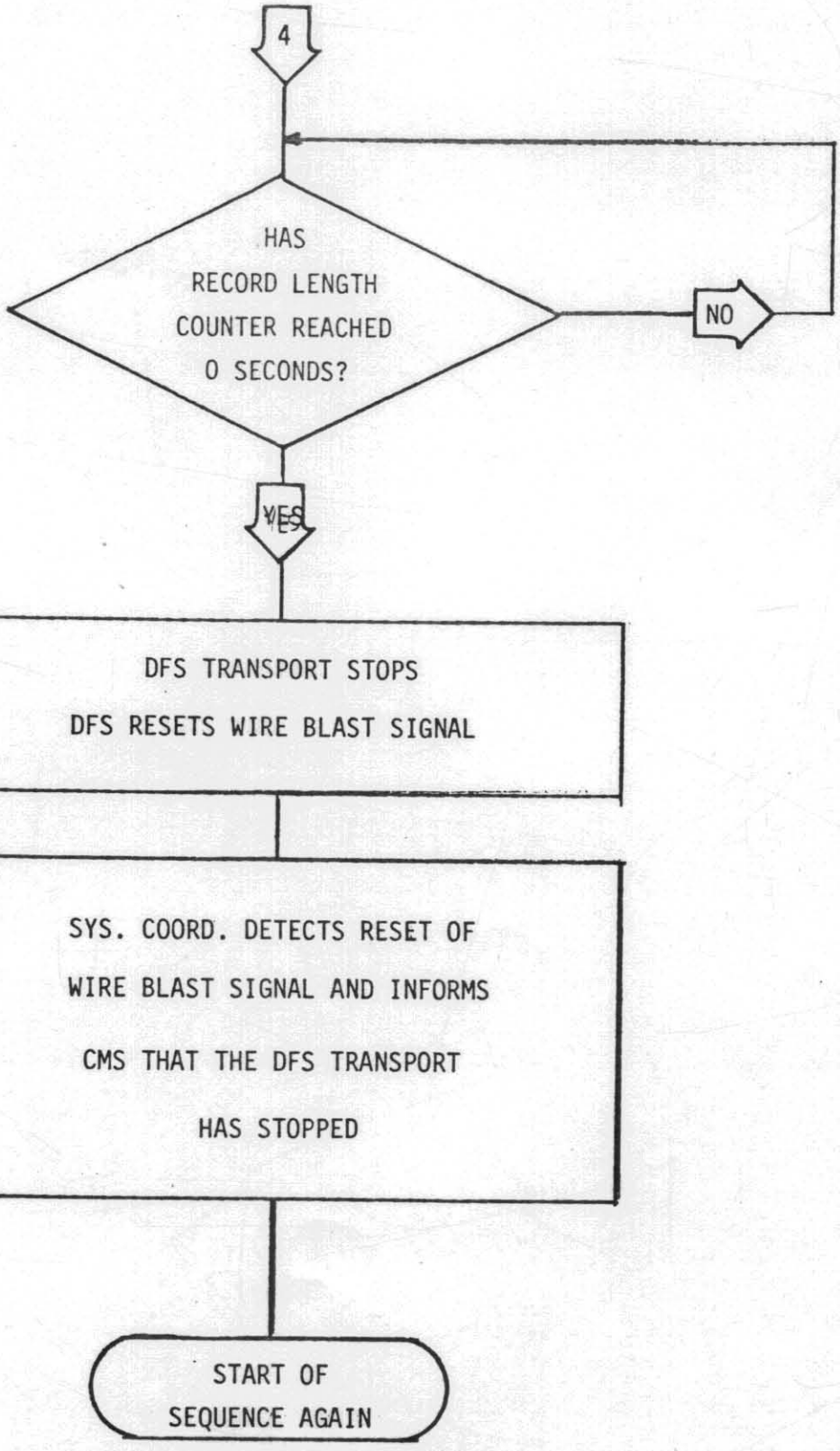

2
TIGER FIRES THE GUNS AND GENERATES A FIELD TIME BREAK TO THE DELAY REC MOD VIA THE SYS. COORD.
IS THERE ANY DELAY?
NO
C
YES
INTERNAL TIME BREAK COUNTER IS RESET
DELAY COUNTER BEGINS TO COUNT DOWN
TIME BREAK IS SENT TO DFS (DFS IGNORES THIS SIGNAL SINCE IT HAS STOPPED)
HAS THE DELAY COUNTER REACHED A VALUE OF 0.6 SECONDS?
NO
YES
DELAY REC MOD RESETS WAIT SIGNAL TO DFS
3

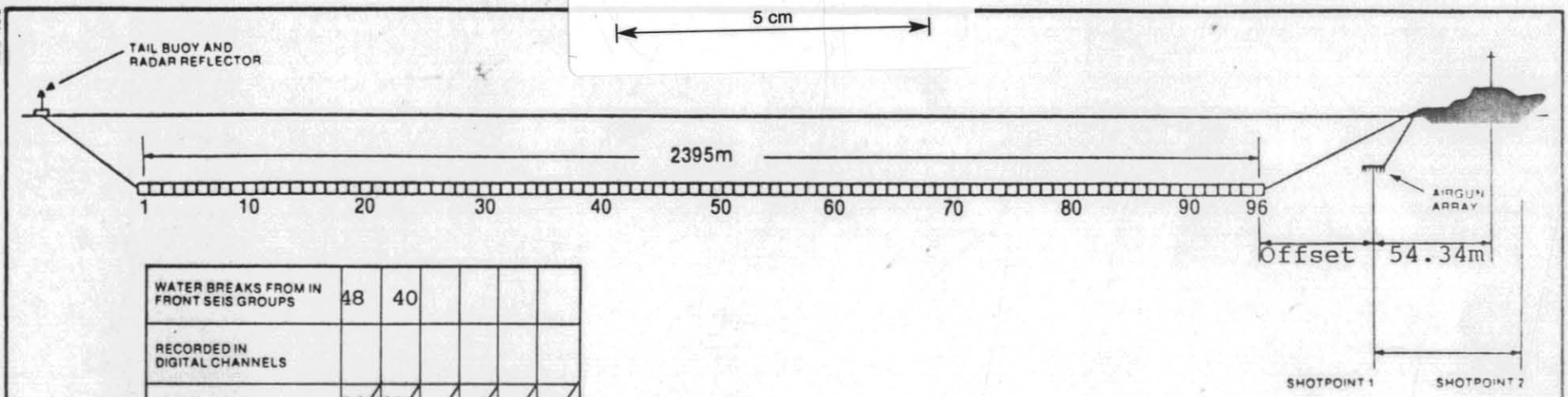

3
DFS TAPE TRANSPORT MOVES FORWARD AND WRITES HEADER
DFS SENDS WIRE BLAST SIGNAL TO DELAY REC MODULE AND STARTS ITS OWN INTERNAL BREAK TIMER
DELAY REC MOD IGNORES WIRE BLAST SIGNAL
HAS DELAY REC MOD COUNTER REACHED A VALUE OF 0.0 SECONDS?
NO
YES
DELAY REC MOD GENERATES A TIME BREAK SIGNAL TO DFS
C
DFS RECEIVES TIME BREAK AND INITIATES DATA. RECORDING (TIMING WORD ZERO)
4

GSI-709


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

GSI-709

GSI-709



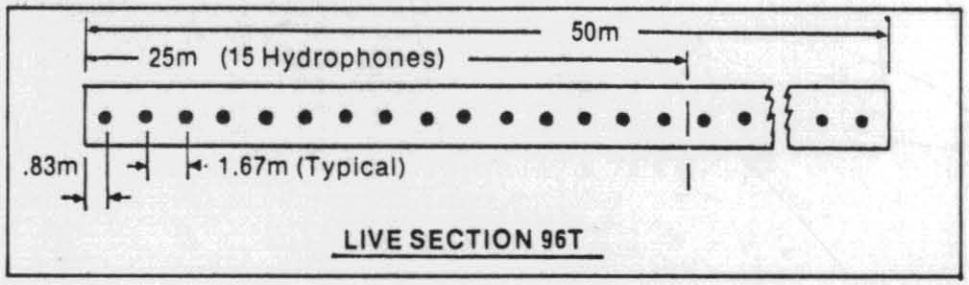
WATER BREAKS FROM IN FRONT SEIS GROUPS	48	40				
RECORDED IN DIGITAL CHANNELS						
DISPLAYED ON SEISMOGRAPH TRACES	64	63				

DEPTH TRANSDUCER NUMBERS	1	2	3	4	5	6
AT/NEAR SEIS GROUP NUMBERS	S/1	10/11	20/21	30/31	40/41	48/S

DEPTH CONTROLLER AT SEIS GROUP NUMBERS	1	10	20	30	40	

NYLON STRETCH	
PIG SECTIONS	

6 TRANSDUCER SECTIONS 4M LONG



LIVE SECTION 96T

MARINE CABLE DIAGRAM

2400 METRES

(OFFEND SPREAD — 96 GROUPS)

G.S.I. PARTY: 2931

SHIP: M/V "EUGENE McDERMOTT II"

CLIENT: UNION TEXAS AUST. INC.

AREA: T-13P

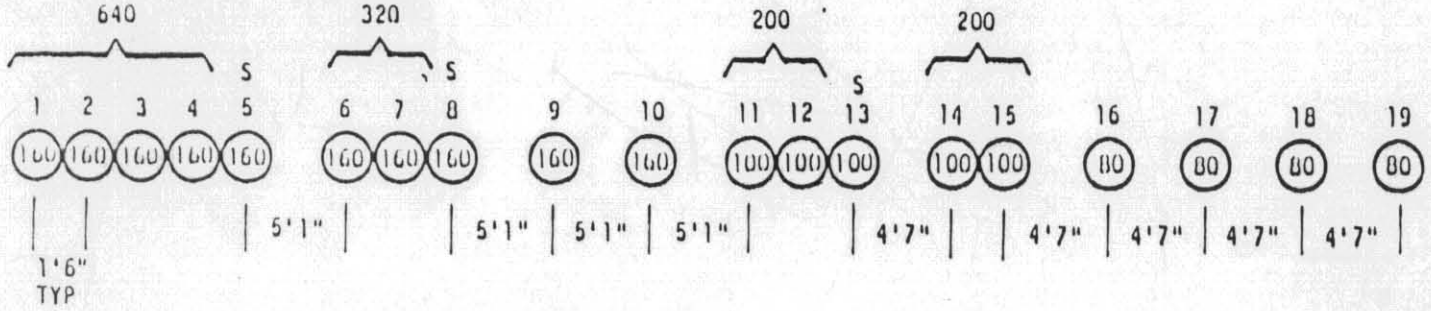
DATE: 28 - 30 NOVEMBER, 1982

PLATE 4

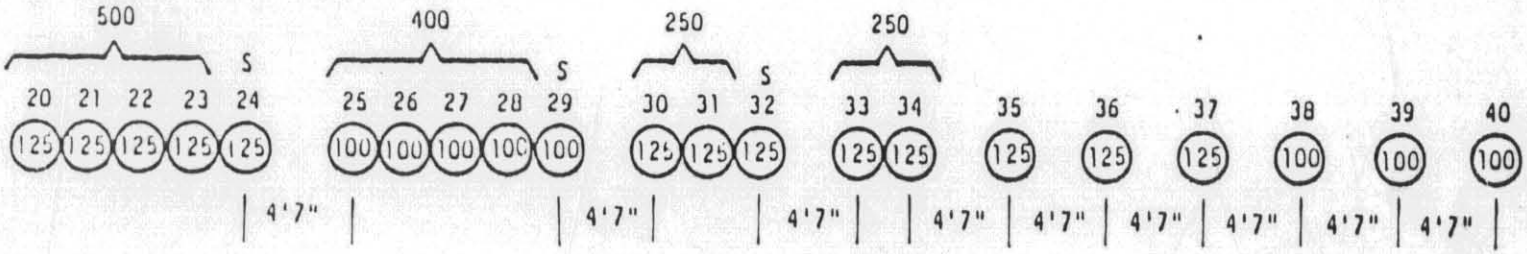
0960039

4000-CUBIC-INCH AIR GUN ARRAY

STARBOARD STRING (56'9", 19 GUNS)



PORT STRING (57'9", 21 GUNS)



25'-30'

NOTES:

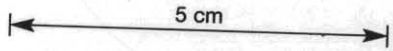
1. GUN SIZE IN CUBIC INCHES
2. GUN SPACING IN FEET AND INCHES; CENTERLINE-TO-CENTERLINE SPACING OF ALL COALESCED GUNS IS 1'6"
3. SPARE GUNS DENOTED BY "S"
4. GUNS 1-10 ARE MOD III PC, GUNS 11-40 ARE MOD II PC
5. MEASURED AVERAGE PERFORMANCE:

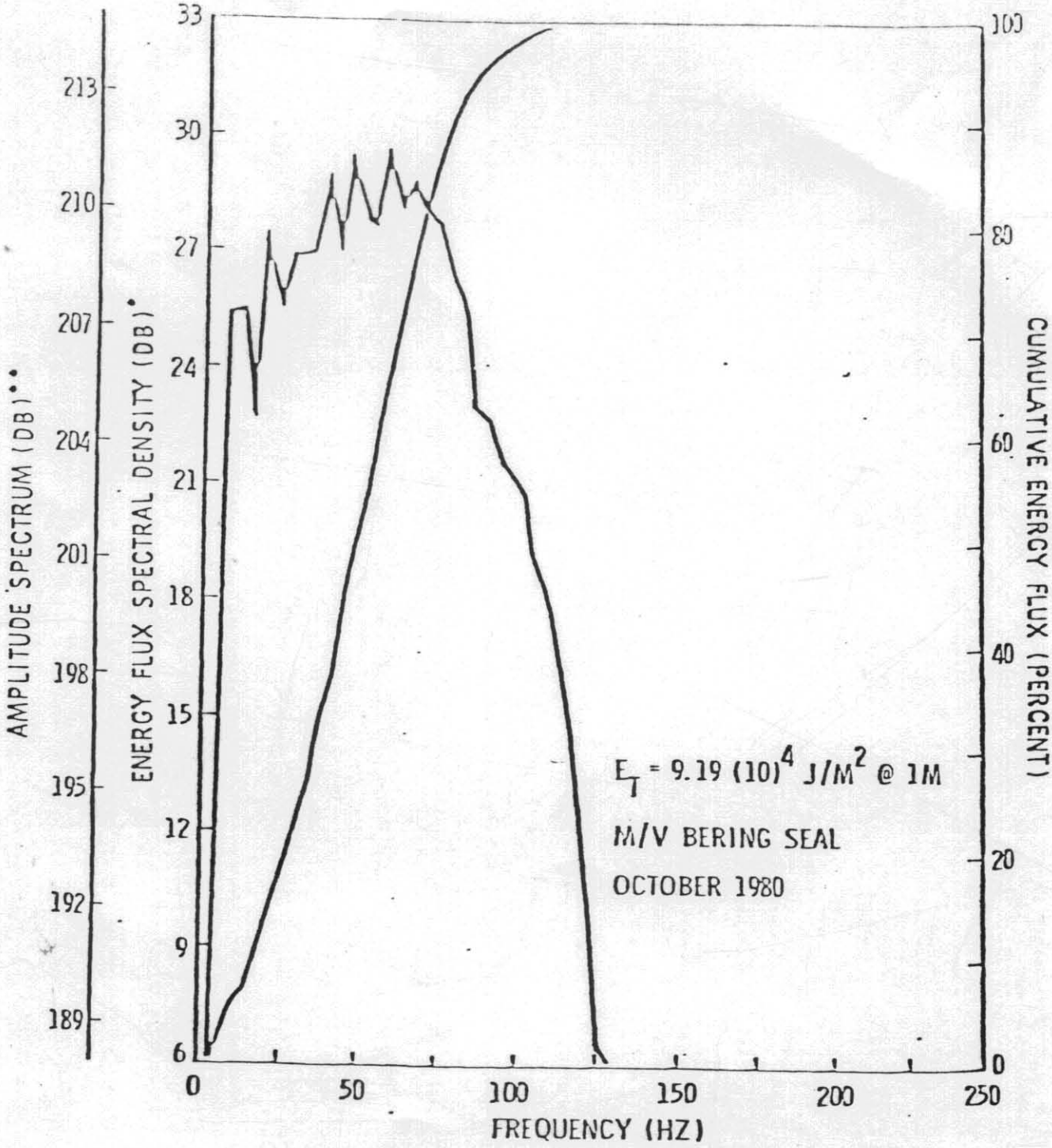
   P_a = 80 BAR-M (P-P, 0-125 HZ)

   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	



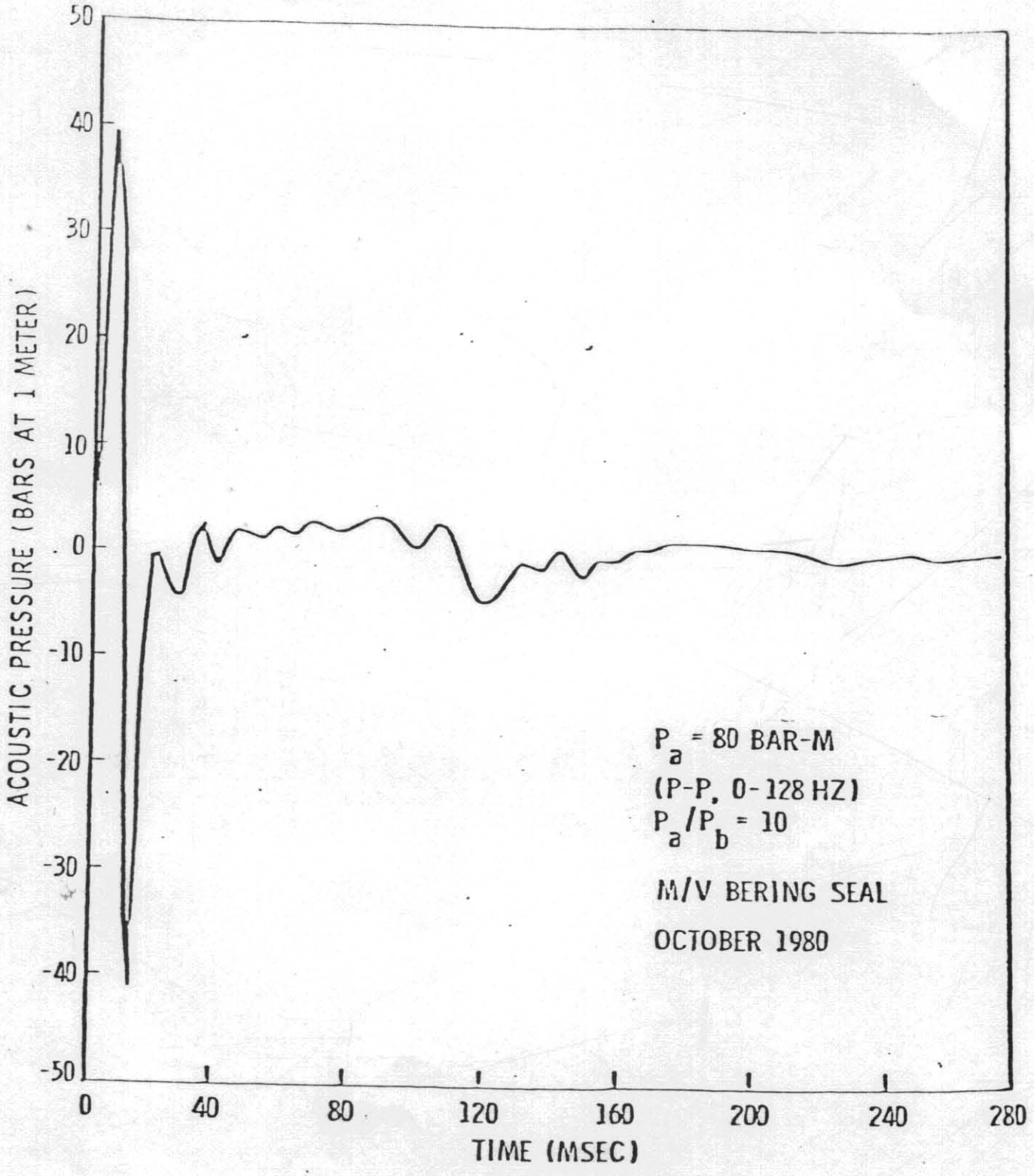


• DB REFERRED TO 1 JOULE/M•• 2/HZ AT 1 METER

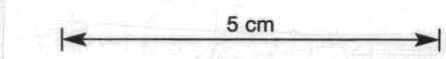
•• DB REFERRED TO 1 MICROPASCAL/HZ AT 1 METER

Amplitude and Energy Spectra of 4000 PNU-CON Array

5 cm



Farfield Signature of 4000 PNU-CON Array



OFFSET DETERMINATION

Physical Measurement

1.	Number of stretch sections:		3 x 61 + 58m lead in
2.	Total length of stretch sections	:	241m
3.	Half group length (near group)	:	7.5m
4.	Distance from boat to near group centre	:	(1 + 2 + 3) = 248.5m
5.	Distance from boat to centre of source	:	27.5m
6.	Calculate offset (4 - 5 = 6)	:	221m

Time Measurement

1.	Record time to depth transducer to gun fired	:	197 msecs
2.	Time delay to Tiger	:	51.2 msecs
3.	Speed of sound in water (from Geonav)	:	1.48 m/ms
4.	(1 - 2) x 3 = 4	:	215.78m
5.	Distance from gun fired to array centre	:	-2.55m
6.	Distance from transducer to near trace centre	:	4.5m
7.	Offset (4 + 5 + 6 = 7)	:	217.7m

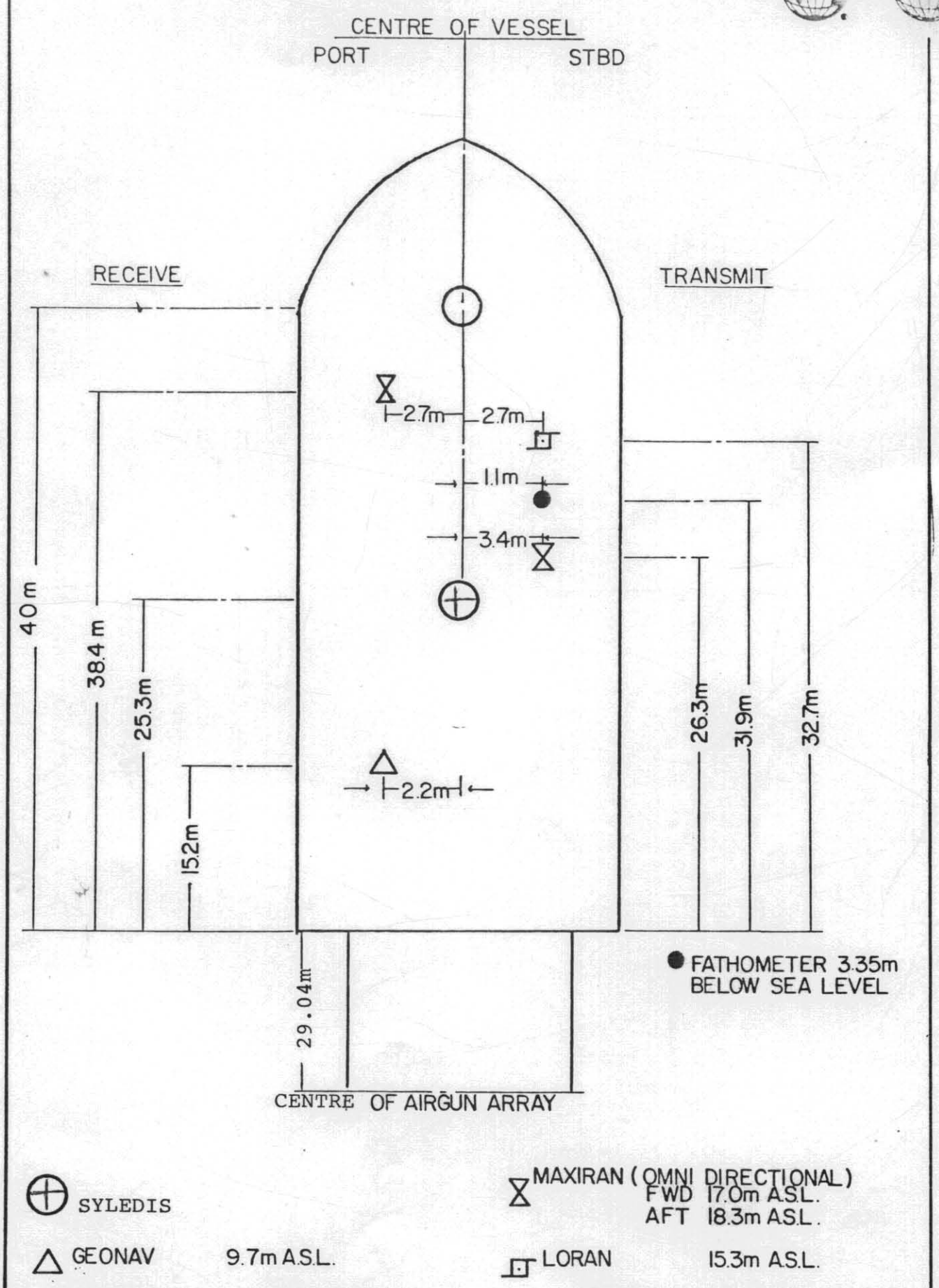
A.D.L.

Offset is computed and recorded on A.D.L. Calculation is made by offset sensor

THE ABOVE IS AN EXAMPLE ONLY

096044

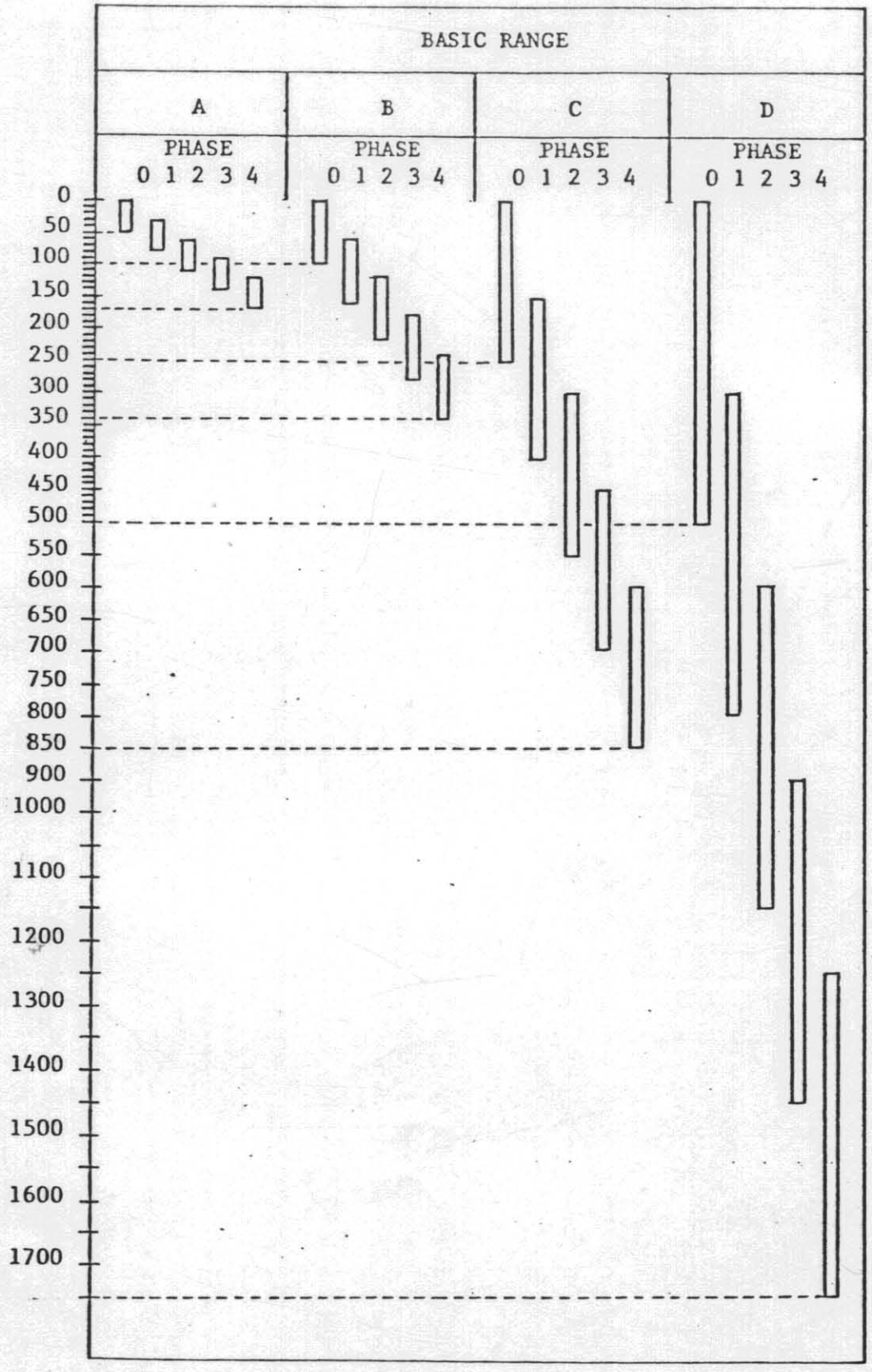
PLATE 7



GSI-709

5 cm

SIMRAD MODEL EA FATHOMETER SCALE



GSI-709

5 cm

096046

DIGITAL DATA PROCESSING REPORT
T13/P 1982 SEISMIC SURVEY

Prepared For

UNION TEXAS AUSTRALIA INC.

Prepared By

GEOPHYSICAL SERVICE INTERNATIONAL

A DIVISION OF TEXAS INSTRUMENTS AUSTRALIA LIMITED

(INCORPORATED IN SOUTH AUSTRALIA)

UTP-82

TABLE OF CONTENTS

INTRODUCTION

The T13/P 1982 survey was conducted by G.S.I.'s M/V "McDermott" in permit T13/P during November of 1982 for Union Texas Australia Inc.

Approximately 180 kilometres of 48 fold reflection coverage was shot by the M/V "McDermott" utilising a 96 trace, 2400 metre streamer under continuous tow. A tuned array of airguns of 4000 cu. in. capacity was used as an energy source and the data was recorded by a 96 trace DFS V system onto ½ in. magnetic tapes in SEG B format.

Data processing was performed by G.S.I. at their Perth Processing Centre from December 1982 to January 1983 and final films were produced in the month of January 1983.

PRODUCTION PROCESSING SEQUENCE

The following is a description of the processing sequence used. Production parameters can be found in Appendix A. A short description of each process can be found in Appendix B.

1. Preprocessing

a. Line File
b. Airgun Delay Correction
c. Trace Edit
d. True Amplitude Recovery
e. Resample
f. Predeconvolution Ramp
g. Designature
h. Common Depth Point Gather
i. Trace Equalisation
j. Output of Near Trace and displayed for Q.C. purposes.

2. Velocity Analysis

Velocity Analysis was performed by G.S.I.'s Velscan velocity analysis module over nine consecutive depth points. This analysis was performed after trace equalisation of the common depth point gather. The analyses were performed at regular intervals of 2 kilometres. The input to the program are common depth point gathers corrected for shot and seismometer depth and airgun delay with Designature applied.

The Velscan display consists of (from left to right): a filtered common depth point gather record (the fifth depth point in each set of nine depth points) without normal moveout corrections applied; the same common depth point gather record as above, after applying normal moveout corrections using five user input velocity function; common depth point stack panels of nine depth points after applying normal moveout corrections using the same five velocity functions as above; a velocity scattergram; an amplitude plot showing relative amplitudes of the events plotted on the scattergram; a plot showing the dips of the event plotted on the scattergram; an event listing table which gives a list of the Root Mean Square Velocity, time, amplitude, dip and moveout for the maximum absolute event in each 100 msec, time gate.

The velocity analyses were interpreted by G.S.I. and the functions interpreted were used to compute normal moveout corrections in the post processing stage.

3. Post-Processing

The common depth point gathers output from the preprocessing stage (i), together with the velocities interpreted from the velocity analyses, formed the input to the post-processing sequence. The following processes were performed:

a. Shot and Receiver Statics

b. Normal Moveout (NMO)

c. Common Depth Point Stack

d. Wave Equation Migration

e. Time Variant Filtering

f. Time Variant Scaling

g. Time to Depth Conversion

4. Display

Final stack, raw stack and single fold cover sections were displayed on paper by a Gould plotter for Q.C. purposes. The final stack was then plotted on film using a Geospace drum plotter.

EXPERIMENTATIONS

A. The following tests were performed on line UTP82-2, shot by M/V "McDermott", to optimise production parameters.

1. TRUE AMPLITUDE RECOVERY (TAR)

Location: SP 1005 and 12

(i) Alpha = 3db/sec; T2 = 4.0 sec.

(ii) Alpha = 4db/sec; T2 = 4.0 sec.

(iii) Alpha = 5db/sec; T2 = 4.0 sec.

2. VELOCITY FILTERING (VEF)

Location: SP 1005 and 12
Using TAR: 3db/sec, T2 = 5.0 sec. and Predeconvolution Ramp (PDR)

(i) VEF (cuts:+9 and -6 msec/tr)

(ii) VEF (cuts:+12 and -8 msec/tr)

(iii) VEF (cuts:+14 and -8 msec/tr)

(iv) VEF (cuts:+16 and -10 msec/tr)

(v) TAR/PDR only

(vi) Noise Analysis of (i), (ii), (iii), (iv) and (v)

3. DESIGNATURE

A. Locations: SP 1-96, SP 903-1004
Using TAR: 3db/sec, T2 = 5.0 sec and PDR

(i) DSG only stack

(ii) VEF (+14, -8 msec/tr)/DSG stack

(iii) VEF (+11, -6 msec/tr)/DSG stack

B. Locations: SP 1-96, SP 903-1004
Using: 2:1 mix, TAR: 3db/sec, T2 = 5.0 sec and PDR

(i) DSG only stack

(ii) VEF (+22, - 12 msec/tr)/DSG stack

Trace equalisation was also applied to the above tests A and B. The stack panels were stacked with a velocity function derived from a velocity analysis performed within the stacked panel range of shotpoints.

4. DEMULTIPLE (DMT)

Locations: SP 1-96, SP 903-1004
Using: TAR: 3db/sec, T2 = 5.0 sec, PDR, DSG stack

5. DECONVOLUTION AFTER STACK (DAS)

Locations: SP 1-96, SP 903-1004
Input: Raw Stack

(i) Autocorrelogram

(ii) DAS: 32 msec gap, 1 gate (water bottom - 3 sec.)
50 points filter

(iii) DAS: 40 msec gap, 1 gate (water bottom - 3 sec.)
60 points filter

6. FILTER ANALYSIS

Locations: SP 1-96, SP 903-1004
Input: Raw Stack

Filter panels produced: 0-10, 10-20, 20-30, 30-40, 40-50, 60-70, 70-80, 90-110, 15-40, 15-50, 15-60, 15-70, 15-80, 15-90, 8-40, 20-60, 20-70, 5-10, 5-20, 5-30, 5-40, 5-50.

7. TIME VARIANT SCALING

A. Locations: SP 1-96, SP 903-1004
Input: Raw Stack with the following filters:

HZ	Time(sec)
15-65	Water Bottom + 0.4 sec.
15-50	Water Bottom + 0.9 sec.

Scaling: Normal scalers, 500 msec gates with 50% overlap starting at water bottom.

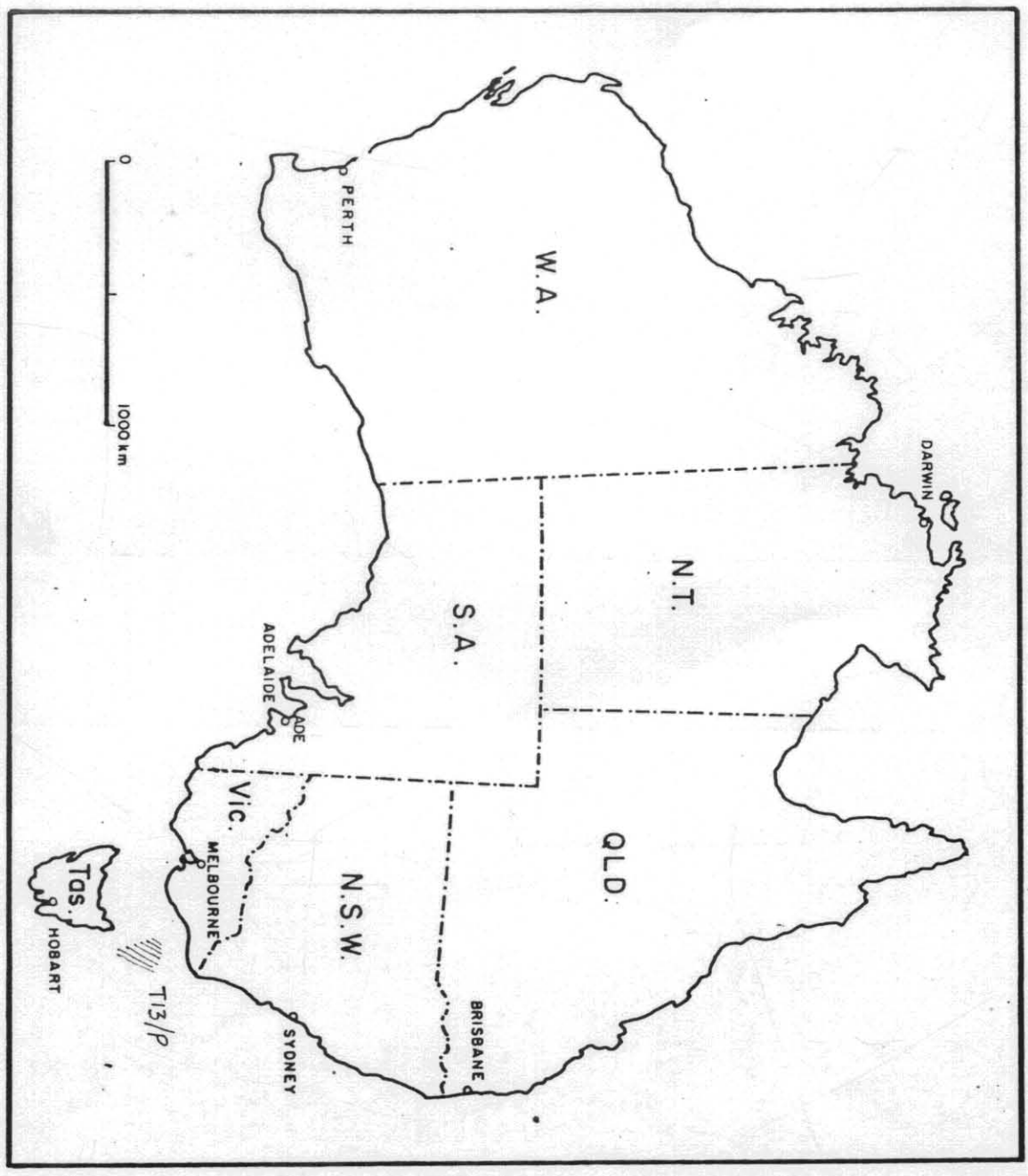
B. Locations: SP 1-96, SP 903-1004
Input: Raw Stack with the following filters:

HZ	Time(sec)
15-65	Water Bottom + 0.4 sec.
15-50	Water Bottom + 0.9 sec.
15-40	Water Bottom + 1.2 sec.

Scaling: Normal scalers, 500 msec gates with 50% overlap starting at water bottom.

RESPECTFULLY PREPARED BY

OOI SAY TEAN
PARTY CHIEF FOR G.S.I.
FEBRUARY 1983



Location Plan

PLATE 1

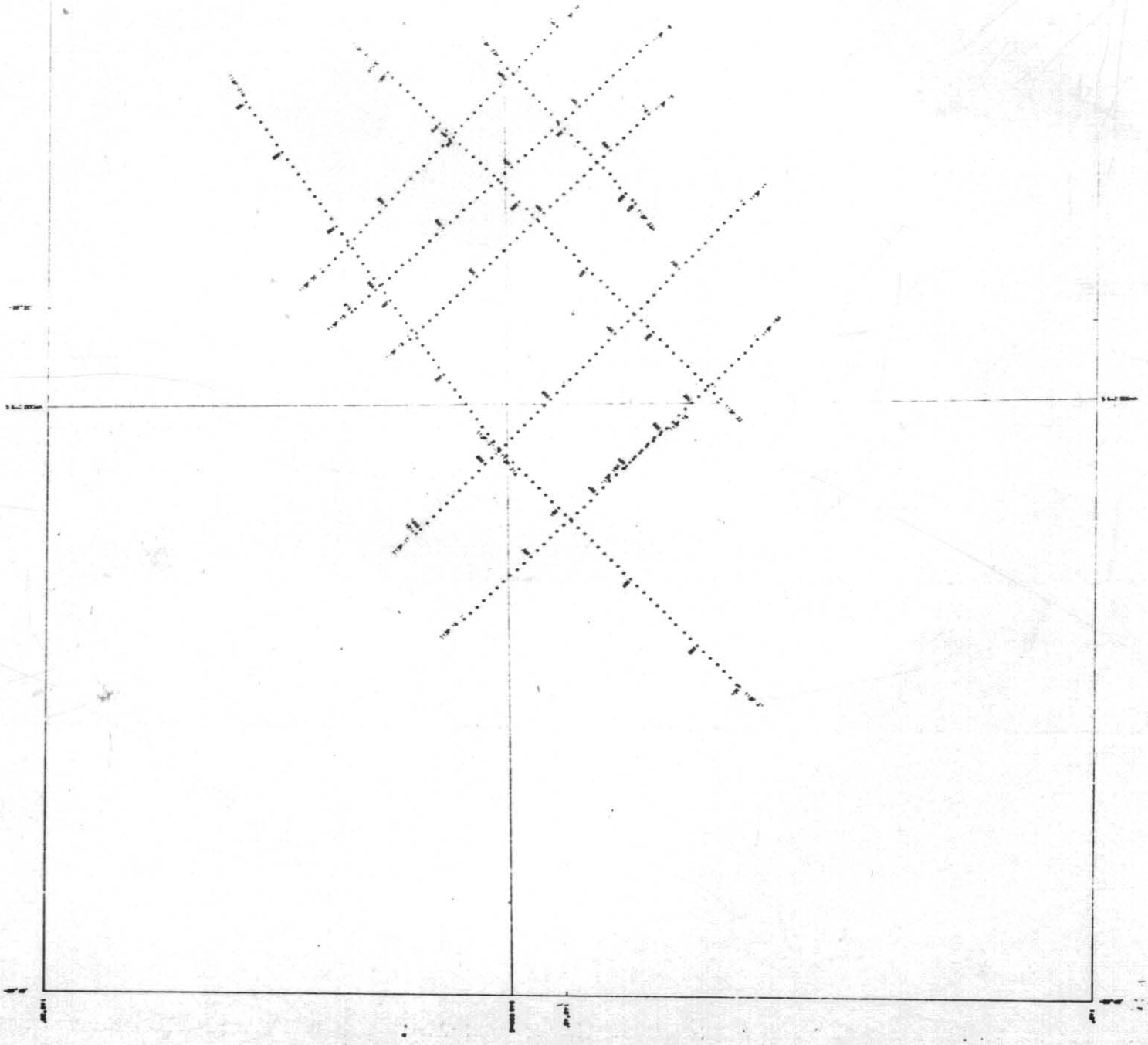


PLATE 2

LINE LOCATION

5 cm

APPENDIX A

PRODUCTION PARAMETERS

M/V "McDERMOTT" Lines

GUN DELAY CORRECTION	52 msec
TAR	ALPHA = 3.0 db/sec T1 = 0.0 sec T2 = 5.0 sec
RESAMPLE	Resample from 2 msec to 4 msec
PREDECON	Water Bottom at Trace 3
RAMP	Water Bottom + 759 msec at Trace 96
DESIGNATURE	Designed on entire shot record utilising 100% of information from current shot.
CDP GATHER	48 Fold
EQUALISATION	2000 msec gates with 20% overlap starting at water bottom + 100 msec
VELOCITY	Type: Discrete Velscan Velocity Modules Interval: 2km CDP's per analyses: 9 dps
STATICS	Shot and Seismometer depth corrections: 13 msec
STACK	96 Trace, 48 Fold
MIGRATION	Narrow Angle Wave Equation Migration

TIME VARIANT FILTERING	Time (sec)	Lo Cut (Hz)	Hi Cut(Hz)
	Water Bottom + 0.4	15	65
	Water Bottom + 0.9	10	50
	Water Bottom + 1.2	10	40

TIME VARIANT SCALING

Type: Normal
Gate Length: 500 msec
Overlap: 50%
1st gate start: water bottom

TIME TO DEPTH CONVERSION

Converts depth of section from time in milliseconds to their appropriate depth in kilometres.

DISPLAY

Final 48 fold stack section
Final Migrated section
Final Migrated Depth section

Horizontal Scale: 10 tr/cm (1:12500)
Vertical Scale: 3.75 in/sec
Mode: Variable area/wiggle trace
Bias: 20%
Polarity: Normal, relative to field recording (pressure increase = trough on section)
Plotter: Geospace drum plotter
Shotpoint Annotation: CDP position

APPENDIX B

MARINE SEISMIC PROCESSING SEQUENCE

1. LINE FILE

A file is constructed for each line containing recording information, shot, receiver and CDP co-ordinates and all their attributes, including statics and water depths. Editing of bad field records is included in this file which is used in all subsequent processing steps.

2. AIRGUN DELAY CORRECTION

The use of the Texas Instruments Airgun Controller System (TIGER) during data collection results in a firing delay of 52 msec which is corrected by applying a bulk static shift to each record.

3. TRACE EDIT

Zeroing of bad traces.

4. TRUE AMPLITUDE RECOVERY

True Amplitude Recovery (TAR) is applied to compensate for energy loss due to spherical divergence and inelastic attenuation.

5. RESAMPLE

If the collection sample period is shorter than the required processing sample rate, the data are resampled, with the appropriate anti-alias filter being applied prior to resampling.

6. PRE-DECONVOLUTION RAMP

This is applied to each shot record in the time - offset domain. Its function is to zero first arrival waves, preventing them from dominating the signature estimate.

7. DESIGNATURE

Designature performs multichannel wavelet deconvolution by estimating the effective source wavelet from the seismic traces and designing an inverse filter to collapse it to a band limited zero phase wavelet.

8. COMMON DEPTH POINT GATHER

This process gathers traces together which have common source - receiver midpoints.

9. EQUALISATION

A fast scaler, computed from the average absolute amplitude of each time gate, is applied to each CDP gather trace to equalise the amplitudes of the traces to a constant value.

10. STATICS

Prior to normal moveout corrections, shot and receiver statics are applied to compensate for the depth of the source and seismometer, thus giving a mean sea level datum.

11. NORMAL MOVEOUT CORRECTIONS

Normal Moveout (NMO) Corrections are made from RMS velocity functions derived from velocity analyses performed at

specified depth point positions. Functions at intermediate depth point locations are obtained by linear interpolation of corresponding knees from adjacent functions.

12. FIRST BREAK SUPPRESSION

An offset and time dependent mute function is applied to the CDP gathers to remove noise on the early part of the traces, particularly on the far offsets. This ramp may be applied before or after NMO corrections.

13. COMMON DEPTH POINT STACK

After application of NMO corrections and the first break suppression ramp, all traces within a CDP gather are summed to form a single output trace.

14. WAVE EQUATION MIGRATION (MSTK)

Migration transform the complex wave fields of the seismic section into a display of properly located subsurface reflectors. The assumption is made that events are in the plane of the section. Inputs are the scaled CDP stacked traces. Smoothed, dip corrected velocities were modified to yield an RMS velocity field used for the migration.

15. TIME VARIANT FILTERING

Zero phase Time Variant Filtering (TVF) is applied after stack or migration to band limit the data to the optimum signal-to-noise ratio frequency bands.

16. TIME VARIANT SCALING

Time Variant Scaling (TVS) is applied after TVF to produce even trace modulation.

17. TIME TO DEPTH CONVERSION (TMZP)

Time to Depth Conversion (TMZP) utilises a smooth stacking function to convert events to their appropriate depth in kilometres.