FINAL REPORT
ATLANTIC GEOSCIENCE CENTRE
GRAND BANKS LITHOPROBE 1987 SURVEY
M/V FRED. J AGNICH

TABLE OF CONTENTS

I INTRODUCTION

Geophoto Services, Ltd., a sister company of Geophysical Service Inc., conducted a Lithoprobe marine seismic survey in 1987 for the Atlantic Geoscience Centre on the southern portion of the Grand Banks, offshore Newfoundland. The M/V Fred J. Agnich, GSI Party 2995, collected 806.200 km of seismic reflection data during the period 1987 05 10 through 1987 06 11.

Due to the very pressing time constrictions upon Geophoto, the survey was commenced prior to acceptance of the proposal by Supply and Services Canada, Geophoto running the risk of non-acceptance. Hence some of the paper work during the early portion of the program makes reference to "spec" or "non-exclusive".

II EQUIPMENT

A. VESSEL

The M/V Fred J. Agnich, a Canadian flag vessel of 56.4 m length and 979.59 gross registered tons, was engaged in this single vessel operation.

For vessel details and crew lists refer to Appendices A-1, A-2, and A-3.

B. SURVEY

The vessel used a combination of the "Geonav" portion of the CMS with an Internav 408 Loran C or Doppler Sonar providing the vessel velocities over much of the prospect. At times vessel velocities had to be estimated and inserted.

A GPS system supplied checks when the galaxy was available.

The Loran C was supplied and operated by the McElhanney Group. All systems were interfaced to the TI 990 computer of the CMS III integrated system.

Navigation equipment is described in Appendix A-10.

C. SOURCE

A 127 L (7780 cubic inch) six-element Pnu-Con airgun array was deployed perpendicular to the line with a width of 80 m +/- 1 m. The array was comprised of 64 active guns with various characteristics towed on six buoy-supported strings spaced approximately 16 m apart, to generate seismic energy at a 50 m shotpoint interval. Compressed air at an operating pressure of approximately 13.8 MPa was supplied by two Sullair and four Chicago Pneumatic PB-44-300 compressors. A GSI Tiger II airgun control fired and timed each gun within the array, offering a phasing standard deviation of within +/- 1 ms.

Considerable difficulty was encountered with the airgun handling system.

Airgun array description and diagram are found in Appendices A-7 and A-8.

D. STREAMER

A TI 3000 m 120 channel analog streamer with 25 m groups each containing 27 dish-hydrophones was used. The cable was towed at an average depth of 11 m.

Difficulties were incurred with cable control while trying to maintain 20 s record length. Attempts were made to increase record length in certain areas, but proved to be futile. Current and changes in water temperature were affecting the cable ballast at these critical speeds.

Streamer details and diagrams are presented in Appendices A-5 and A-6.

E. RECORDING INSTRUMENTS

The ship used a TI DFS V to record 120 channel data at a 4 ms sample period for a minimum of 20 s on 1/2 inch tape in SEG-B format at 1600 bpi. Low cut filters were 5.3 Hz at 18 db/octave while the high cuts were 64 Hz with 72 db/octave. The instruments were calibrated prior to the start of the program and standard performance tests were conducted regularly. A modification was required during the survey to allow greater than 20 s recording.

Recording instrument details are found in Appendix A-4.

III OPERATIONS

The M/V Fred J. Agnich mobilized for the work in Halifax harbour and proceeded toward the prospect at 1987 05 10 01:00 GMT. Problems with the navigation equipment and the array handling system required a port call in St. John's for parts on 05 12. The ship arrived on the prospect at 05 14 01:30 and proceeded with streamer ballasting and source deployment. Continual problems with ballast of the cable were encountered due to the slow vessel speed and the variation of currents and temperatures. Chargeable recording commenced at 05 17 05:19 on Line 3B, with the chargeable portion being completed at 15:49. After more ballasting recording resumed on Line 3D in an attempt to fill in a gap left by ballast problems, but due to a combination of continued bad currents and a misplaced in-fill this segment was non-chargeable.

Several days of poor weather ensued, with further work on the ballast as the seas allowed, until Line 4 was commenced at 05 22 00:29. Interrupted by weather, a CMS idle, Line 4 was completed in three segments 4, 4A, and 4B at 05 24 05:26. The cable and guns were retrieved for the long line change to Line 2.

After two false starts due to streamer ballasting and DFS problems, Line 2B commenced at 05 26 15:37. Weather again interrupted the shooting at 05 27 02:00 and work recommenced at 05 29 03:15. Line 3C was finished that day at 04:49.

Weather stalled the start of Line 1A until 05 29 16:18. After delays due to DFS and depth transducer problems early the next day, weather caused an extensive interruption until 06 01 23:09. Line 1C was completed at 06 02 12:49 and again the trailing equipment was retrieved for a long line change.

Line 5 was started at 06 03 14:38 but weathered out less than seven hours later. Recording did not resume until 06 06 02:29 and was interrupted later that day by a CMS idle. After stops due to various problems including ballasting and weather, Line 5C, and the prospect, was completed at 06 09 09:44. The Agnich then travelled to Halifax to off-load data, arriving on the 11th.

IV PRODUCTION STATISTICS

Total Kilometres	806.200
Total Hours	767.00
Recording Hours	116.01
Line Change Hours	84.65
Km / Total Hour	1.05
Km / Recording Hour	6.95
Km / Record & L/C Hour	4.02
Km / Total Day	25.23
Km / Recording Day	166.79
Km / Record & L/C Day	96.43
Total Pops	16124
Pops / Total Hour	21.02
Pops / Recording Hour	138.99
Pops / Record & L/C Hour	80.35
Pops / Total Day	504.53
Pops / Recording Day	3335.71
Pops / Record & L/C Day	1928.52

IV TIME STATISTICS

Recording Activities		116.01
Line Change		84.65
Travel and Resupplying		130.75
Streamer Handling		99.80
Airgun Handling		40.42
Downtime		313.87
Weather	270.19	
Nav/Judgement/A/G	16.58	
Instrument D/T	27.10	
	313.87	
TOTAL		785.50

IV TIME AND PRODUCTION STATISTICS
ATLANTIC GEOSCIENCE CENTRE
GRAND BANKS LITHOPROBE 1987
M/V FRED J. AGNICH
GSI PARTY 2995
1987 05 10 TO 1987 06 11

DATE	LINE	1ST S.P.	LAST S.P.	TOTAL S.P.'S	KM	RECORD TIME	LINE CHANGE	TRAV/ SUPPLY	STRMER HANDLE	GUN HANDLE	DOWNTIME	DAY TOTAL
05 10								23.00				23.00
05 11								24.00				24.00
05 12								4.50				
											14.50 NAV/AG	
								5.00				24.00
05 13								24.00				24.00
05 14								1.50				
									22.50			24.00
05 15									2.00			
										22.00		24.00
05 16										8.00		
									16.00			24.00
05 17									5.32			
	3B	101 -	800	700	35.000	10.43						
		1027 -	1575	549	27.450							
									5.83			
											2.08 JGE	
							0.34					24.00

IV TIME AND PRODUCTION STATISTICS
ATLANTIC GEOSCIENCE CENTRE
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M/V FRED J. AGNICH
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1987 05 10 TO 1987 06 11

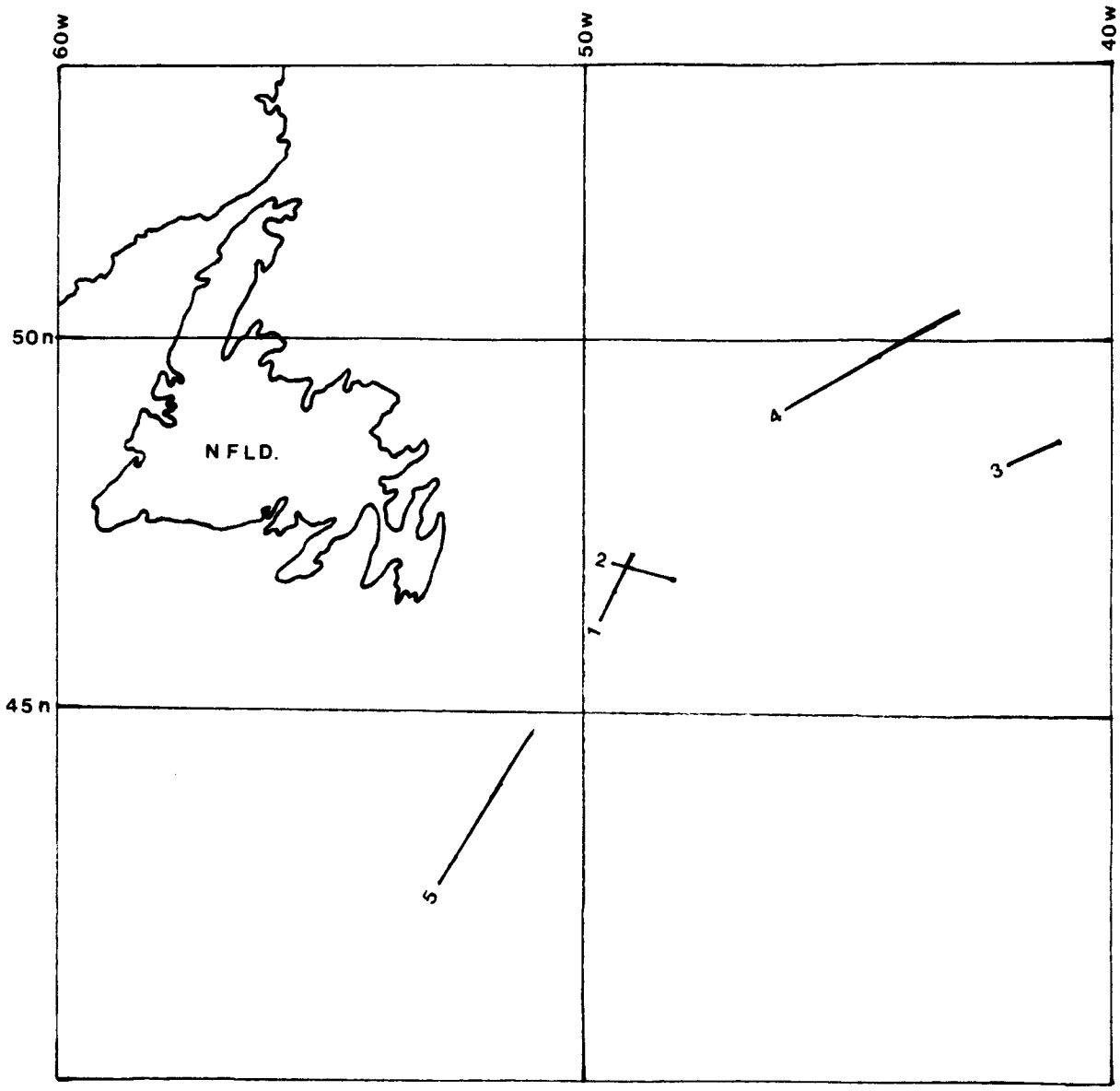
DATE	LINE	1ST S.P. - LAST S.P.	TOTAL S.P.'S	KM	RECORD TIME	LINE CHANGE	TRAV/ SUPPLY	STRMER HANDLE	GUN HANDLE	DOWNTIME	DAY TOTAL
05 18						16.83					
										7.17 WX	24.00
05 19										24.00 WX	24.00
05 20										24.00 WX	24.00
05 21										14.50 WX	
								3.33			
									6.17		24.00
05 22									0.48		
	4	101 - 636	536	26.800	3.65						
										15.23 WX	
	4A	715 - 1396	682	34.100	4.64						24.00
05 23	4A	1397 - 3647	2251	112.550	14.90						
										3.75 CMS	
	4B	3793 - 4603	811	40.550	5.35						24.00
05 24	4B	4604 - 5445	842	42.100	5.43						
						18.57					24.00
05 25						19.40					
								4.60			24.00
05 26								11.30			
										4.32 DFS	
	2B	101 - 1433	1333	66.650	8.38						24.00

IV TIME AND PRODUCTION STATISTICS
ATLANTIC GEOSCIENCE CENTRE
GRAND BANKS LITHOPROBE 1987
M/V FRED J. AGNICH
GSI PARTY 2995
1987 05 10 TO 1987 06 11

DATE	LINE	1ST S.P.	LAST S.P.	TOTAL S.P.'S	KM	RECORD TIME	LINE CHANGE	TRAV/ SUPPLY	STRMER HANDLE	GUN HANDLE	DOWNTIME	DAY TOTAL
05 27	2B	1434	1741	308	15.400	2.00						
											22.00 WX	24.00
05 28											24.00 WX	24.00
05 29											3.25 WX	
	2C	1970	2167	198	9.900	1.57						
							3.70					
											7.78 WX	
	1A	101	1212	1112	55.600	7.70						24.00
05 30	1A	1213	1369	157	7.850	1.17						
											9.68 DFS	
											6.15 DPL	
											7.00 WX	24.00
05 31											24.00 WX	24.00
06 01											23.15 WX	
	1C	1525	1624	100	5.000	0.85						24.00
06 02	1C	1625	3050	1426	71.300	12.82						
							11.18					24.00
06 03							14.63					
	5	101	973	873	43.650	6.77						
											2.60 WX	24.00

IV TIME AND PRODUCTION STATISTICS
ATLANTIC GEOSCIENCE CENTRE
GRAND BANKS LITHOPROBE 1987
M/V FRED J. AGNICH
GSI PARTY 2995
1987 05 10 TO 1987 06 11

DATE	LINE	1ST S.P. - LAST S.P.	TOTAL S.P.'S	KM	RECORD TIME	LINE CHANGE	TRAV/ SUPPLY	STRMER HANDLE	GUN HANDLE	DOWNTIME	DAY TOTAL
06 04										24.00 WX	24.00
06 05										24.00 WX	24.00
06 06										2.48 WX	
	5A	1094 - 2341	1248	62.400	8.72						
										3.20 CMS	
	5B	2383 - 3765	1383	69.150	9.60						24.00
06 07	5B	3766 - 4542	777	38.850	5.33						
								18.67			24.00
06 08								6.00			
										18.00 WX	24.00
06 09										3.03 WX	
	5C	5411 - 6248	838	41.900	6.70						
									3.77		
								4.25			
							6.25				24.00
06 10							24.00				24.00
06 11							18.50				
TOTALS			16124	806.200	116.01	84.65	130.75	99.80	40.42	313.87	767.00


60w
50w
40w
50n
45n
NFLD.
1
2
3
4
5

Geophoto greatly appreciates the help given by both Dr. Charlotte Keen and Mr. William Nickerson in the conduct of this survey.

Yours truly,

Keith Matthews

pp John W. Clink
Director

JWC/lsc

APPENDIX A-1

M/V FRED J. AGNICH

I VESSEL

Owner	Geophoto Services, Ltd.
Year Built	1973
Shipyard	Ferguson's, Pictou, Nova Scotia
Country of Registry	Canada
Classification	Lloyds 100 A1 LMC ICE 2, CSI IX
Registration Number	330117
Home Port	St. John's, Newfoundland
Trade	Seismic exploration
Tonnage	Gross 2773.9 m^3 (979.59 tons)
Length	56.4 m
Beam	11.9 m
Depth	4.6 m
Draught, medium	4.1 m
Type of Vessel	Rig supply vessel
Engine	2 - EWSL 16 MGR Lister Blackstone 2000 HP
Power	2.98 MW
Speed	7.2 m/s (14 knots)
Fuel Capacity	339 m^3
Potable Water Supply	166 m^3
Endurance	35 days
Accommodation	38
Ship's Crew (#)	10
Technical Personnel (#)	20

II AUXILIARY EQUIPMENT

Generators (AC)	Cat D 343 - 2 at 250 kW Cat D 333 - 2 at 115 kW

III NAVIGATIONAL EQUIPMENT

Radio Equipment	SSB: Marconi and CAI VHF: CMS DN42
Call Sign	VOBJ
Gyro	Decca Microtechnica
Auto Pilot	Decca Arkas 550 GM
Radar	Two - Decca 914 & Decca 916
Fathometer	Simrad EA

IV SEISMIC EQUIPMENT

Control System	CMS II *
Recording System	DFS V **
Streamer	120 trace - universal length
Airgun Array	127.48 L Mod II & Mod III Airguns
Compressors	Four: PB44/300 Chicago Pneumatic Two: Sullair

V SAFETY EQUIPMENT

Fire Containment	Foam Deluge and Auxilary Pump System Engine Room CO_2 Smoke Diving Equipment Firesuits Extinguishers
Flotation	Life Rings Life/Work Vests & Survival Coats Life Jackets with Lights & Whistles Runabout with Engine Life Rafts
Signal	Life Raft Emergency Radio Pyrotechnics (distress signals) Aldis Signal Lamp
General	First Aid Equipment Line Thrower Lifeline Tether Harnesses Smoke Alarms Resuscitator

* Trademark of Geophysical Service Inc.
** Texas Instruments Trademark

APPENDIX A-2

CREW DESCRIPTION

SHORE-BASED PERSONNEL

1 Operations Supervisor/Senior Administrator

ON-BOARD SEISMIC PERSONNEL

1 Party Manager

2 CMS Operators

3 DFS V Operators

1 Quality Control Person

2 Compressor Mechanics

2 Airgun Mechanics

1 Contracted Survey Operator (CAN-NAV Ltd.)

2 Client Representatives

VESSEL CREW

1 Ship's Captain

1 First Mate

1 Chief Engineer
1 Second Engineer
1 Third Engineer

2 Seamen

1 Chief Cook

APPENDIX A-3

PERSONNEL

Operations Supervisor	M. Kimball	(CDN)
Senior Adminstrator	M. Kimball	(CDN)
Party Manager	J. Hennessey	(CDN)
Quality Control Personnel	K. O'Gorman	(CDN)
CMS Operators	T. Sutherland	(CDN)
	M. Teal	(CDN)
DFS Operators	G. Sheehy	(CDN)
	R. Dawson	(CDN)
	W. Oxner	(CDN)
Compressor Mechanics	R. Walsh	(CDN)
	H. Crews	(CDN)
Airgun Mechanics	J. Abbott	(CDN)
	G. Brinson	(CDN)
Contracted Survey Operator	B. Henchley	(CDN)
VESSEL		
Captain	P. Tran	(CDN)
Mate	R. Wilson	(CDN)
Chief Engineer	G. Reid	(CDN)
Second Engineer	D. Porter	(CDN)
Third Engineer	C. Killam	(CDN)
Seamen	F. Ryan	(CDN)
	B. Halfyard	(CDN)
Cook	T. Peach	(CDN)

APPENDIX A-4

INSTRUMENT DETAILS

Recording System	
Type	Texas Instruments DFS V*
Serial No.	583
Transports	
Make & Model	DFS V*, EPT 10
Number in use	2
Number of tracks	9
Format	
Type	SEG-B (phase encoded)
Packing Density	1600 bpi
Tape Speed	49.06 ips
Recording System	1 System / Nears and Fars
Sample Period	4 ms
Record Length	20 s
Gain Control Mode	IFP
Reproduce Mode	PGC
Gain Constant	36 dB
Quoted System Dynamic Range	$\geq$ 84 dB
Total System Gain	120 dB
Filters: Hi-Cut	64.0 Hz @ 72 dB/oct
Lo-Cut	5.3 Hz @ 18 dB/oct
System Polarity	SEG-B
Number of Seismic Channels	120
Camera	
Make & Model	SIE ERC 10C
Number of Channels	60 Data & 4 Auxillary
Polarity	Positive pressure on hydrophone causes a downbreak on camera galvo.

* Texas Instruments Trademark

APPENDIX A-5

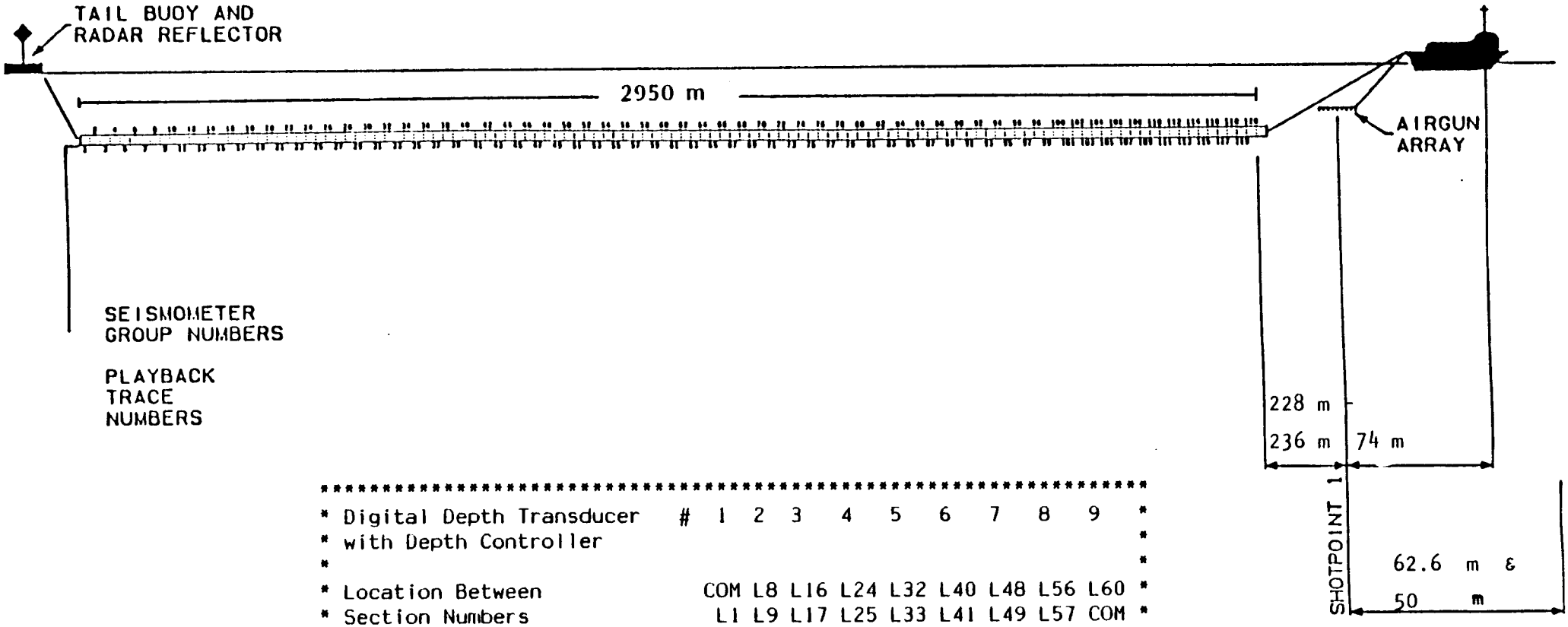
CABLE DETAILS

Type of Streamer	Texas Instruments neutral bouyancy, continuous tow
Length (Center to Center)	3024 m
Number of Live Sections	60
Live Section Length	50 m
Number of Groups	120
Group Length	25 m
Number of Hydrophones / Group	27
Hydrophone Interval	0.93 m
Type of Hydrophone	TI two-chip dish
Depth Transducer Length	4 m
Compass Section Length	3 m
Front End Adapter	1 m
Length of Tailbuoy Rope	183 m
Stretch Section Length	50 m
Total Length of Nylon Stretch Sections	250 m
Stretch Factor	10 % - 15 %
Skin Type	PU (cold water skin)
Target Cable Depth	12 m (+/- 2 m)
Ship Speed during Production	4.3 - 5.3 knots
Average Water Temperature	12 Degrees Celsius
Type of Depth Controllers	RCL-2 Cable Levellers (individually programmable)
Location of Depth Transducers & Depth Controllers	See cable diagram

APPENDIX A-6

DIAGRAM of 3000 m STREAMER

120 Traces



Digital Depth Transducer with Depth Controller	#	1	2	3	4	5	6	7	8	9
Location Between Section Numbers		COM L1	L8 L9	L16 L17	L24 L25	L32 L33	L40 L41	L48 L49	L56 L57	L60 COM
Nylon Stretch Sections	250 m									

L = Live Section COM = Compass Section

APPENDIX A-7

AIRGUN DESCRIPTION

Type of Source	Six strings, staggered array
Type of Airguns	TI Mk II & Mk III Pnu-Con
Total Volume in Use	127.48 L
Total Spare Volume	34.58 L
Operating Depth	12 m +/- 1 m
Timing Controller	
Type	TIGER II*
Serial No.	04
Firing Delay	51.2 ms
Operating Pressure	12.8 - 13.8 MPa
Compressors	
Type	Sullair
No. in Use	3
Type	GMC / Dual PB44-300
No. in Use	4
Coalescing Gun Separation Distance	0.53 m
Array Width	80 m +/- 1 m
Gun String Length	9.9 m
Distance, Stern to First Gun	
Inner Arrays	65 m
Middle Arrays	70 m
Outer Arrays	75 m
Distance, Stern to Gun Array Centre	73.3 m
Distance, Common Navigation Position to Acoustic Centre of Gun Array	74.0 m
Distance, Array Centre to Near Group Centre (OFFSET)	228 m - 236 m

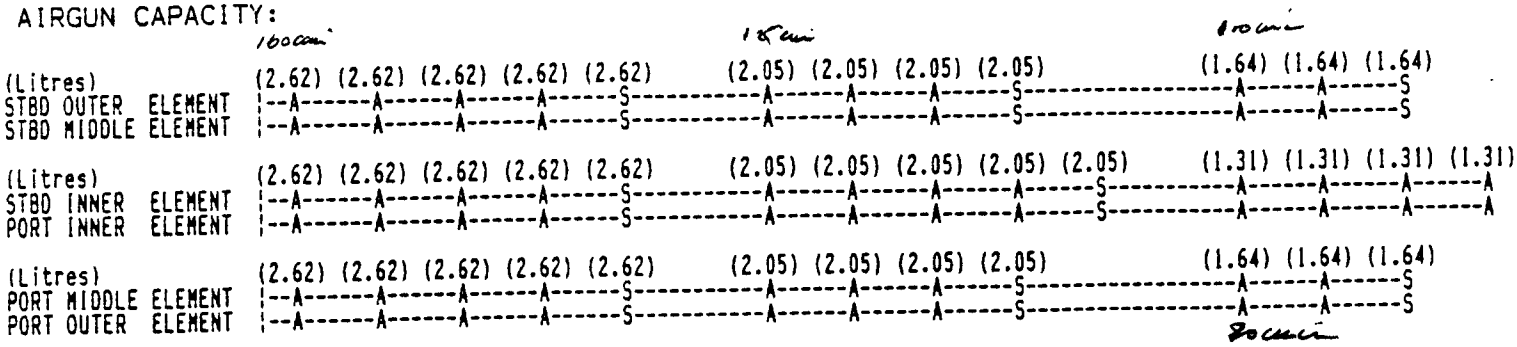
* Trademark of Geophysical Service Inc.

APPENDIX A-8

AREAL TUNED AIRGUN ARRAY

127.49 Litres - 6 Elements

AIRGUN CAPACITY:



A = Active airgun S = Spare airgun

AIRGUN ARRAY COMPOSITION:

Active Guns:	24	x	2.62 L	Spare Guns:	6	x 2.62 L
	20	x	2.05 L		6	x 2.05 L
	8	x	1.64 L		4	x 1.64 L
	8	x	1.31 L			
Total Active Guns	127.48 L			Total Spare Guns	34.58 L	

NOTES:

1. This wide-tow airgun array is comprised of six elements towed on separate strings. The total array width is 80 m (+/- 1 m).

2. Gun are Texas Instruments Mk II & Mk III Pnu-Con Airguns.

3. The array contained 76 airguns; however the working array consisted of 60 guns, allowing 16 guns to be used as spares as required.

APPENDIX A-9

SURVEY INFORMATION

PRIMARY SYSTEM

Type	Transit Satellite/Loran C
Survey Company	GSI
Operating Frequency	150 MHz & 400 MHz
Antenna Locations (from stern)	
First Antenna	0.5 m

SECONDARY SYSTEM

Type	Loran C
Survey Company	McElhanney
Operating Frequency	100 kHz
Antenna Locations (from stern)	
First Antenna	35.2 m

ANCILLARY SYSTEMS

Global Positioning System

Common Navigation Position (CNP)	GPS Antenna (1 m from stern)
Coverage	3000%
Shotpoint Interval	50 m
Auxiliary Equipment	2 track plotters Doppler Sonar
Calibration	GPS was used to check the position and velocities. It was also used as a secondary system when the constellations were available.

APPENDIX A-10

POST-PLOT PARAMETERS

Spheroid	Clarke 1866
Datum	NAD 1927
Projection	Lambert Conformal Conic
Northern Parallel	60 N
Southern Parallel	45 N
Origin Latitude	55 30 N
Origin Longitude	66 00 W
Map Scale	1:1 996 7000
Position Plotted	Antenna
Shotpoint Plot Interval	100
Shotpoint Label Interval	1000

APPENDIX A-11

FATHOMETER / SINGLE TRACE PROFILER

FATHOMETER

Manufacturer	Simrad
Model	EA
Serial No.	41
Conversion Velocity	1470 m/s
Operating Frequency	38 kHz
Transducer Position	
From Stern	33.5 m
Port of Centre Line	2.1 m
Correction for Draught	4 m

SINGLE TRACE PROFILER

Manufacturer	EPC Labs Inc.
Model	3200
Serial No.	256
Source	Seismic Trade #117
Gain Mode	Same as recording unit
Recorder Trigger	TIGER synch out signal
Filters	
Hi-Cut	64.0 Hz @ 72 dB/oct
Low-Cut	5.3 Hz @ 18 dB/oct
Display Method	Single channel