FINAL REPORT
ATLANTIC GEOSCIENCE CENTRE
LITHOPROBE EAST 1985 SURVEY
M/V FRED J. AGNICH

TABLE OF CONTENTS

I INTRODUCTION

Geophysical Service Inc. conducted the Lithoprobe East 1985 marine seismic survey for the Atlantic Geoscience Centre in the Grand Banks area. The M/V Fred J. Agnich, GSI Party 2995, collected 991.800 km of both seismic reflection and magnetics data as well as 948.950 km of gravity data during the period of 1985 09 04 through 1985 09 26.

All data were forwarded to Calgary for processing. All navigation data were post-processed and mapped by GSI's navigation department in Calgary.

II EQUIPMENT

A. VESSELS

The M/V Fred J. Agnich, a Canadian flag vessel of 56.4 m length and 2774 cu m gross tonnage, was engaged in this single vessel operation.

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

B. RECORDING INSTRUMENTS

A Texas Instruments Trace Sequential Recorder was used to collect 120 trace data at a 4 ms sample rate for 18, 20 or 22 s on 1/2 inch tape (format SEG-D: Group Coded) with a 6250 bpi packing density. Due to great variances in water depth, it was necessary to alter the record length in order to retain a constant 16 seconds of data from water bottom.

Prior to the start of this survey the TSR unit was reconfigured to comply with client specifications, and monthly tests were conducted to check its performance. In addition standard performance tests were conducted regularly during the program. Overall the system performed well.

Recording instrument details are found in Appendix A-4.

C. STREAMER

A 3000 m Texas Instruments PVC streamer comprised of 120 x 25 m groups, each containing 27 acceleration cancelling hydrophones, was towed at a target depth range of 11 m to 15 m to collect the seismic data. Weather conditions and strong currents complicated streamer ballasting activities, but no major problems were encountered with this cable. Streamer details and diagrams are presented in Appendices A-5 and A-6.

D. SOURCE

A tuned wide tow airgun array of 127.48 L capacity, comprised of 60 active and 12 spare guns with various characteristics towed on six buoy-supported strings, was used to generate seismic energy at a 50 m interval. Compressed air at an operating pressure of approximately 13.8 MPa was supplied by three Sullair and four Chicago Pneumatic PB-44-300 compressors.

Airgun array description and diagram are found in Appendices A-7 and A-9.

E. SURVEY

SPOT, a range-to-range navigation system manufactured by Offshore Naivgation Inc. and operated by CAN-NAV Limited, provided the primary navigation data, supplemented with satellite fixes and Loran-C velocities. An ARGO DM-54 radio-positioning system, also operated by CAN-NAV Limited, provided the secondary source of navigation information. Both systems, which were calibrated prior to the start of recording activities, were interfaced to the CMS II integrated satellite / doppler sonar system of the Texas Instruments R-980B computer.

The SPOT base stations used in this survey were located at:

Sta. Cape Pine	046 36 56.34 N	053 31 58.17 W
Sta. Cappahayden	046 51 45.99 N	152 56 19.08 W
Sta. Mayberly	048 37 07.62 N	053 00 45.01 W
Sta. Pound Cove	049 10 03.01 N	053 33 03.67 W
Sta. Great Brehat	051 25 38.69 N	055 29 25.62 W

The ARGO base stations used for this survey were located at:

Sta. Cape Race	046 39 31.11 N	053 04 26.20 W
Sta. Francis	047 48 26.69 N	052 47 16.26 W
Sta. Bonavista	048 42 04.07 N	053 05 08.45 W
Sta. Freels	049 15 42.23 N	053 30 04.86 W

The Loran-C base stations used for this survey were located at:

Sta. Fox Harbour	052 22 35.11 N	055 42 31.35 W
Sta. Cape Race	046 46 32.62 N	053 10 32.41 W
Sta. Angissoq	059 59 18.16 N	045 10 32.65 W

For further details about the survey systems, see Appendix A-9.

III OPERATIONS

The M/V Fred J. Agnich resupplied for this survey on 1985 09 04 in the port of St. John's, Newfoundland. While in port the crew also started work on a new airgun array configuration which could accomodate a total of 72 guns on six separate elements in accordance with the client's specifications. This task continued while the vessel traveled to the survey site in the Grand Banks area on 09 05 and 09 06, but here testing of the new array and the streamer was repeatedly interrupted between 09 08 and 09 13 by stormy seas.

An improvement in weather conditions allowed recording activities to begin at 17:00 G.M.T. on 09 13 on Line 85-3. However a loss of power to the SPOT and ARGO navigation systems forced an early termination of this line at 23:18. The next line segment, 85-3A, was restarted at 07:27 on 09 14 at a new point two nautical miles north of the original course to allow the vessel to steer clear of hazardous obstacles such as well head buoys. This change of course was verified with Dr. Charlotte Keene of AGC. Shooting continued until 00:36 the next day when the streamer sank to 30 m as the vessel encountered extreme currents on the eastern edge of the Grand Banks.

After the streamer was reballasted and additional compass floats were attached to it, recording resumed on Line 85-3B at 20:42 on 09 15 and proceeded very well through 04:38 on 09 17, when water depths dropped dramatically, causing loss of control of the streamer. After further streamer work Line 85-3C was shot between 13:36 on 09 17 and 11:12 on 09 18, after which the supplementary compass floats were removed to accomodate the warmer water conditions of the Gulf Stream, allowing the crew to complete the final segment of this line, 85-3D, at 10:19 on 09 19.

The streamer and airgun array were retrieved while the vessel traveled to the start of Line 85-4, which it started to record at 01:06 on 09 21. Although data quality was acceptable, the first portion of this line were not listed as chargeable data as it was not part of the original preplotted line. In the face of deteriorating weather conditions work on Line 85-4 halted at 13:11 the next day due to TSR failure, problems with the airguns and a drifting streamer. Strong winds and high swells resulted in the loss of a paravane and a float, and prevented the resumption of shooting activities on Line 85-04A until 12:42 on 09 25. This line was completed at 06:36 the next day, and after the airgun array and streamer were retrieved the crew headed for St. John's, which it reacned at the close of that same day.

IV PRODUCTION STATISTICS

Total Kilometres	991.80
Total Hours	552.00
Recording Hours	137.10
Line Change Hours	7.88
Km / Total Hours	1.80
Km / Recording Hours	7.23
Km / Recording & Line Change Hours	6.84
Km / Total Days	43.12
Km / Recording Days	173.62
Km / Recording & Line Change Days	164.18

Total Shotpoints	19 836
Pops / Total Hours	35.93
Pops / Recording Hours	144.68
Pops / Recording & Line Change Hours	136.82
Pops / Total Days	862.43
Pops / Recording Days	3 472.39
Pops / Recording & Line Change Days	3 283.65

IV TIME STATISTICS

Weather Downtime	174.20		31.56 %
Recording	137.10		24.84 %
Mobilization	79.00		14.31 %
Travel & Resupplying	66.75		12.09 %
Streamer / Airgun Handling	66.47		12.04 %
Streamer Failure	12.45		2.26 %
Navigation Failure	8.15		1.48 %
Line Change	7.88		1.42 %
TOTAL	552.00	Hours	100.00 %

IV STATISTICS

MAGNETICS DATA

LINE	S.P. RANGE	TOTAL S.P.	KM
85-3	101 - 1039	857	42.850
85-3A	101 - 2633	2533	126.650
85-3B	2733 - 7585	4704	235.200
85-3C	7586 - 10681	2817	140.850
85-3D	10714 - 11910	1160	58.000
85-4	401 - 5445	4949	247.450
85-4A	5446 - 8361	2816	140.800
TOTALS		19836	991.800

IV STATISTICS

GRAVITY DATA

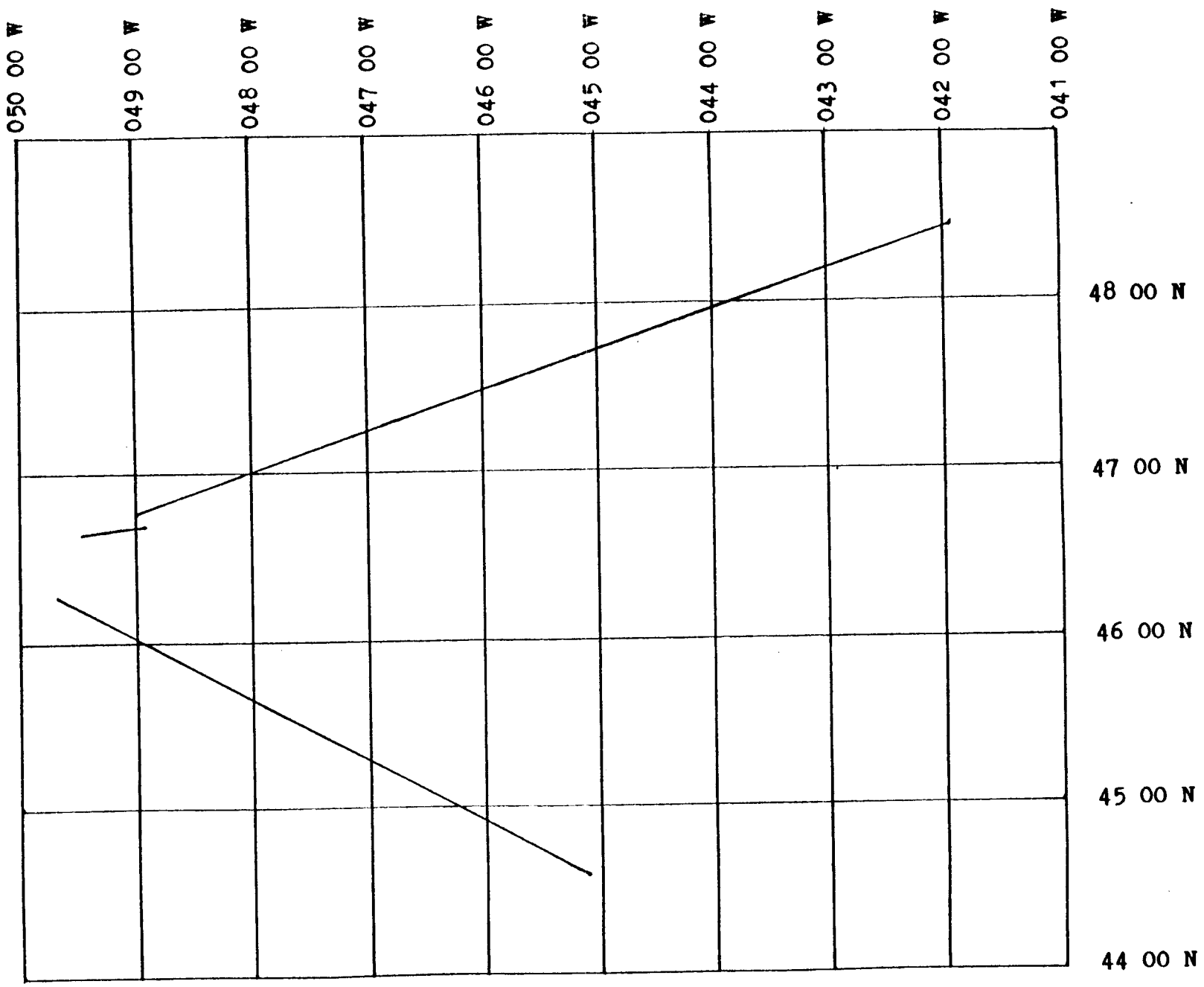
LINE	S.P. RANGE	TOTAL S.P.	KM
85-3A	101 - 2633	2533	126.650
85-3B	2733 - 7585	4704	235.200
85-3C	7586 - 10681	2817	140.850
85-3D	10714 - 11910	1160	58.000
85-4	401 - 5445	4949	247.450
85-4A	5446 - 8361	2816	140.800
TOTALS		18979	948.950

IV TIME & PRODUCTION STATISTICS
ATLANTIC GEOSCIENCE CORPORATION
LITHOPROBE EAST 1985 SURVEY
M/V FRED J. AGNICH
1985 09 04 to 1985 09 26

DATE	LINE	S.P. RANGE	TOTAL SHOTPOINTS	KM	RECORD	LINE CHANGE	TRAVEL/ SUPPLY	STRM/GUN HANDELING	NAV CALIB	DOWNTIME	TOTAL
09 04							15.00			9.00 MOB	24.00
09 05							8.00			16.00 MOB	24.00
09 06							10.00			14.00 MOB	24.00
09 07										24.00 MOB	24.00
09 08										24.00 WX	24.00
09 09										24.00 WX	24.00
09 10										8.00 WX 16.00 MOB	24.00
09 11								7.00 5.00		12.00 WX	24.00
09 12										24.00 WX	24.00

DATE	LINE	S.P. RANGE	TOTAL SHOTPOINTS	KM	RECORD	LINE CHANGE	TRAVEL/ SUPPLY	STRM/GUN HANDELING	NAV CALIB	DOWNTIME	TOTAL
09 13										16.00 WX	
						1.00					
	85-3	101 - 1039	857	42.850	6.30					0.70 NAV	24.00
09 14										7.45 NAV	
	85-3A	101 - 2633	2533	126.650	16.55						24.00
09 15										0.60 STR	
	85-3A	2634 - 2732	0	0.000				4.40 7.50 5.50			
						2.70					
	85-3B	2733 - 3273	504	25.200	3.30						24.00
09 16											
	85-3B	3274 - 6865	3592	179.600	24.00						24.00
09 17											
	85-3B	6866 - 7585	608	30.400	4.63			2.87		6.10 STR	
	85-3C	7586 - 9096	1475	73.750	10.40						24.00
09 18											
	85-3C	9097 - 10681	1342	67.100	11.20			2.80		5.75 STR	
								4.25			24.00
09 19								1.00			
						0.55					
	85-3D	10714 - 11910	1160	58.000	8.77			3.68 2.25			
							7.75				24.00

DATE	LINE	S.P. RANGE	TOTAL SHOTPOINTS	KM	RECORD	LINE CHANGE	TRAVEL/ SUPPLY	STRM/GUN HANDELING	NAV CALIB	DOWNTIME	TOTAL
09 20							14.00				
								3.50			
								6.00			
						0.50					
											24.00
09 21											
						1.10					
	85-4	101 - 400	0	0.000		2.03					
	85-4	401 - 3422	3022	151.100	20.87						
											24.00
09 22											
	85-4	3423 - 5445	1927	96.350	13.18						
								2.82			
								2.50			
										5.50 WX	
											24.00
09 23											
										24.00 WX	
											24.00
09 24											
										24.00 WX	
											24.00
09 25											
										12.70 WX	
	85-04A	5446 - 7282	1737	86.850	11.30						
											24.00
09 26											
	85-04A	7283 - 8361	1079	53.950	6.60						
								3.40			
								2.00			
							12.00				
											24.00
	TOTALS		19836	991.800	137.10	7.88	66.75	66.47		273.80	552.00



AGC: LITHOPROBE EAST 1985 SURVEY

Geophysical Service Inc. wishes to take this opportunity to thank the Atlantic Geoscience Centre for its cooperation in the conduct of this survey.

Respectfully submitted,

John W. Clink
Arctic Marine Operations Manager

JWC/kjb

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	Up to 127.48 Litres, Mk I, II, & III PnuCon Airguns
Compressors	Four: PB44/300 Chicago Pneumatic Three: 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

* GSI Trademark
** Texas Instruments Trademark

APPENDIX A-2

CREW DESCRIPTION

SHORE-BASED PERSONNEL

1	Operations Supervisor
1	Senior Administrator

ON-BOARD SEISMIC PERSONNEL

1	Party Manager
2	Quality Control Personnel
2	CMS Operators
3	TSR Operators
1	Compressor Mechanic
5	Airgun Mechanics
3	Survey Operators (CAN-NAV Limited)
2	Gravity Operators (EDCON)

VESSEL CREW

1	Ship's Captain
1	Mate
1	Chief Engineer
1	Second Engineer
2	Seamen

APPENDIX A-3

PERSONNEL

Operations Supervisor	Matt Kimball	(CDN)
Senior Administrator	F. Cholette	(CDN)
Party Manager	E. Pickstone	(U.K.)
Quality Control Personnel	G. Michael	(CDN)
	R. Knudson	(CDN)
CMS Operators	D. Accardo	(CDN)
	P. Doyle	(CDN)
TSR Operators	G. Wakamoto	(CDN)
	A. Kirk	(CDN)
Compressor Mechanic	L. O'Keefe	(CDN)
Airgun Mechanics	D. Brown	(CDN)
	J. Churchill	(CDN)
	N. Mills	(CDN)
	G. Brinson	(CDN)
	P. Murphy	(CDN)
Survey Operators (CAN-NAV Limited)	D. Parkhill	(CDN)
	G. Ryan	(CDN)
	M. MacAllister	(CDN)
Gravity Operators (EDCON)	J. Connick	(CDN)
	A. Thompson	(CDN)

VESSEL

Captain	J. Martian	(CDN)
Mate	T. Pham	(CDN)
Chief Engineer	D. Lang	(CDN)
Second Engineer	J. Birkelund	(CDN)
Seamen	F. Ryan	(CDN)
	D. Forward	(CDN)

APPENDIX A-4

INSTRUMENT DETAILS

Recording System	
Type	Trace Sequential Recorder
Serial No.	0004
Number of Analog Modules	2
Number of Tracks on Tape	9
Tape Manufacturer	WABASH
Tape Format / Packing Density	
Type	SEG-D, Group Coded
Packing Density	6250 bpi
Tape Speed	125 ips
Sample Period	4 ms
Record Length	18 s, 20 s, 22 s
Gain Control Mode	IFP
Reproduce Mode	PGC
Gain Constant	24 dB
Total System Gain	108 dB
Quoted System Dynamic Range	84 db
Filters	Hi-Cut: 64 Hz @ 72 dB/oct Lo-Cut: 5.3 Hz @ 18 dB/oct
Camera	SIE ERC 10C
Polarity	+ pressure on hydrophones causes a downbreak on camera galvo

APPENDIX A-5

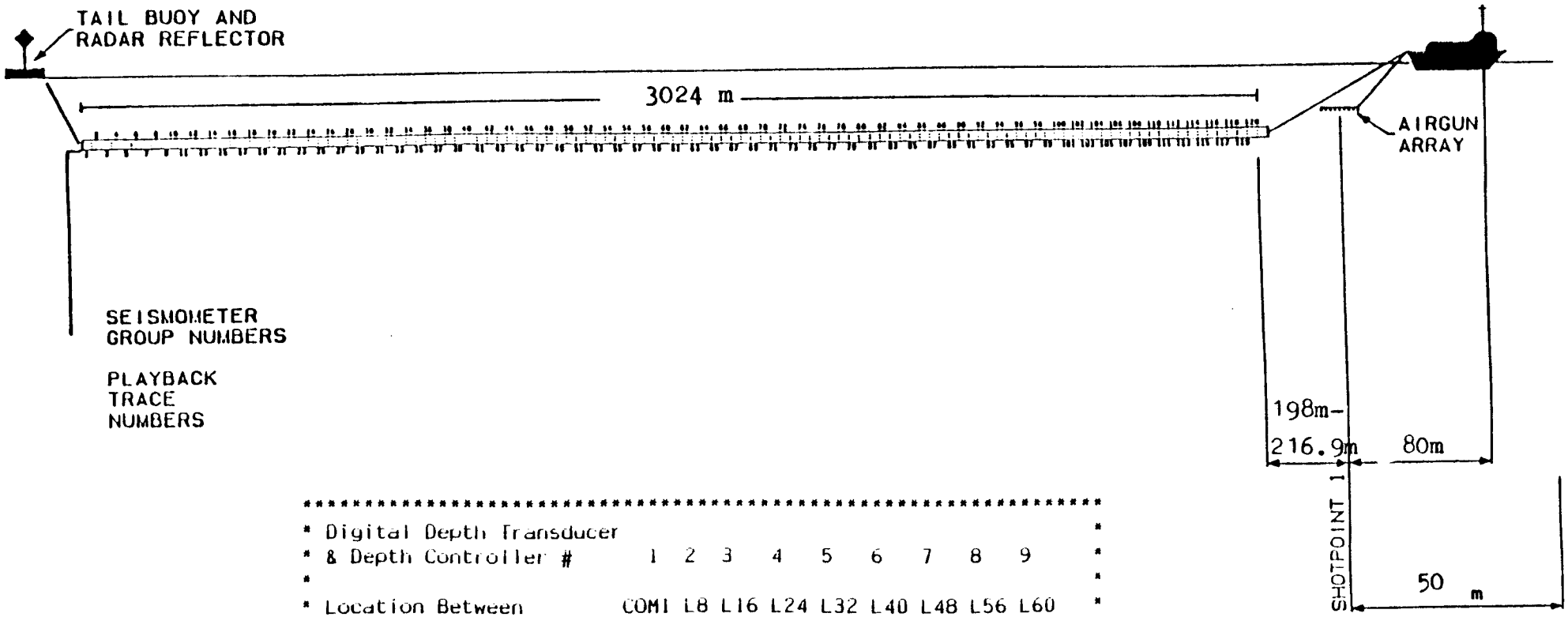
CABLE DETAILS

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	.93 m
Depth Transducer Length	4 m
Compass Section Length	3 m
Front End Adapter	1 m
Length of Tailbuoy Rope	202 m
Stretch Section Length	50 m
Total Length of Nylon Stretch Sections	250 m
Stretch Factor	10 % - 15 %
Target streamer depth range	13 m (+/- 2 m)
Locations of Depth Transducers	See cable diagram
Location of Depth Controllers	See cable diagram
Type of Depth Controllers	Syntron Model 2000 Remote Control Levellers
Location & Details of Auxiliary Sections (if used)	See cable diagram

APPENDIX A-6

DIAGRAM of 3000 m STREAMER

120 Traces



Digital Depth Transducer & Depth Controller #	1	2	3	4	5	6	7	8	9
Location Between Section Numbers	COM1 L1	L8 L9	L16 L17	L24 L25	L32 L33	L40 L41	L48 L49	L56 L57	L60 COM9
Compass Section #	1	2	3	4	5	6	7	8	9
Location Between Section Numbers	TS3 DDT1	L4 L5	L12 L13	L20 L21	L28 L29	L36 L37	L44 L45	L52 L53	DDT9 FEA

Nylon Stretch Sections 250 m

L = Live Section
COM = Compass Section
DDT = Digital Depth Transducer with Depth Controller
TS = Tail Stretch Section
FEA = 120 Trace Front End Adapter

APPENDIX A-7

AIRGUN DESCRIPTION

Type	Six string, wide tow array
Make & Model	Texas Instruments MK1, Mk II, Mk III Pnu-Con Airguns
Total Active Volume	127.48 L
Total Spare Volume	25.24 L
Operating Depth	13 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	
Four Outside Strings	.56 m
Two Inner Strings	.51 m
Length of each Array String	
Four Outside Strings	9.3 m
Two Inner Strings	7.0 m

cont'd.

* GSI Trademark

AIRGUN ARRAY cont'd.

Array String Separation Distance

Outer Strings to Middle Strings	23 m
Middle Strings to Inner Strings	15 m
Inner String to Inner String	9 m
Total Array Width	83 m (+/- 2 m)

Distance, Stern to First Gun

Inner Strings	70 m
Middle Strings	80 m
Outer Strings	87 m
Distance, Stern to Acoustic Centre of Gun Array	80.0 m
Distance, Common Navigation Position to Acoustic Centre of Gun Array	80.0 m
Distance from Array Centre to Near Group Centre (OFFSET)	198 m - 216.9 m

Comment on Configuration:

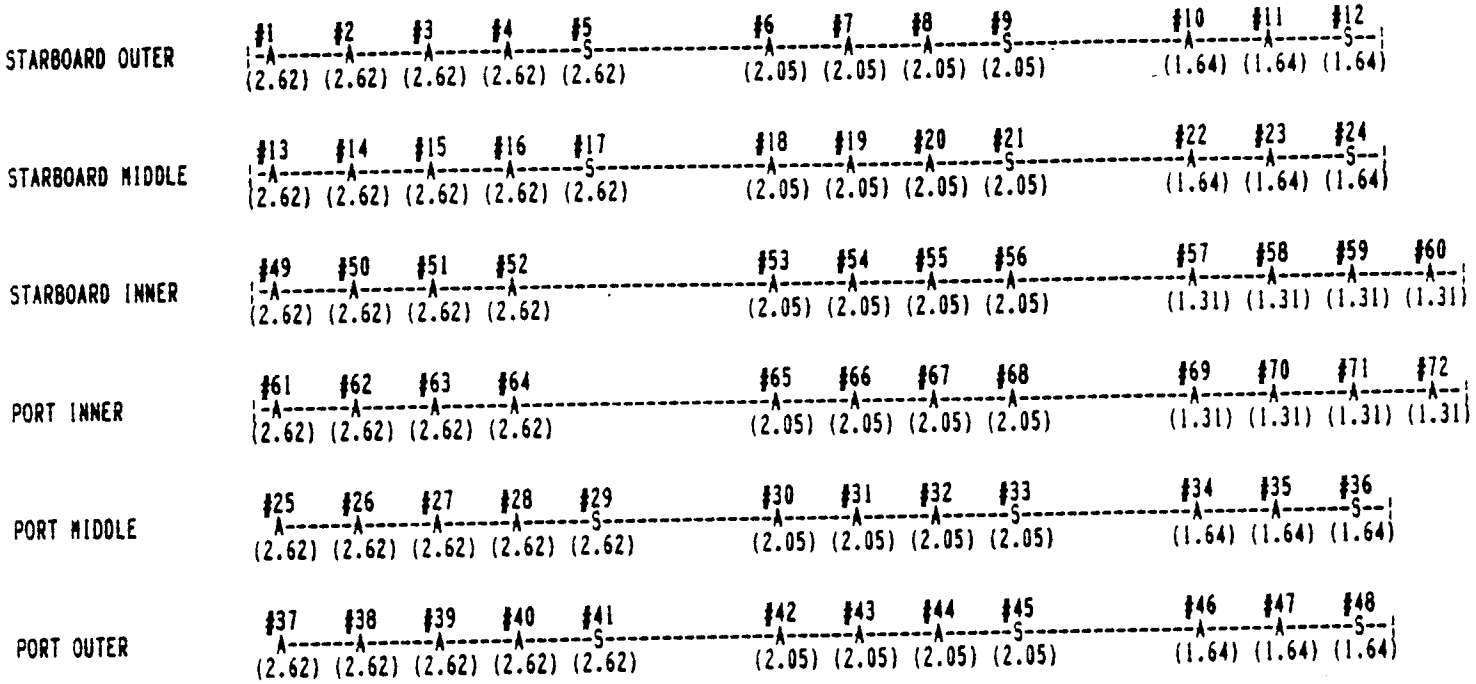
This gun array consisted of 72 guns--60 active and 12 spare guns. Since the TIGER II timing controller can only monitor 65 guns at a time it was necessary to switch 8 of the spare guns "in and out" of the patch panel. Consequently gun numbers appearing on the ADL (Automatic Data Logger) do not correspond to actual gun numbers, but instead to the 64 TIGER channels. The Shipment Summary Report lists the TIGER channels as they appear on the ADL and the airguns which correspond to each channel.

APPENDIX A-8

GSI WIDE TUNED AIRGUN ARRAY

127.48 Litres

ELEMENT DIAGRAMS: Number of Airgun
Active or Spare Status
Capacity in Litres



AIRGUN ARRAY COMPOSITION

Active Guns:	24 x 2.62 L	Spare Guns:	4 x 2.62 L
	20 x 2.05 L		4 x 2.05 L
	8 x 1.64 L		4 x 1.64 L
	8 x 1.31 L		
Total	127.48 L	Total	25.24 L

NAVIGATION cont'd.

Supplementary Navigation Systems	Loran-C (velocities) Satellite Updates (fixes)
Back-up Navigation System	GEONAV
Common Navigation Position	GPS antenna located on 3D tow fixture
Coverage	6000%
Shotpoint Interval	50 m
Auxiliary Equipment	2 track plotters
Primary calibration points used	Three way fixes and baseline crossings. Satellite updates.

APPENDIX A-9

SURVEY INFORMATION

PRIMARY SYSTEM

Type	SPOT
Survey Company	CAN-NAV Limited
Operating Frequency	2 MHz
Data Rate	2 s
Date Format	1
Lane Width	149.8345 m
Primary Antenna Location	
Site	on port stack
Distance from CNP	34.4 m
Bearing	0.0 degrees
Secondary Antenna Location	
Site	on helideck tower
Distance from CNP	34.5 m
Bearing	355.0 degrees

SECONDARY SYSTEM

Type	ARGO DM-54
Survey Company	CAN-NAV Limited
Operating Frequency	1628 kHz
Data Rate	2 s
Date Format	1
Lane Width	84.0822 m
Antenna Location	
Site	on starboard stack
Distance from CNP	34.5 m
Bearing	5.0 degrees

APPENDIX A-10

POST-PLOT PARAMETERS

Spheroid	Clarke 1866
Datum	NAD 1927
Projection	Lambert Conformal Conic
Northern Parallel	49 Degrees North
Southern Parallel	43 Degrees North
Origin Latitude	46 Degrees North
Origin Longitude	46 Degrees West
Map Scale	1:1 000 000
Position Plotted	Antenna
Shotpoint Plot Interval	50
Shotpoint Label Interval	1000

APPENDIX A-11

FATHOMETER / SINGLE TRACE PROFILER

FATHOMETER

Manufacturer	Simrad
Model	EA
Conversion Velocity	1470 m/s
Operating Frequency	38 kHz
Transducer Position	
From Stern	33.5 m
Port of Centre Line	2.1 m
Is Instrument Corrected for draft	Yes; 4 m

SINGLE TRACE PROFILER

Manufacturer	EPC Labs Inc.
Model	3200
Serial No.	256
Source	Trace #119
Gain Mode	Per recording system
Recorder trigger	Field time break
Display Method	Varied modes
Filters	Hi-Cut: 64 Hz @ 72 dB/oct Lo-Cut: 5.3 Hz @ 18 dB/oct