FINAL REPORT
ATLANTIC GEOSCIENCE CENTRE
ST. LAWRENCE SURVEY 1986
M/V FRED J. AGNICH

TABLE OF CONTENTS

I INTRODUCTION

Geophoto Services, Ltd. conducted the St. Lawrence marine seismic exploration survey for the Atlantic Geoscience Centre during 1986 in the Gulf of St. Lawrence. The M/V Fred J. Agnich (Geophoto Party 2995) recorded 1171.550 km of seismic data during the period of 1986 08 02 to 1986 08 21.

All of the seismic data were forwarded to Geophoto's office in Calgary, Alberta for processing. The navigation data were post-processed and mapped by the navigation department at this same centre.

II EQUIPMENT

A. VESSELS

The M/V Fred J. Agnich, a Canadian flag vessel of 56.4 m length and 979.59 gross tonnage, conducted 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 DFS V* unit was used to record 120 trace data at a 4 ms sample rate for 18 s and 20 s on 1/2" tape (format SEG-B; phase encoded) with a 1600 bpi packing density. Regular quality control tests were performed to assure satisfactory performance of the unit.

Additional information about the recording instruments are provided in Appendix A-4.

C. STREAMER

A 3024 m Texas Instruments streamer comprised of 120 x 25 m live-groups, each containing acceleration cancelling hydrophones spaced .93 m apart, was towed at a target depth range of 15 +/- 2 m to collect seismic data. Strong currents, kelp and regular maintenance accounted for the streamer downtime during this survey.

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

D. SOURCE

A wide tuned airgun array of 127.48 L capacity, comprised of 60 active 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 13.1 - 13.8 MPa was supplied by three Sullair and four Chicago Pneumatic PB-44-300 compressors. A GSI TIGER II timing controller assured precision firing of the individual airguns.

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

E. SURVEY

GEONAV, using a Transit Magnavox MX 1107 RS satellite receiver and sonar velocities, provided the primary navigation information for this survey. For the secondary system, CAN-NAV Ltd. personnel operated a Loran-C system, which employed an INTERNAV LRM-08 receiver. Also Geophoto personnel operated a Texas Instruments 4100 GPS (Global Positioning System) receiver as a backup source of survey information.

A Geophoto 990 NAV unit provided real time navigation, while the CMS (Configurable Marine System) assured line control. All survey information systems were interfaced to the CMS II integrated satellite / doppler sonar system of the Texas Instruments R-990 computer.

The Loran-C base stations were located at:

Sta. Caribou	049 48 27.54 N	067 55 39.35 W
Sta. Nantucket	041 15 11.98 N	069 58 40.51 W
Sta. Cape Race	046 46 32.62 N	053 10 32.41 W
Sta. Fox Harbour	052 22 35.11 N	055 42 31.35 W

Additional details about the survey systems can be found in Appendix A-9.

III OPERATIONS

The M/V Fred J. Agnich commenced resupplying for this survey at 05:00 G.M.T. on 1986 08 02 in the port of Halifax, Nova Scotia. This task was completed at 02:00 the next day, and the vessel set a course for the survey site, calibrating the Loran-C navigation system with the GPS (Global Positioning System) en route. Maintenance work and testing of the 3024 m streamer and the six-string 127.48 L airgun array occupied the crew during the next three days.

Production started on 1987 08 07. The first attempt to record Line 5A was terminated when the streamer tail drifted out of depth specifications, and a second run was made on this leg of the line. During the next two days shooting on subsequent portions of the line was interrupted by a loss of power in an inner string of the airgun array, by a mistaken fire alarm (due to smoke in the gun shack) which resulted in shutting down the back deck equipment as part of emergency proceedures, and by navigation failure when the 990 NAV unit stopped reading the sonar data. However the line was completed at 10:00 on 08 09, and the streamer and airgun array were retrieved in preparation for a long transit to Line 4. During this line change repairs were made to both the streamer and airguns.

Recording restarted on Line 4 at 07:30 on 08 10, and progressed smoothly using 20 s records through the completion of this line at 07:30 the next day. Another extended line change and repairs to the DFS V unit were required before recording resumed on Line 2B (returning to 18 s records) at 13:00 on 08 12. During the next four days work progressed steadily on portions of this line despite interruptions caused by inclement weather conditions, problems with the airgun array's port paravane buoy (which was not floating properly), the streamer's entanglement with kelp, cable drift, and a broken shaft on the electrical motor driving the saltwater pump, which provided cooling for the gunshack. Line 2F was completed at 15:30 on 08 15.

The M/V Fred J. Agnich then traveled to Line 1, which the crew started to record at 22:00 that same day, and proceeded without interruption through the completion of this line at 04:00 on 08 17. The next day shooting continued on Line 3, although a segment of the line was deleted as both of the vessel's radar systems were down, and the vessel was traveling through fog in a shipping lane. Sonar problems resulted in poor navigation information for the first portion of data collection on this line. After a break to await daylight conditions for shooting near Cornerbrook, Newfoundland, Line 3A was completed at 12:30 on 08 19, and the vessel headed for Cornerbrook to resupply.

With supplies replenished, the M/V Fred J. Agnich left port at 19:00 on 08 20, and returned to the survey area. After the airguns and streamer were deployed, the crew shot a test line (Deep Probe) before recording the final line of the survey, Line 3AA, between 12:15 and 18:30 on 1987 08 21. Upon completion of this line, the crew retrieved the trailing gear and the M/V Fred J. Agnich departed the prospect area.

IV PRODUCTION STATISTICS

Total Kilometres	1 171.55
Total Hours	475.00
Recording Hours	154.50
Line Change Hours	55.75
Km / Total Hours	2.47
Km / Recording Hours	7.58
Km / Recording & Line Change Hours	5.57
Km / Total Days	59.19
Km / Recording Days	181.99
Km / Recording & Line Change Days	133.73

Total Shotpoints	22 431
Pops / Total Hours	49.33
Pops / Recording Hours	151.66
Pops / Recording & Line Change Hours	111.44
Pops / Total Days	1 183.88
Pops / Recording Days	3 639.77
Pops / Recording & Line Change Days	2 674.64

IV TIME STATISTICS

Recording	154.50	32.53 %
Streamer & Gun Handling	94.50	19.89 %
Travel & Resupplying	79.00	16.63 %
Line Change	55.75	11.74 %
Streamer Failure	30.75	6.47 %
DFS V Failure	13.50	2.84 %
Streamer Damage / Loss	11.75	2.47 %
Other	11.00	2.32 %
Airgun Failure	8.25	1.74 %
CMS Downtime	8.25	1.74 %
Compressor Failure	3.00	.63 %
Weather Downtime	2.75	.58 %
Navigation Calibration	2.00	.42 %
TOTAL	475.00 Hours	100.00 %

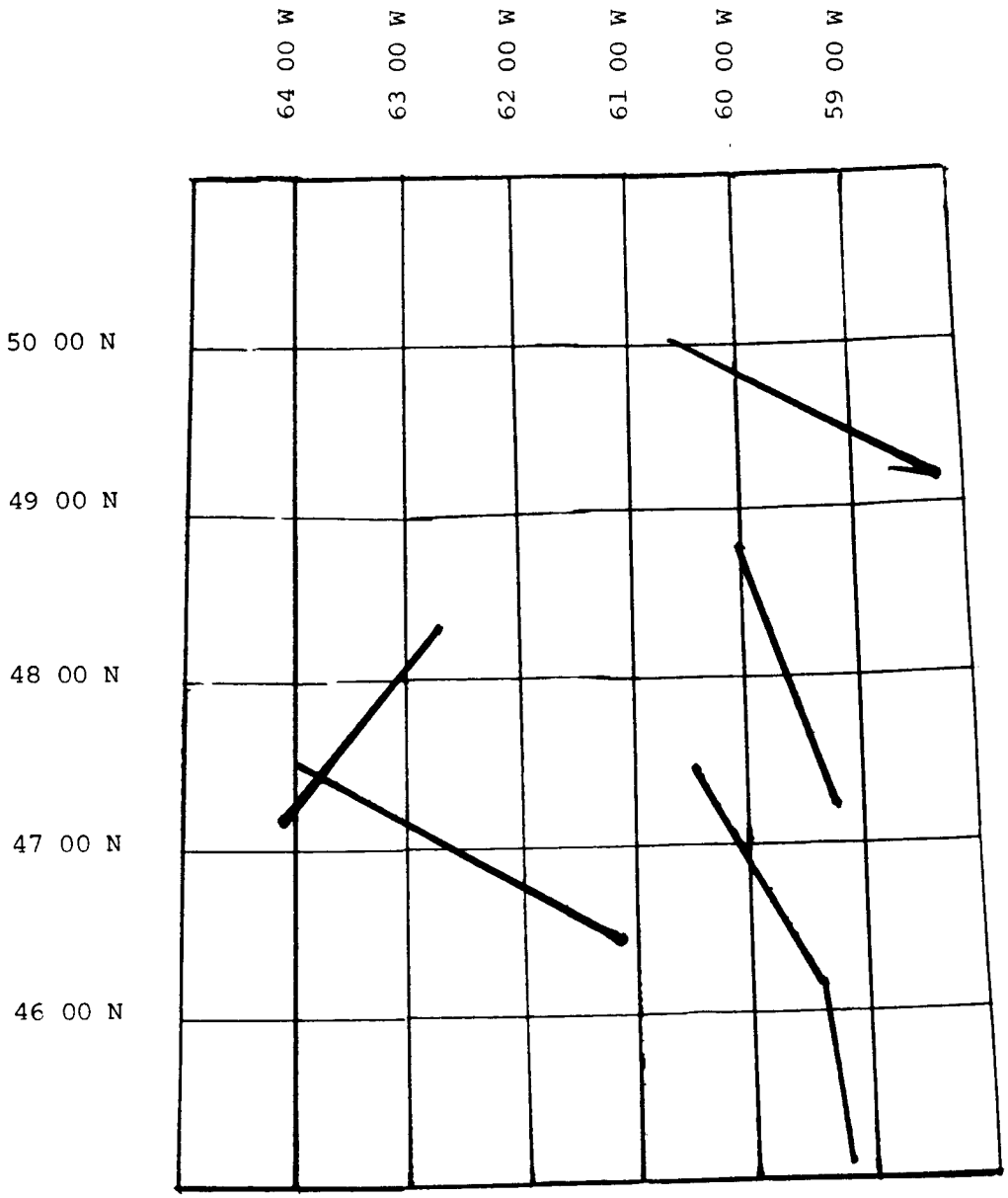
IV TIME & PRODUCTION STATISTICS
ATLANTIC GEOSCIENCE CENTRE
ST. LAWRENCE SURVEY
M/V FRED J. AGNICH
1986 08 02 to 1986 08 21

DATE	LINE	S.P. RANGE	TOTAL SHOTPOINTS	KM	RECORD	LINE CHANGE	TRAVEL/ SUPPLY	STRM/GUN HANDLING	NAV CALIB	DOWNTIME	TOTAL
1986											
08 02							19.00				
											19.00
08 03											
							2.00				
							16.00				
									2.00		
								4.00			
											24.00
08 04											
								21.00			
								3.00			
											24.00
08 05											
								1.00			
								4.00			
										2.00 STR	
								12.50			
										4.50 STR	
											24.00
08 06											
								7.00			
										3.00 CMS	
						0.25					
										0.50 STR	
								4.00			
										4.25 STR	
								5.00			
											24.00

DATE	LINE	S.P. RANGE	TOTAL SHOTPOINTS	KM	RECORD	LINE CHANGE	TRAVEL/ SUPPLY	STRM/GUN HANDLING	NAV CALIB	DOWNTIME	TOTAL
08 07								4.00			
						1.00					
	LINE 5A	101 - 2212	2112	105.600	12.50						
						3.75					
	LINE 5B	101 - 519	419	20.950	2.75						24.00
08 08											
	LINE 5B	520 - 1367	782	39.100	5.50					3.25 A/G	
	LINE 5BA	1261 - 1834	533	26.650	3.75					3.50 OTH	
	LINE 5BB	1794 - 2589	755	37.750	6.25					1.75 CMS	24.00
08 09										3.50 CMS	
	LINE 5BC	2549 - 3539	950	47.500	6.50	9.00		5.00			24.00
08 10										3.00 STR	
								4.50			
	LINE 4	101 - 2601	2501	125.050	16.50						24.00
08 11											
	LINE 4	2602 - 3720	1119	55.950	7.50			3.00			
						13.00				0.50 DFS V	24.00
08 12										13.00 DFS V	
	LINE 2B	101 - 439	231	11.550	2.25					2.75 WX	
										5.00 A/G	
	LINE 2C	311 - 459	108	5.400	1.00						24.00

DATE	LINE	S.P. RANGE	TOTAL SHOTPOINTS	KM	RECORD	LINE CHANGE	TRAVEL/ SUPPLY	STRM/GUN HANDLING	NAV CALIB	DOWNTIME	TOTAL
08 13											
	LINE 2C	460 - 2324	1852	92.600	11.50					11.75 STR DMG	
	LINE 2D	2271 - 2371	60	3.000	0.75						24.00
08 14											
	LINE 2D	2372 - 4479	2020	101.000	13.75					10.25 STR	24.00
08 15											
										4.75 STR	
	LINE 2E	4357 - 4805	414	20.700	3.00					3.00 COMP	
	LINE 2F	4765 - 5507	702	35.100	4.75	6.50					
	LINE 1	101 - 553	453	22.650	2.00						24.00
08 16											
	LINE 1	554 - 4322	3769	188.450	24.00						24.00
08 17											
	LINE 1	4323 - 4951	629	31.450	4.00	20.00					24.00
08 18											
						1.00					
								3.00			
								5.00			
						0.75					
	LINE 3	901 - 3246	2201	110.050	14.25						24.00
08 19											
	LINE 3	3247 - 3575	329	16.450	2.25					6.75 OTH	
	LINE 3A	101 - 646	546	27.300	3.50						
								2.50			
										1.50 STR	
							2.50				
							5.00				
											24.00

DATE	LINE	S.P. RANGE	TOTAL SHOTPOINTS	KM	RECORD	LINE CHANGE	TRAVEL/ SUPPLY	STRM/GUN HANDLING	NAV CALIB	DOWNTIME	TOTAL
08 20											
							19.00				
							5.00				
											24.00
08 21											
							3.00				
								2.00			
							6.00				
	DEEP PROBE	101 - 191	0	0						0.75 OTH	
						0.50					
	LINE 3AA	101 - 1097	946	47.300	6.25						
								3.00			
								1.00			
							1.50				
											24.00
TOTALS			23431	1171.550	154.50	55.75	79.00	94.50	2.00	89.25	475.00



AGC: ST. LAWRENCE SURVEY 1986

Geophoto Services, Ltd. wishes to take this opportunity to thank the Atlantic Geoscience Centre for its cooperation in conducting this survey.

Respectfully submitted,

John W. Clink
Director

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	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

* GSI Trademark
** Texas Instruments Trademark

APPENDIX A-2

CREW DESCRIPTION

SHORE-BASED PERSONNEL

1	Operations Supervisor
1	Administrator

ON-BOARD SEISMIC PERSONNEL

1	Party Manager
2	CMS Operators
2	DFS V Operators
2	Quality Control Personnel
1	Compressor Mechanic
5	Airgun Mechanics
1	Contracted Survey Operator (CAN-NAV Ltd.)

VESSEL CREW

1	Ship's Captain
1	First Mate

APPENDIX A-3

PERSONNEL

Operations Supervisor	M. Kimball	(CDN)
Administrator	E. Williams	(CDN)
Party Manager	E. Pickstone	(AUST)
CMS Operators	G. Ryan	(CDN)
	M. Wolfe	(CDN)
DFS V Operators	B. Dawson	(CDN)
	G. Williams	(CDN)
Quality Control	L. Redbourne	(CDN)
	C. Grandy	(CDN)
Compressor Mechanic	E. Gaulton	(CDN)
Airgun Mechanics	G. Hall	(CDN)
	D. Brown	(CDN)
	J. Abbott	(CDN)
	G. Herrit	(CDN)
	C. Churchill	(CDN)
Survey Operator: CAN-NAV Ltd.	G. Ryan	(CDN)

VESSEL CREW

Captain	I. Williams	(CDN)
First Mate	R. Harber	(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	18 s & 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 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.

* TI Trademark

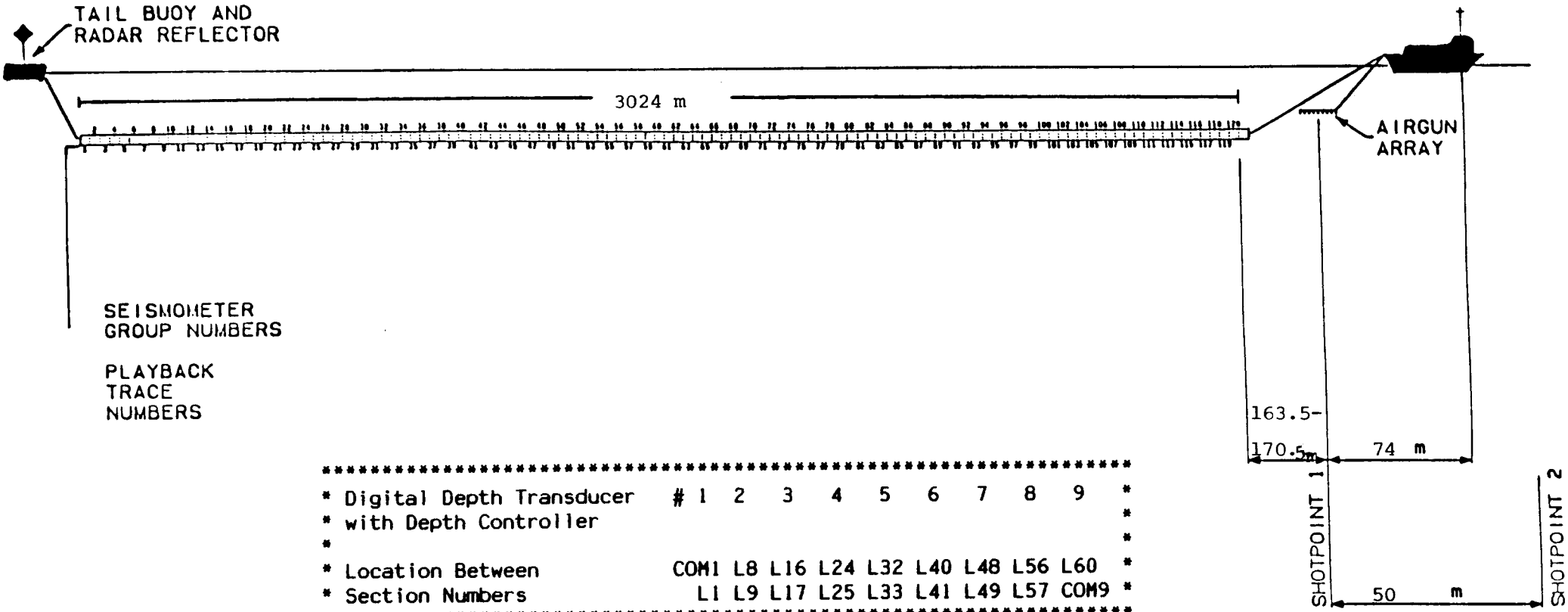
APPENDIX A-5

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 Live Groups	120
Group Length	25 m
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	200 m
Stretch Factor	10 % - 15 %
Skin Type	PU (cold water skin)
Target Cable Depth	15 m (+/- 1 m)
Average Water Temperature	6 Degrees Celsius
Ship Speed during Production	3.8 - 4.5 knots
Type of Depth Controllers	RCL-2 Cable Levellers (individually programmable)
Locations of Depth Transducers & Depth Controllers	See cable diagram

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		COM1 L1	L8 L9	L16 L17	L24 L25	L32 L33	L40 L41	L48 L49	L56 L57	L60 COM9
Nylon Stretch Sections	200 m									
L = Live Section	COM = Compass Section									

APPENDIX A-7

AIRGUN DESCRIPTION

Type of Source	Six strings, staggered array
Type of Airguns	TI Mod II & Mod III Pun-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	13.1 - 13.8 MPa
Compressors	
Type	Sullair
No. in Use	3
Type	GMC / Dual PB44-300
No. in Use	4
Coalescing Gun Separation Distance	.53 m
Total Array Width	70 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)	163.5 m - 170.5 m

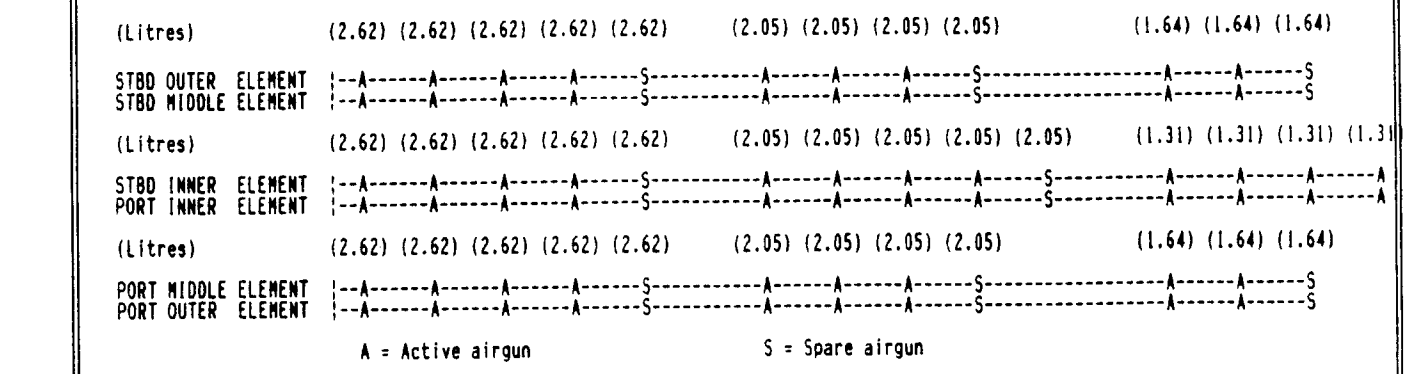
* GSI Trademark

APPENDIX A-8

AREAL TUNED AIRGUN ARRAY

127.48 Litres - 6 Elements

AIRGUN CAPACITY:



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. Guns are Texas Instruments Mod II & Mod 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

System	GEONAV: Transit Satellite with sonar velocities
Survey Company	Geophoto Services, Ltd.
Satellite Receiver	Magnavox MX1107 RS
Receiver Frequencies	400 MHz & 150 MHz
Antenna	
Height above sea level	20 m
Distance from Stern	35 m
Offset from Centreline	1 m
Distance & Bearing from CNP	34.4 m @ 358.4 Degrees

SECONDARY SYSTEM

Type	Loran-C
Survey Company	CAN-NAV Ltd.
Receiver	InterNav LRM-08
Lane Width	299.6929
Antenna	
Height above sea level	15 m
Distance from Stern	35 m
Offset from Centreline	3 m
Distance & Bearing from CNP	34.4 m @ 5 Degrees

Survey Information cont'd.

BACKUP SYSTEM

Type	Global Positioning System
Survey Company	Geophoto Services, Ltd.
Receiver	Texas Instruments 4100
Antenna	
Height above sea level	5 m
Distance from Stern	1 m
Distance & Bearing from CNP	Antenna is located on the tow fixture and is the CNP

Common Navigation Point	GPS Antenna (located on the tow fixture)
Coverage	30 Fold (3000 %)
Shotpoint Interval	50 m
Auxiliary Equipment	2 track plotters
Primary calibration points used	Satellite updates. Baseline crossings.

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 Trace #117
Gain Mode	Same as recording unit
Filters	
Hi-Cut	64 Hz @ 72 dB/oct
Low-Cut	5.3 Hz @ 18 dB/oct
Recorder Trigger	TIGER synch out signal
Display Method	Single channel

APPENDIX A-10

POST-PLOT PARAMETERS

Ellipsoid	International
Projection	Lambert Conformal Conic
Northern Parallel	049 00 00.00 N
Southern Parallel	043 00 00.00 N
Origin Latitude	043 00 00.00 N
Origin Longitude	051 00 00.00 N
Map Scale	1 : 1 000 000
Project Units	Metres
Position Mapped	Antenna