FINAL REPORT
ATLANTIC GEOSCIENCE CENTRE
LABRADOR TRANSIT
LABRADOR SEA
M/V FRED J. AGNICH
1990

TABLE OF CONTENTS

I INTRODUCTION

Geophoto Services, Ltd., a subsidiary of Halliburton Geophysical Services, Inc., conducted a marine seismic survey for Energy Mines and Resources, Atlantic Geoscience Centre (AGC), in the Labrador Sea under contract number OSC89-00554-(011)/A.

The M/V Fred J. Agnich, HGS Party 2995, collected 953.75 km of seismic data during the period 1989 07 18 through 1989 08 01 and 1990 10 30 through 1990 11 06

II EQUIPMENT

A. VESSEL

The M/V Fred J. Agnich, a Canadian flag vessel of 56.4 m length and 979.59 gross 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. RECORDING INSTRUMENTS

A Texas Instruments DFS V was used to record seismic data from the conventional analog streamer. Data was sampled at 4 ms and recorded through 90 Hz 72 dB/ octave high cut and 5.3 Hz 18 dB/octave low cut filters. The record length was 20 s.

Recording instrument details are found in Appendix A-4.

C. STREAMER

A 3000 m analog streamer with 120 groups 25 m in length, each containing 32 hydrophones, was used. The cable was towed at an average depth of 12 m +/-2 m.

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

D. SOURCE

For the first part of the survey, a point source 6 string gun array was used. The two outer arrays had paravanes and floats to achieve the outer-to-outer spread required. The array consisted of 64 active guns with a total volume of 115.62 L, and 6 spares with a volume of 13.86 L. The line completion on 1990 10 31 was acquired using a 4 string gun array which consisted of 57 active guns with a total volume of 59.26 L, and 9 spares with a volume of 15.27 L.

The timing and firing of the guns was controlled by a Texas Instruments Airgun Controller (TIGER II) system. This system continually adjusted the firing pulse to each individual gun to make the whole array fire simultaneously and obtain optimum performance. Individual gun firing delays were continuously controlled to maintain array timing with +/- 1 ms of the operational 51.2 ms.

E. NAVIGATION

On the first part of the survey, the G.P.S. (TI 4100 Navstar Navigator) was used as the primary navigation system and Magnavox MX1107 Satellite Receiver was used as the secondary navigation system. For the remainder of the survey, the Trimble GPS system was fully operational after being successfully interfaced to the CMS. The Trimble was highly accurate, giving stable navigation, with no problems being encountered. Differential GPS was not used on this line, RAW information from the Trimble was used with good results and accuracy.

Survey instrument details found in Appendix A-9.

III OPERATIONS

The M/V Fred J. Agnich docked at Halifax NS at 1990 07 06 13:00 GMT to repair and modify equipment and to resupply for the Labrador Sea Survey. She departed that port on 07 10 at 07:00 en route to St. Anthony NF, arriving there at 07 13 09:00 to top up supplies and people and load more Oceonic navigation equipment.

The ship departed St. Anthony the next day at 15:00 and proceeded to the west end of the program. Work commenced laying streamers at 07 16 01:30 and then spent some time working on it and the air gun array. The ballasting was interrupted by a navigation failure due to unreliable velocities from Loran

C and GPS. The guns were deployed by midnight of the 17/18th, including 17 hours of badly identified time!!!!. Foggy conditions and large icebergs on the line inhibited recording until 07 18 14:06, when Line AGC-90-001 commenced. After 827 SP's, the GPS and Loran C signals were not reliable until 07 19 05:18, when useful recording, after an aborted attempt at Line 001A, was again under way on Line 001B. The lack of GPS coverage once more caused an interruption at 12:59 but recording began again at 18:47, Line 001C, and was interrupted once more at 07 19 01:48. At 05:22 recording was re-started, Line 001D, only to be halted at 09:09, this time for the loss of the paravane and float from the port outer string. An attempt was made to renew operations at 05:47 on 07 21, Line 001E, but this was aborted due to swell noise. At 15:06 that day, recording was resumed, Line 001F, to be stopped by loss of GPS coverage from 17:50 to 21:45, when another 560 SP's were recorded on Line 001G. This was followed by a sequence of problems beginning at 07 22 01:27, including lack of GPS coverage, CMS failure, and DFS failure, until acceptable recording began on Line 001K at 13:17. Loss of the GPS coverage caused an interruption from 17:34 to 20:45 when Line 001L was started. This lasted until 07 23 09:27 when once more the GPS coverage was insufficient. At 12:02 recording resumed on Line 001M and carried on until 22:29, when this segment was completed, finishing the 369.2 km of Line AGC-90-001.

The Agnich circled to come on to Line AGC-90-002 but was prevented by navigation failure and then, once the line commenced, by CMS failure. Line 002A started at 07 24 08:04 and was interrupted by lack of navigation at 14:28 through 20:17. Line 002C was shut down by loss of GPS at 07 25 01:42 and recommenced as Line 002D at 06:39. The TIGER failed at 09:30 and the line was resumed, as Line 002E at 11:58 but was shut down once more for lack of GPS at 17:23. At 21:45 Line 002F was started and this continued until 07 26 01:29, again being shut down by GPS. Line 002G was started at 04:13 but a CMS failure terminated it after a few shotpoints. Line 002H was begun at 06:17 and was interrupted for GPS loss from 13:31 until 14:23, when the starboard outer paravane and float were lost. After recovery, the guns were back in the water and but operations were prohibited by a finger problem and weather until Line 002L was started at 22:34. Loss of GPS coverage again prevented operations from 07 28 01:58 until 05:00. Line 002M was stopped by weather at 07 28 21:17 and Line 002N did not commence until 07 30 at 03:24. This segment was finished at 13:30, completing Line AGC-90-002.

A short circle brought the Agnich on to Line AGC-90-003 at 13:30. GPS loss from 00:54 until 03:36 was interspersed prior to Line 003A and another from 17:06 until 20:10 led to Line 003B. This was interrupted at 08 01 00:30, again for GPS, and then an attempt at Line 003C was aborted by a CMS failure. Work began on Line 003D at 06:30 and carried on until stopped by lack of

GPS signals at 14:22. Recording started on Line 003E at 17:52 but was stopped by ice at 19:39.

The decision was made, in conjunction with the Scientific Authority, to suspend operations until completion of other West Greenland work, when the missing portion of Line AGC-90-003 was to be acquired on the way back to Canada and using the West Greenland source.

The guns and streamer were retrieved and the Agnich headed for Nuuk (Godthaab) Greenland, arriving there at 08 03 05:00 but having to wait for dock space until 19:00.

Following completion of other work offshore West Greenland, the Agnich resupplied at Nuuk while waiting-on-weather and left port at 90 10 30 11:45. The streamer and guns were laid en route and the boat commenced shooting at 10 31 14:46 from the east end of Line AGC-90-003, segment 003F. A total of 30.95 km were acquired of which the first 15.90 were chargeable; the remainder being an overlap, at the Scientific authorities request, to afford comparison between the two sources. This work was completed at 18:50; the guns and cable were on board by 21:45 and the Agnich proceeded to the shelter of the Greenland coast to wait out a storm.

At 90 11 02 02:00, the weather was good enough to begin transit to Halifax. The vessel arrived at Halifax 11 06 20:00, completing the work for AGC.

PRODUCTION STATISTICS

Total Kilometres	953.75
Total Hours	870.00
Recording Hours	159.49
Line Change Hours	5.88
Km/Total Hour	1.10
Km/Recording Hour	5.98
Km/Record & L/C Hour	5.77
Km/Total Day	26.31
Km/Recording Day	143.52
Km/Record & L/C Day	138.42

Total Pops	19075
Pops/Total Hour	21.93
Pops/Recording Hour	119.60
Pops/Record & L/C Hour	115.35
Pops/Total Day	526.21
Pops/Recording Day	2870.40
Pops/Record & L/C Day	2768.34

TIME STATISTICS

	HOURS	%
Recording Activities	159.49	18.33
Line Change	5.88	0.68
Travel	270.47	31.09
Supply	120.00	13.79
Streamer Handling	22.00	2.53
Airgun Handling	63.34	7.28
Weather Time	95.44	10.97
Ice Delay	17.28	1.99
Other Downtime	116.10	13.34

	Hours	%
Navigation	70.36	60.60
Instruments	5.32	4.58
CMS	14.80	12.75
Other	20.62	17.76
Streamer	5.00	4.31
Total	116.10	100.00

TOTAL	870.00	100.00

TIME AND PRODUCTION STATISTICS

ATLANTIC GEOSCIENCE CENTRE
LABRADOR SEA – LABRADOR TRANSIT

M/V FRED J. AGNICH
1990 07 18 TO 1990 08 01
1990 10 30 AND 1990 10 31

DATE	LINE	ACQUIRED 1ST S.P.	ACQUIRED LST S.P.	CHARGED 1ST S.P.	CHARGED LST S.P.	TOTAL S.P.'S	SEISMIC KM	RECORD TIME	LINE CHG.	TRAVEL TIME	SUPPLY TIME	STRMR HNDL	GUN HNDL	WTHR. TIME	ICE DELAY	OTHER DT	HOURS
07-06			-		-						11.00						11.00
"			-		-												11
07-07			-		-						24.00						24.00
"			-		-												24
07-08			-		-						24.00						24.00
"			-		-												24
07-09			-		-						24.00						24.00
"			-		-												24
07-10			-		-						7.00						7.00
"			-		-					17.00							17.00
"			-		-												24
07-11			-		-					24.00							24.00
"			-		-												24
07-12			-		-					24.00							24.00
"			-		-												24
07-13			-		-					9.00							9.00
"			-		-						15.00						15.00
"			-		-												24
07-14			-		-						15.00						15.00
"			-		-					9.00							9.00
"			-		-												24
07-15			-		-					24.00							24.00
"			-		-												24
07-16			-		-					1.50							1.50
"			-		-							14.50					14.50
"			-		-											5.00 STM	5.00
"			-		-								3.00				3.00
"																	24

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07-17			-			-									1.50					1.50
"			-			-												2.50	NAV	2.50
"			-			-								3.00						3.00
"			-			-									17.00					17.00
"			-			-														24
07-18			-			-											14.10			14.10
"	AGC90-001	101	-	927	101	-	841	741	37.050	5.77										5.77
"			-			-												4.13	NAV	4.13
"			-			-														24
07-19	AGC90-001A	781	-	822		-												5.30	NAV	5.30
"	AGC90-001B	781	-	1883	842	-	1721	880	44.000	7.68										7.68
"			-			-												5.80	NAV	5.80
"	AGC90-001C	1661	-	2435	1722	-	2435	714	35.700	5.22										5.22
"			-			-														24
07-20	AGC90-0001	2436	-	2689	2436	-	2611	176	8.800	1.80										1.80
"			-			-												3.57	NAV	3.57
"	AGC90-0010	2551	-	3120	2612	-	3021	410	20.500	3.78										3.78
"			-			-									14.85					14.85
"			-			-														24
07-21			-			-									5.78					5.78
"	AGC90-001E	2961	-	3104		-										9.32				9.32
"	AGC90-001F	2961	-	3370	3022	-	3286	265	13.250	2.73										2.73
"			-			-												3.92	NAV	3.92
"	AGC90-001G	3225	-	3565	3287	-	3565	279	13.950	2.25										2.25
"			-			-														24
07-22	AGC-001G	3566	-	3784	3566	-	3777	212	10.600	1.46										1.46
"			-			-												3.08	NAV	3.08
"	AGC-001H		-			-												3.43	CMS	3.43
"	AGC-001J		-			-												5.32	DFS	5.32
"	AGC-001K	3717	-	4337	3778	-	4281	504	25.200	4.28										4.28
"			-			-												3.18	NAV	3.18
"	AGC-001L	4221	-	4686	4282	-	4686	405	20.250	3.25										3.25
"			-			-														24

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07-23	AGC-001L	4687	-	6068	4687	-	6029	1343	67.150	9.46										9.46
"			-			-												2.58	NAV	2.58
"	AGC-001M	5969	-	7484	6030	-	7484	1455	72.750	10.44										10.44
"			-			-					1.52									1.52
"			-			-														24
07-24			-			-					1.96									1.96
"			-			-												2.22	NAV	2.22
"	AGC-002	101	-	240		-												3.88	CMS	3.88
"	AGC-002A	101	-	1002	101	-	969	869	43.450	6.40										6.40
"	AGC-002B	909	-	931		-												5.82	NAV	5.82
"	AGC-002C	909	-	1440	970	-	1440	471	23.550	3.72										3.72
"			-			-														24
07-25	AGC90-001C	1441	-	1682	1441	-	1597	157	7.850	1.70										1.70
"			-			-												4.94	NAV	4.94
"	AGC90-002D	1537	-	1975	1598	-	1957	360	18.000	2.85										2.85
"			-			-												2.47	CMS	2.47
"	AGC90-002E	1897	-	2686	1958	-	2561	604	30.200	5.42										5.42
"			-			-												4.37	NAV	4.37
"	AGC90-002F	2529	-	2831	2562	-	2831	270	13.500	2.25										2.25
"			-			-														24
07-26	AGC90-002F	2832	-	3032	2832	-	3009	178	8.900	1.48										1.48
"			-			-												2.73	NAV	2.73
"	AGC90-002G	2977	-	2996		-												2.07	CMS	2.07
"	AGC90-002H	2977	-	4026		-				7.23										7.23
"			-			-												0.87	NAV	0.87
"			-			-									9.62					9.62
"			-			-														24
07-27			-			-									3.70					3.70
"	AGC-002J	3929	-	4253		-												2.62	OTH	2.62
"	AGC90-002K	4121	-	4235		-										16.25				16.25
"	AGC90-002L	2977	-	3195	3010	-	3195	186	9.300	1.43										1.43
"			-			-														24
"			-			-														

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07-28	AGC90-002L	3196	-	3482	3196	-	3405	210	10.500	1.97										1.97
"			-			-												3.03	NAV	3.03
"	AGC90-002M	3373	-	5466	3406	-	5466	2061	103.050	16.28										16.28
"			-			-										2.72				2.72
"			-			-														24
07-29			-			-										24.00				24.00
"			-			-														24
07-30			-			-										3.40				3.40
"	AGC90-002N	5405	-	6476	5467	-	6476	1010	50.500	7.70										7.70
"			-			-					2.40									2.40
"	AGC90-003	101	-	1498	101	-	1498	1398	69.900	10.50										10.50
"			-			-														24
07-31	AGC90-003	1499	-	1639	1499	-	1617	119	5.950	0.90										0.90
"			-			-												2.70	NAV	2.70
"	AGC90-003A	1585	-	3549	1618	-	3489	1872	93.600	13.50										13.50
"			-			-												3.07	NAV	3.07
"	AGC90-003B	3429	-	3956	3490	-	3956	467	23.350	3.83										3.83
"			-			-														24
08-01	AGC90-003B	3957	-	4017	3957	-	4017	61	3.050	0.50										0.50
"			-			-												3.05	NAV	3.05
"	AGC90-003C	3985	-	4018		-												2.95	CMS	2.95
"	AGC90-003D	3985	-	4927	4018	-	4853	836	41.800	7.87										7.87
"			-			-												3.50	NAV	3.50
"	AGC90-003E	4821	-	5118	4854	-	5097	244	12.200	1.78										1.78
"			-			-											3.18			3.18
"			-			-									1.17					1.17
"			-			-														24
08-02			-			-									2.50					2.50
"			-			-								1.50						1.50
"			-			-						20.00								20.00
"			-			-														24

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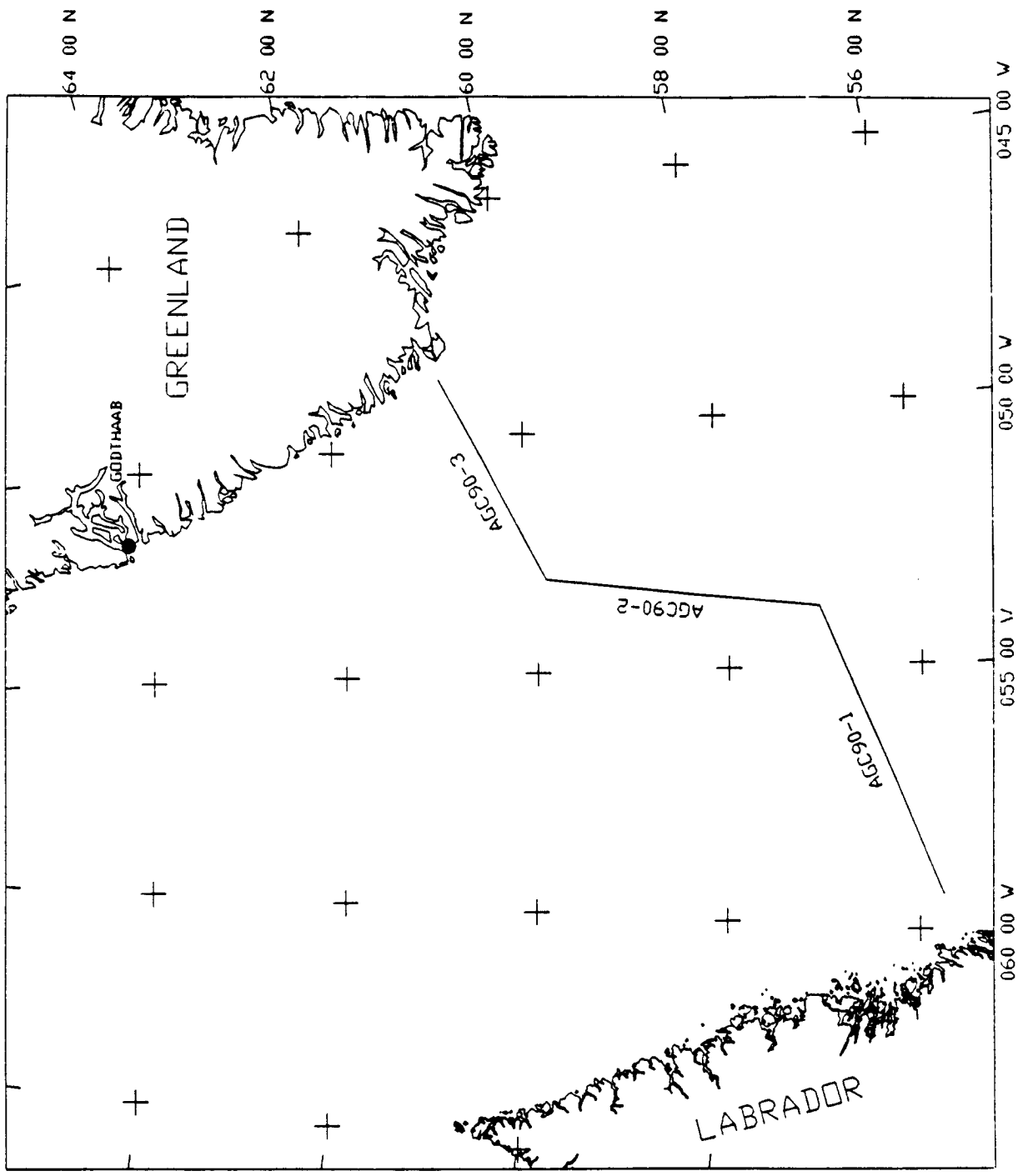
08-03			-		-					5.00								5.00
"			-		-											14.00	OTH	14.00
"			-		-													19
10-30			-		-									11.75				11.75
"			-		-					12.25								12.25
"			-		-													24
10-31										9.25								9.25
"			-		-									2.00				2.00
"			-		-							0.75						0.75
"			-		-								1.30					1.30
"			-		-					1.47								1.47
"	AGC90-3F	4797	- 5417	5098	- 5415	318	15.900	4.06										4.06
"			-		-								0.67					0.67
"			-		-							2.25						2.25
"			-		-								2.25					2.25
"			-		-													24
11-01			-		-									24.00				24.00
"			-		-													24
11-02			-		-									2.00				2.00
"			-		-					22.00								22.00
"			-		-													24
11-03			-		-					24.00								24.00
"			-		-													24
11-04			-		-					24.00								24.00
"			-		-													24
11-05			-		-					24.00								24.00
"			-		-													24
11-06			-		-					20.00								20.00
"			-		-											4.00	DEM	4.00
"			-		-													24
TOTAL						19075	953.750	159.49	5.88	270.47	120.00	22.00	63.34	95.44	17.28	116.10		870.00


64 00 N
62 00 N
60 00 N
58 00 N
56 00 N
045 00 W
050 00 W
055 00 W
060 00 W
GREENLAND
GODTHAAB
AGC90-3
AGC90-2
AGC90-1
LABRADOR

Geophoto Services, Ltd. wishes to take this opportunity to thank Atlantic Geoscience Centre for its co-operation in conducting this survey.

Respectively submitted,

John W. Clink
Director
Geophoto Services, Ltd.

APPENDIX A-1

M/V FRED J. AGNICH

I VESSEL

Owner	Geophoto Services, Ltd.
Flag	Canadian
Year Built	1973
Shipyard	Ferguson's, Pictou, N. S.
Country of Registry	Canada
Registration Number	330117
Classification	Lloyds 100 A1 LMC ICE 2, CS IIX
Home Port	St. John's, Newfoundland
Trade	Research/Utility
Tonnage	Gross 979.59 tons
Dimensions	a. Length 56.4 m b. Beam 11.9 m c. Depth 4.6 m d. Draught, Medium 4.1 m
Type of Vessel	Rig Supply Vessel
Engine	2 - EWSL 16 MGR Lister Blackstone 2000 HP
Speed	7.2 m/s (14 knots)
Fuel Capacity	295 m3
Fresh Water Capacity	60 m3
Fresh Water Maker	N/A
Endurance	35 days
Number of Berths	36
Ship's Crew (#)	9
Technical Personnel (#)	17
Helicopter D-Rating	MB105, Bell 206 L Longranger or equivalent
Lub Oil Capacity	4545 L
Cable Oil Capacity	18,180 L
Blades/Propeller	4 blades each/2 propellers
Variable Pitch	N/A
Bow Thruster	Transverse Tunnel - Electric
Stern Thruster	N/A

II AUXILIARY EQUIPMENT

Generators (AC)	2 - Cat D 343 at 250 Kw 1 - Cat D 333 at 115 Kw
Clean Power Generator	1 x Motor Generator (110 V) plus 2-5 KVA UPS (110 V)

III NAVIGATIONAL EQUIPMENT

Radio Equipment	VHF: CMS DN42 SSB: 400 W Radio Telephone
Call Sign	VOBJ
Gyrocompass	Sperry Rand
Auto Pilot	Sperry Rand
Radar	Furuno FR 800D Decca RM 916
Fathometer	Simrad EA
Standard Compass	Magnetic
Echo Sounder	Simrad
Marisat Receiver	MX III
Marisat Number	1560203
Other Communications	Facsimile Capable
Weather Fax	Alden Mx4
Radio Direction Finder	Standard Ship

IV SEISMIC EQUIPMENT

Control System	CMS III
Recording System	Texas Instument DFS V
Streamer	Conventional (Analog)
Airguns	MOD II, Sleeve Gun
Airgun Control	TIGER II
Compressors	4 PB 44/300 2 Sullair

V SAFETY EQUIPMENT

Fire Containment	Foam Deluge and Auxiliary Pump System Engine Room CO2 Smoke Diving Equipment Firesuits Extinguishers
Flotation	Life Rings Life/Work Vests & Survival Cots Life Jackets with Lights & Whistles Runabout with Engine Life Rafts Survival Suits
Signal	Life Raft Emergency Radio Pyrotechnics (distress signals) Aldis Signal Lamp
General	First Aid Equipment Line Thrower Lifeline Tether Harnesses Smoke Alarms Resuscitator

* HGS Trademark
** Texas Instruments Trademark

APPENDIX A-2

CREW DESCRIPTION

SHORE-BASED PERSONNEL

1	Operations Supervisor

ON-BOARD SEISMIC PERSONNEL

1	Party Manager
2	CMS Operators
3	DFS Operators
2	Quality Control
1	Back Deck Supervisor
6	Source Mechanics
1	Client Representatives
1	Chief Engineer
1	Second Engineers

VESSEL

1	Ship's Captain
2	Mates
1	Chief Cook
1	Second Cook
1	Messman
2	Deck Dept.

APPENDIX A-3

VESSEL PERSONNEL

Operations Supervisor	M. Kimball	(CDN)
Party Manager	E. Hann	(CDN)
DFS Operators	L. Gall	(CDN)
	L. Hansen	(CDN)
	D. Bolduc	(CDN)
CMS Operators	A. Gaulton	(CDN)
	J. Cleveland	(CDN)
Quality Control	T. Knee	(CDN)
	R. Gallagher	(CDN)
Client Representative	W. Kay	(CDN)
Back Deck Supervisor	E. Humber	(CDN)
Source Mechanics	G. Brinson	(CDN)
	C. Jordan	(CDN)
	D. Dacey	(CDN)
	L. Parsons	(CDN)
	E. Gaulton	(CDN)
	R. Perry	(CDN)
Chief Engineer	G. Reid	(CDN)
Second Engineer	G. St.Louis	(CDN)
Captain	C. Feeney	(CDN)
Mate	J. Parsons	(CDN)
	R. Chaddock	(CDN)
Chief Cook	B. Brown	(CDN)

Second Cook	C. Synard	(CDN)
Messman	P. Conner	(CDN)
Deck Dept.	L. Power	(CDN)
	D. Windsor	(CDN)

APPENDIX A-4

RECORDING INSTRUMENT DETAILS

Recording System Type	:	Texas Instruments DFS V
Number of Analog Modules	:	2 per system
Sample Rate	:	4 ms
Hi Cut Filter and Slope	:	90 Hz 72 db per octave
Low Cut Filter and Slope	:	5.3 Hz 18 db per octave
Gain Constant	:	24 dB
Quoted System Dynamic Range	:	84 dB
Final System Gain	:	120 dB
System Polarity	:	as per Seg B definition
Record Length	:	20 sec
Transports	:	2 - 10 in. Texas Instruments FX 6250 Transports
Number of tracks	:	9
Tape Format	:	SEG B GCR 6250 bpi
Reproduce Mode	:	PGC
Initial Gain	:	36 dB
Galvo	:	15/18 db
No. of Bytes in Header Block	:	276
No. of Bytes per Data Scan	:	314

Auxiliary Channels	:	61-64
Timing Word Zero	:	galvo 4
Record Number	:	Aux Channel 61

APPENDIX A-5

STREAMER DETAILS

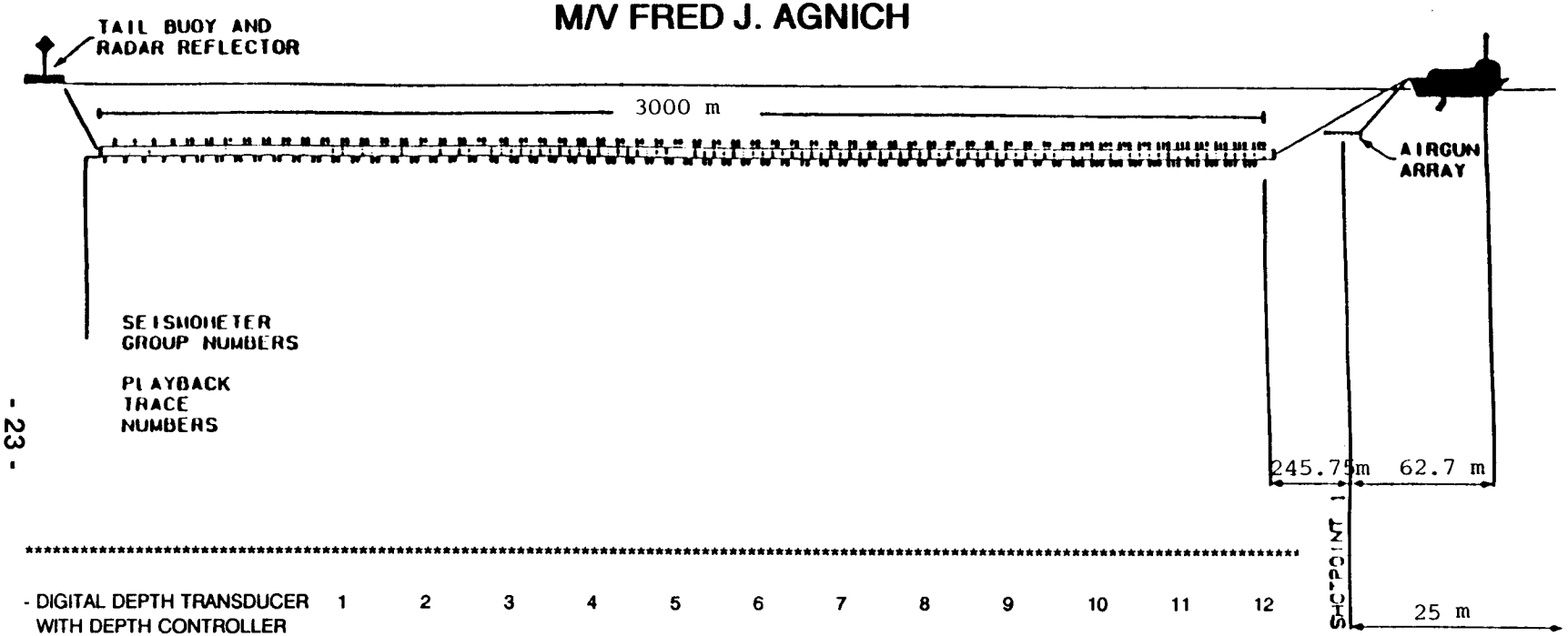
Type of Streamer	:	Conventional (Analog)
Length	:	3000 m
Number of Live Sections	:	60
Live Section Length	:	50 m
Number of Groups	:	120
Length of Groups	:	25 m
Streamer Skin Type	:	Pu Cold-Water Sections
Length of Stretch Sections	:	50 m
Calculated Stretch Factor	:	10 %
Sensitivity	:	6.86 uVolts/uBar,
Target Depth	:	12 m, +/- 2 m
Type of Depth Controllers	:	DigiCourse 396 Birds
Compass and Depth Transducer	:	DigiCourse 396 Birds
Number of Depth and Compass Units in Use	:	12

All the DigiCourse 396 birds are mounted upon 4 m sections which contain a coil for communication between the Digital Acquisition Unit in the instrument room and the unit itself.

DIAGRAM OF 3000 m STREAMER

120 TRACES

M/V FRED J. AGNICH



- DIGITAL DEPTH TRANSDUCER WITH DEPTH CONTROLLER	1	2	3	4	5	6	7	8	9	10	11	12
- LOCATION OF DIGITAL TRANSDUCER	TS1	CS1	L6	L12	L18	L24	L30	L36	L42	L48	L54	L60
	CS2	L11	L7	L13	L19	L25	L31	L37	L43	L49	L55	FEA
- LOCATION OF COMPASS	TS1	CS1	L12	L24	L36	L48	L60	L72	L84	L96	L108	L120
	CS2	L1	L15	L25	L37	L49	L61	L73	L85	L97	L109	FEA
- NYLON STRETCH SECTIONS	50 m											

APPENDIX A-7

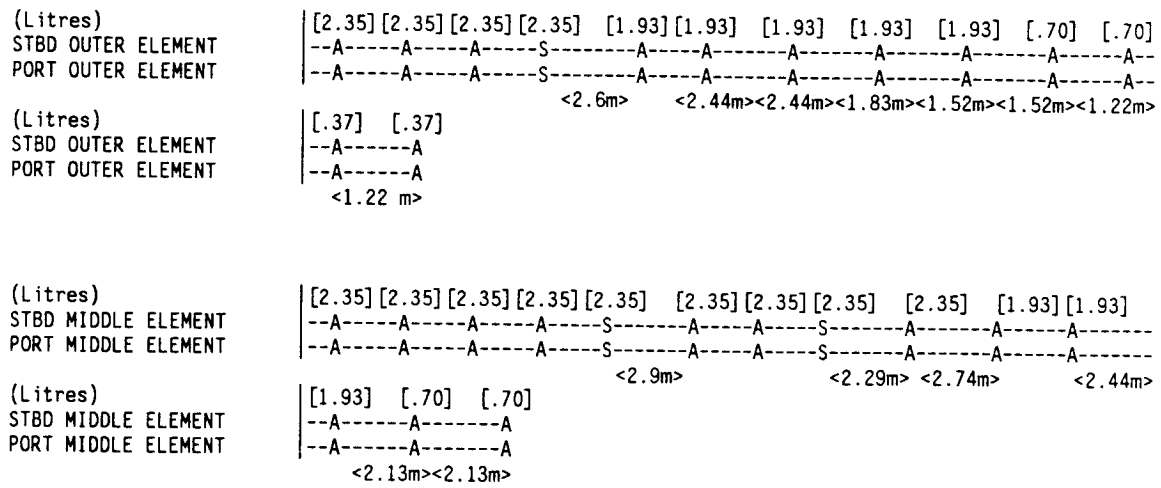
SOURCE DETAILS

Type	:	6 element
Airguns	:	MOD II, SLEEVE GUN
Total Volume (Active)	:	115.7 L
Total Spare Volume	:	13.9 L
Operating Pressure	:	12.4 - 13.8 MPa
Operating Depth	:	12 m +/- 1 m
Timing Controller	:	TIGER II
Firing Delay	:	51.2 ms
Distance Stern to Centre Array	:	53 m
Array Spread Outer to Outer	:	75 m

APPENDIX A-8
AIRGUN ARRAY
M/V FRED J. AGNICH

115.62 Litre - 6 Element

AIRGUN CAPACITY:



AIRGUN ARRAY COMPOSITION

Active Guns:	32 X 2.31 L 18 X 1.88 L 10 X .655 L 4 X .328 L	Spare Guns:	6 X 2.31 L
Total Active Guns:	115.62	Total Spare Guns:	13.86 L

NOTES:

1. This airgun array is comprised of 6 elements. The total array width is 86 (m +/- 1 m).
2. Mod II and Sleeve Airguns.
3. The array contained 70 airguns; however, the working array consisted of 64 guns, allowing 6 guns to be used as spares as required.

APPENDIX A-9

SURVEY INFORMATION

CMS Software in use

CMS Program in use	:	903.11
Patches in use	:	included in 903.13
STS Software Version	:	7.2
990 QC Software Version	:	1.0
990 Nav Software Version	:	3.6
Tiger II Software Version	:	3.3
Shotpoint Interval	:	50 m
Mag. Dec.	:	30.00 West
Geoidal Height	:	28.00 m

Spheroid

	:	CLARKE 1866
Semi Major Axis	:	6378206.4
Reciprocal of Flattening	:	294.9786985
Datum	:	NAD 27
delta X	:	39 m
delta Y	:	-154 m
delta Z	:	-180 m

Satellite System

Type	:	Magnavox MX1107 RS Dual ch. Sat. receiver
Operating Frequency	:	150/400 KHz
Antenna Height from Sea Level	:	19.8 m
Antenna Location from CNP (Range and Bearing)	:	13.8 m at 0.0 deg.
Offset from Ship's Centreline	:	1.57 m
Antenna Location from Stern	:	33.0 m at 0.0 deg.

G.P.S. System

Type	:	Texas Instruments 4100 Navstar Navigator
Operating Frequency	:	Primary L1 1575.42 Mhz Secondary L2 1227.60 Mhz
Antenna height from sea level	:	11 m
Offset from ships center line	:	1.57 m @ 270 deg.
Antenna location from stern	:	19.7 m