FINAL REPORT

FOR THE MARINE SEISMIC SURVEY

OFFSHORE NOVA SCOTIA

AUGUST 8, 1988 TO AUGUST 31, 1988

FOR ATLANTIC GEOSCIENCE CENTER

GEOLOGICAL SURVEY OF CANADA

BY

WESTERN GEOPHYSICAL, A DIVISION OF

WESTERN ATLAS CANADA, Ltd.

M/V RESOLUTION

PARTY 115

Report Written by William Rabson

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ILLUSTRATIONS

A. INTRODUCTION

Western Geophysical (a division of Western Atlas Canada Ltd.) was contracted to acquire 583 kilometers of deep seismic data for the Atlantic Geoscience Centre in two line segments offshore Nova Scotia, from August 8, 1988 to August 31, 1988. The purpose of the survey was to uncover information about the earth's crust and in order to accomplish this end, long record lengths from 21 to 24 seconds were required, as well as a wide airgun array of large volume. The vessel used on this project was the M/V Resolution which is a state of the art diesel-electric powered seismic ship capable of dual streamer/dual array acquisition. This survey required only a single streamer and single source array and the recording system used was LRS-16A with a 4800m, 180 channel digital streamer. Where the currents were very strong near the Bay of Fundy, the streamer length was shortened to 3200m at 120 channels for greater control. The source was an LRS-7000, 1800 psi, 8100 cu.in. airgun array 76 meters wide. Navigation positioning was accomplished using the LORAN C system.

Several problems were encountered during the course of the survey. Two of the vessel's generators failed and repairs took 8 days in Halifax harbor. Recording time on the prospect was lost due to very strong currents which caused streamer imbalance and noise, and also due to very active fishing in some areas.

A field office was set up in Halifax, Nova Scotia for the duration of the survey with support coming from Western's Calgary office. All supplies and services were purchased in Halifax. These included customs agency services,

accommodation, shipping, food, fuel, and hardware.

Prior to operations, the vessel was inspected by Dr. Charlotte Keen of Atlantic Geoscience Centre.

B. **PROSPECT SUMMARY**

Number of Lines:	2
Shooting Interval:	80.00 / 53.34 meters
Average Line Length: (including taper)	300 km
Number of Survey Km: (including taper)	600 km
Record Length:	21 TO 24 sec.
Sample Rate:	4 msec.
Recording System:	LRS-16A

3. FIELD SYSTEMS -

a. Recording Vessel: M/V RESOLUTION

b. Energy Source:

8100 cubic inch low pressure airgun array comprised of 6 identical sub-arrays with 7 guns per sub-array.

c. Streamer and Cables:

120 Channel - 3200 meter Digital Streamer or 4800 meter Digital Streamer. The cable consisted of 120 or 180 groups each with a group interval of 26.67 meters.

d. SSTS:

High Resolution Acoustic trilateration system for near offset streamer positioning.

e. Recording System - LRS16A.

C. CLIENT REPRESENTATIVES & WESTERN PERSONNEL

Client Representatives for Atlantic Geoscience Center	Bob Heins Geophysical Consultant

Key personnel to be engaged in the project are listed below:

Supervisor	Leo Snowman
Party Manager	Bo Wilkerson
Coodinator	Curtis Sims
Digital Technician(s)	Brandon Wells
	Mark Sherry
Gun Operator(s)	John Reese
	Todd Parish
	Brandon Halbrook
	Tony Jensould
Observers	Eric Foster
	Ernie Renner
	Cliff Hearn
	James Wells
	Ron gregory
	Christopher Papadakis
Navigators	Dan Zapada
	Brian Moncado
Compressor	Brennan Says

D. CHRONOLOGICAL EVENT LOG

START TIME	END TIME	HOURS	CODE	LINE NAME	STATUS	FSP	LSP	HDG	TOTAL SHOTS	TOTAL KILOMETERS	TAPES USED	REMARKS
** DATE: 08/06/88												
1420	2400	9.67	TT			0	0		0	0.0000	0	U/W TO NEXT PROSPECT
** Subtotal **												
		9.67							0	0.0000	0	
** DATE: 08/07/88												
0	2400	24.00	TT			0	0		0	0.0000	0	U/W TO PROSPECT
** Subtotal **												
		24.00							0	0.0000	0	
** DATE: 08/08/88												
0	2217	22.28	TT			0	0		0	0.0000	0	U/W TO PROSPECT
2217	2258	0.69	OT			0	0		0	0.0000	0	OFF LOADING DATA, W. RABSON, F. HALL AND A. HAYES TO A SUPPLY BOAT
2258	2320	0.36	TT			0	0		0	0.0000	0	U/W TO PROSPECT
2320	2400	0.67	CI			0	0		0	0.0000	0	LAYING CABLE
** Subtotal **												
		24.00							0	0.0000	0	
** DATE: 08/09/88												
0	329	3.48	CI			0	0		0	0.0000	0	LAYING CABLE 4800M
329	400	0.52	LC			0	0		0	0.0000	0	U/W TO LINE
400	1030	6.50	CW			0	0		0	0.0000	0	WORKING ON LEAKAGE BIRD AND COMPASS LINE
1030	1232	2.03	LC			0	0		0	0.0000	0	CABLE OUT CHECKING OUT CABLE BALANCE PULLING AWAY FROM TRAWLERS
1232	1906	6.57	TR			0	0		0	0.0000	0	PICKING UP CABLE BALANCING CABLE
1906	2350	4.73	LC			0	0		0	0.0000	0	CABLE OUT CHECKING OUT TRIM U/W TO LINE LAYING GUN
2350	2400	0.17	GN			0	0		0	0.0000	0	ABORT LINE DUE TO GUNS TWO GUNS OUT
** Subtotal **												
		24.00							0	0.0000	0	
** DATE: 08/10/88												
0	150	1.83	GN			0	0		0	0.0000	0	CIRCLING DUE TO GUNS
150	300	1.17	SR			0	0		0	0.0000	0	LOST SHIPS POWER
300	630	3.50	CI			0	0		0	0.0000	0	PICKING UP GUNS AND CABLE ONLY TWO GENERATORS WORKING
630	2400	17.50	SR			0	0		0	0.0000	0	WORKING ON GENERATORS 1316-1518 MOVING CABLE OVER TO PORT REEL
** Subtotal **												
		24.00							0	0.0000	0	

CHRONOLOGICAL EVENT LOG - RESOLUTION
ATLANTIC GEOSCIENCE
NOVA SCOTIA

START TIME	END TIME	HOURS	CODE	LINE NAME	STATUS	FSP	LSP	HDG	TOTAL SHOTS	TOTAL KILOMETERS	TAPES USED	REMARKS
** DATE: 08/11/88												
0	2400	24.00	SR			0	0		0	0.0000	0	TWO GENERATORS DOWN
** Subtotal **												
		24.00							0	0.0000	0	
** DATE: 08/12/88												
0	1757	17.95	SR			0	0		0	0.0000	0	TWO GENERATORS DOWN 0550-TWO MEN ON BOARD FOR GENERATORS
1757	2300	5.05	TT			0	0		0	0.0000	0	U/W TO HALIFAX FOR GENERATOR REPAIR
2300	2400	1.00	SR			0	0		0	0.0000	0	TIED TO DOCK- HALIFAX REPAIRING GENERATORS
** Subtotal **												
		24.00							0	0.0000	0	
** DATE: 08/13/88												
0	2400	24.00	SR			0	0		0	0.0000	0	AT HALIFAX REPAIRING GENERATORS
** Subtotal **												
		24.00							0	0.0000	0	
** DATE: 08/14/88												
0	2400	24.00	SR			0	0		0	0.0000	0	AT HALIFAX REPAIRING GENERATORS
** Subtotal **												
		24.00							0	0.0000	0	
** DATE: 08/15/88												
0	2400	24.00	SR			0	0		0	0.0000	0	AT HALIFAX REPAIRING GENERATORS
** Subtotal **												
		24.00							0	0.0000	0	
** DATE: 08/16/88												
0	2400	24.00	SR			0	0		0	0.0000	0	AT HALIFAX REPAIRING GENERATORS
** Subtotal **												
		24.00							0	0.0000	0	
** DATE: 08/17/88												
0	2400	24.00	SR			0	0		0	0.0000	0	AT HALIFAX REPAIRING GENERATORS
** Subtotal **												
		24.00							0	0.0000	0	
** DATE: 08/19/88												
0	129	1.48	IN			0	0		0	0.0000	0	CIRCLING FOR INSTRUMENT PROBLEMS
129	140	0.19	PR	88-1	I	0	0	142	0	0.0000	1	SP101-120 NO GOOD DUE TO INSTRIMENT PROBLEMS
140	2220	20.66	IN			0	0		0	0.0000	0	PROBLEM WITH MOSTEK MEMORY 1901-1955 HELO ON BOARD LYLE GETTING OFF
2220	2400	1.67	PR	88-1	I	101	268	142	168	13.4400	1	SP 101-120 WERE A SHOTS 268 LAST SHOT OF THE DAY

CHRONOLOGICAL EVENT LOG - RESOLUTION
ATLANTIC GEOSCIENCE
NOVA SCOTIA

START TIME	END TIME	HOURS	CODE	LINE NAME	STATUS	FSP	LSP	HDG	TOTAL SHOTS	TOTAL KILOMETERS	TAPES USED	REMARKS
** Subtotal **												
		24.00							168	13.4400	2	
** DATE: 08/20/88												
0	756	7.93	PR	88-1	I	269	1102	142	834	66.7200	11	STOPPED DUE TO GUNS
756	1226	4.50	GN			0	0		0	0.0000	0	CIRCLING FOR GUNS
1226	2243	10.29	PR	88-1	C	1103	2122	142	1020	81.6000	11	SP1072-1102 A SHOT STOPPED LINE DUE TO LONGLINERS
2243	2400	1.28	F			0	0		0	0.0000	0	CIRCLING FOR FISHING GEAR
** Subtotal **												
		24.00							1854	148.3200	22	
** DATE: 08/21/88												
0	724	7.40	CW			0	0		0	0.0000	0	WORKING ON NOISY GROUPS HAD CABLE PROBLEMS ON THE WAY BACK OUT
724	1022	2.97	F			0	0		0	0.0000	0	CABLE OUT U/W TO LINE OFFSET 26KM TO THE NE DUE TO FISHING GEAR
1022	1428	4.10	PR	88-1A	I	2062	2509	142	448	35.8400	5	STOPPED DUE TO GUNS
1428	1730	3.03	GN			0	0		0	0.0000	0	CIRCLING DUE TO GUNS
1730	1836	1.10	S			0	0		0	0.0000	0	CIRCLE EXTENDED DUE TO SHIP TRAFFIC
1836	1930	0.90	PR	88-1A	I	2508	2568	142	61	4.8800	1	SP2477-2507 WERE A SHOTS STOPPED DUE TO CABLE TRIM
1930	2400	4.50	TR			0	0		0	0.0000	0	1930-2039 PICKING UP GUNS 2039- START CABLE UP FOR CABLE TRIM
** Subtotal **												
		24.00							509	40.7200	6	
** DATE: 08/22/88												
0	205	2.08	TR			0	0		0	0.0000	0	BALANCING CABLE
205	330	1.42	LC			0	0		0	0.0000	0	CABLE OUT U/W TO LINE
330	650	3.33	PR	88-1A	I	2569	2868	142	300	24.0000	4	SP2518-2568 WERE A SHOTS STOPPED FOR SHIP NOISE
650	1015	3.42	S			0	0		0	0.0000	0	CIRCLING FOR SHIP NOISE
1015	1248	2.55	PR	88-1A	I	2808	3073	142	266	21.2800	3	SP2808-2868 WERE A SHOTS STOPPED FOR LRS 100 PROBLEMS
1248	1614	3.43	IN			0	0		0	0.0000	0	CIRCLING FOR LRS 100
1614	1733	1.32	PR	88-1A	I	3085	3162	142	78	6.2400	2	SP3043-3084 WERE A SHOTS STOPPED FOR TIME BREAK PROBLEMS
1733	2137	4.07	IN			0	0		0	0.0000	0	CIRCLING FOR TIME BREAK PROBLEM LRS 100
2137	2400	2.38	PR	88-1A	I	3163	3307	142	145	11.6000	4	SP3043-3084 B SHOTS SP3085-3162 A SHOTS LAST SHOT OF THE DAY
** Subtotal **												
		24.00							789	63.1200	13	

CHRONOLOGICAL EVENT LOG - RESOLUTION
ATLANTIC GEOSCIENCE
NOVA SCOTIA

START TIME	END TIME	HOURS	CODE	LINE NAME	STATUS	FSP	LSP	HDG	TOTAL SHOTS	TOTAL KILOMETERS	TAPES USED	REMARKS
** DATE: 08/23/88												
0	255	2.92	PR	88-1A	I	3308	3644	142	337	26.9600	4	STOPPED DUE TO CABLE TRIM
255	1217	9.36	TR			0	0		0	0.0000	0	PICKING UP BALANCING CABLE CABLE OUT 10:46 AND U/W TO LINE
1217	1626	4.15	PR	88-1A	I	3645	4122	142	478	38.2400	6	SP3600-3644 WERE A SHOTS STOPPED DUE TO NAV. (LORAN OUT OF SPEC.)
1626	2110	4.74	WN			0	0		0	0.0000	0	CIRCLING FOR NAVIGATION
2110	2400	2.83	PR	88-1A	I	4123	4305	142	183	14.6400	4	SP4020-4122 WERE A SHOTS LAST SHOT OF THE DAY
** Subtotal **												
		24.00							998	79.8400	14	
** DATE: 08/24/88												
0	135	1.58	PR	88-1A	C	4306	4472	142	167	13.3600	3	LINE COMPLETED
135	353	2.30	CI			0	0		0	0.0000	0	PICKING UP GUNS AND CABLE
353	2400	20.12	TT			0	0		0	0.0000	0	CABLE ON BOARD U/W TO LINE 88-2
** Subtotal **												
		24.00							167	13.3600	3	
** DATE: 08/25/88												
0	408	4.13	TT			0	0		0	0.0000	0	U/W TO LINE 88-2
408	903	4.92	CI			0	0		0	0.0000	0	LAYING CABLE TAKING OFF SOME WEIGHTS
903	1200	2.95	LC			0	0		0	0.0000	0	CABLE OUT CHECKING CABLE BALANCE LAYING GUNS
1200	1229	0.48	F			0	0		0	0.0000	0	PICKING UP GUNS DUE TO LONGLINER GEAR ALL AROUND US
1229	1404	1.59	F			0	0		0	0.0000	0	PICKING UP CABLE LONGLINER GEAR ALL AROUND US 1 BIRD DAMAGED
1404	1555	1.85	F			0	0		0	0.0000	0	RUNNING LINE TO FIND THE END OF FISHING GEAR
1555	2104	5.15	CI			0	0		0	0.0000	0	LAYING CABLE REPAIRING SOME SECTIONS WITH HOLES
2104	2220	1.26	LC			0	0		0	0.0000	0	CABLE OUT CHECKING CABLE BALANCE
2220	2400	1.67	CW			0	0		0	0.0000	0	PICKING UP CABLE SECTION 29B BAD
0	408	4.13	TT			0	0		0	0.0000	0	U/W TO LINE 88-2
408	903	4.92	CI			0	0		0	0.0000	0	LAYING CABLE TAKING OFF SOME WEIGHTS
903	1200	2.95	LC			0	0		0	0.0000	0	CABLE OUT CHECKING CABLE BALANCE LAYING GUNS
1200	1229	0.48	F			0	0		0	0.0000	0	PICKING UP GUNS DUE TO LONGLINER GEAR ALL AROUND US
1229	1404	1.59	F			0	0		0	0.0000	0	PICKING UP CABLE LONGLINER GEAR ALL AROUND US 1 BIRD DAMAGED
1404	1555	1.85	F			0	0		0	0.0000	0	RUNNING LINE TO FIND THE END OF FISHING GEAR
1555	2104	5.15	CI			0	0		0	0.0000	0	LAYING CABLE REPAIRING SOME SECTIONS WITH HOLES

CHRONOLOGICAL EVENT LOG - RESOLUTION
ATLANTIC GEOSCIENCE
NOVA SCOTIA

START TIME	END TIME	HOURS	CODE	LINE NAME	STATUS	FSP	LSP	HDG	TOTAL SHOTS	TOTAL KILOMETERS	TAPES USED	REMARKS
2104	2220	1.26	LC			0	0		0	0.0000	0	CABLE OUT CHECKING CABLE BALANCE
2220	2400	1.67	CW			0	0		0	0.0000	0	PICKING UP CABLE SECTION 29B BAD
** Subtotal **												
		48.00							0	0.0000	0	
** DATE: 08/28/88												
0	302	3.03	TR			0	0		0	0.0000	0	CIRCLING DUE TO CURRENTS
302	338	0.60	PR	88-3A	I	166	260	038	95	5.0667	1	STOPPED FOR CREW BOAT TO TRANSFER PEOPLE SP166-196 WERE A SHOTS
338	638	3.00	LC			0	0		0	0.0000	0	CIRCLING TO TRANSFER PERSONNEL 0400-0410 TRANSFER PERSONNEL
638	752	1.24	LC			0	0		0	0.0000	0	EXTENDED FOR SATELLITE FIX
752	859	1.11	PR	88-3A	I	261	372	038	112	5.9741	2	SP230-260 WERE A SHOTS STOPPED FOR SHIP NOISE
859	1141	2.70	S			0	0		0	0.0000	0	CIRCLING FOR SHIP NOISE
1141	1352	2.19	S			0	0		0	0.0000	0	CIRCLING AGAIN FOR SHIP NOISE
1352	1414	0.36	PR	88-3A	I	342	406	038	65	3.4671	1	SP342-372 WERE A SHOTS CABLE OUT OF SPEC. DUE TO CURRENTS
1414	1743	3.49	TR			0	0		0	0.0000	0	CIRCLING FOR CURRENTS
1743	1757	0.23	PR	88-3A	I	0	0	038	0	0.0000	1	SP342-372 B SHOTS STOPPED FOR CABLE OUT OF SPEC. DUE TO CURRENTS
1757	1830	0.55	EN			0	0		0	0.0000	0	CIRCLING FOR NOISE DUE TO CURRENTS
1830	2130	3.00	OT			0	0		0	0.0000	0	STANDING BY FOR CLIENT ON WHAT TO DO NEXT
2130	2400	2.50	LC			0	0		0	0.0000	0	U/W TO LINE 88-4
** Subtotal **												
		24.00							272	14.5079	5	
** DATE: 08/26/88												
0	456	4.93	CW			0	0		0	0.0000	0	CHANGING OUT SECTION 29B AND REPEATER
456	737	2.69	LC			0	0		0	0.0000	0	CABLE OUT U/W TO LINE
737	1155	4.30	CW			0	0		0	0.0000	0	ABORT LINE FOR NOISY SECTION PICKING UP GEAR WORKING ON CABLE
1155	1518	3.38	LC			0	0		0	0.0000	0	CABLE OUT U/W TO LINE
1518	1942	4.40	PR	88-2	I	310	722	348	413	33.0400	5	STOPPED DUE TO CABLE NOISE DUE TO CURRENTS
1942	2400	4.30	EN			0	0		0	0.0000	0	CIRCLING FOR NOISE FROM CURRENTS 2112-2241 REPLACED SYNTRIEVES M.O.B
** Subtotal **												
		24.00							413	33.0400	5	
** DATE: 08/27/88												
0	29	0.48	EN			0	0		0	0.0000	0	CIRCLING FOR NOISE FROM CURRENTS
29	41	0.20	PR	88-2	I	662	686	348	25	2.0000	1	SP652-686 WERE A SHOTS CURRENTS AFFECTING BALANCE AND NOISE

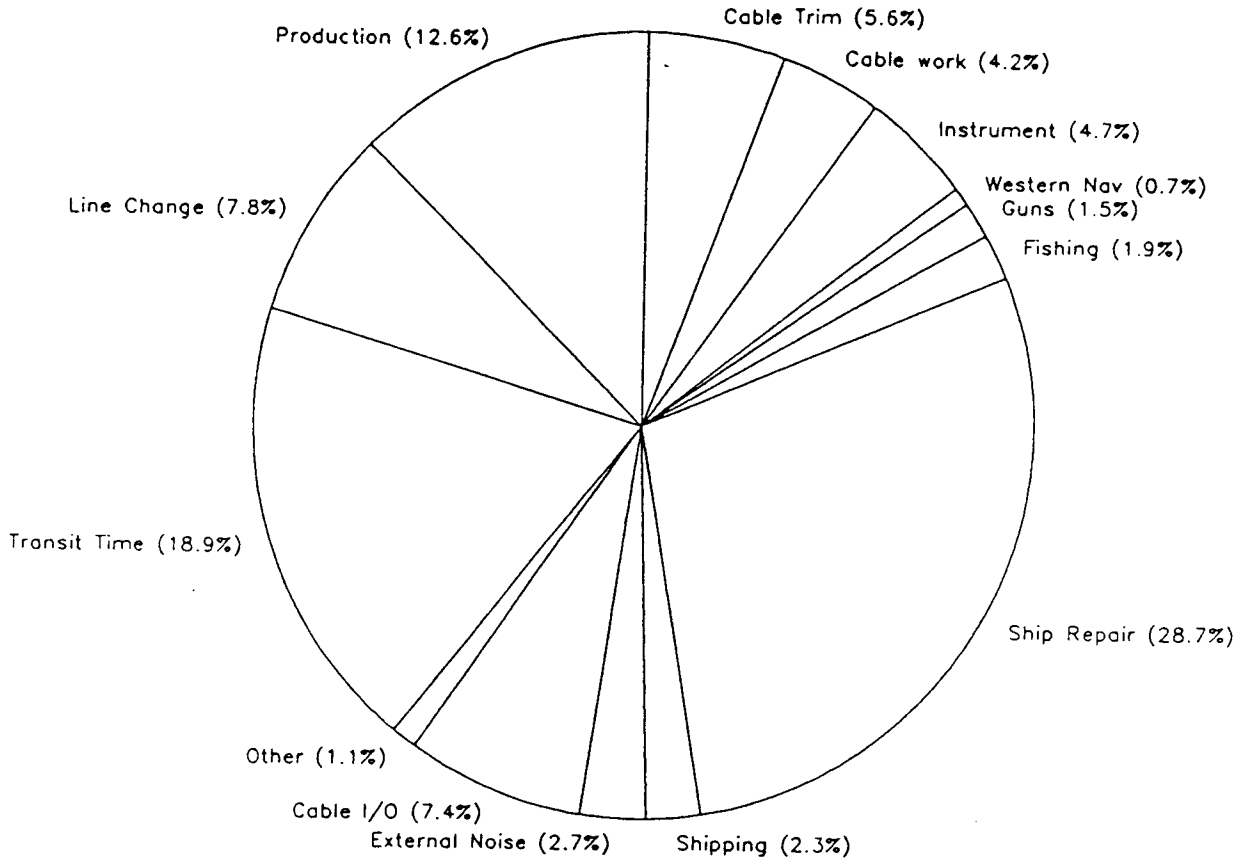
CHRONOLOGICAL EVENT LOG - RESOLUTION
ATLANTIC GEOSCIENCE
NOVA SCOTIA

START TIME	END TIME	HOURS	CODE	LINE NAME	STATUS	FSP	LSP	HDG	TOTAL SHOTS	TOTAL KILOMETERS	TAPES USED	REMARKS
41	350	3.15	CI			0	0		0	0.0000	0	PICKING UP GUNS AND CABLE
350	804	4.24	TT			0	0		0	0.0000	0	U/W TO LINE 88-3 0750-0804 TRANSFER CREW TO AND FROM LA CUNDA
804	1020	2.26	CI			0	0		0	0.0000	0	LAYING CABLE OUT
1020	1303	2.72	LC			0	0		0	0.0000	0	CABLE OUT LAYING GUNS AND U/W TO LINE
1303	1526	2.38	PR	88-3	I	101	376	038	276	22.0800	3	STOPPED DUE TO NOISE FROM CURRENTS
1526	2100	5.57	CI			0	0		0	0.0000	0	PICKING UP GEAR CHANGING FROM 4800M TO 3200M CABLE
2100	2313	2.22	LC			0	0		0	0.0000	0	CABLE OUT U/W TO LINE
2313	2351	0.63	PR	88-3A	I	101	196	038	96	5.1206	1	STOPPED DUE TO CURRENTS
2351	2400	0.15	TR			0	0		0	0.0000	0	CIRCLING DUE TO STRONG CURRENTS
** Subtotal **												
		24.00							397	29.2006	5	
** DATE: 08/28/88												
0	302	3.03	TR			0	0		0	0.0000	0	CIRCLING DUE TO CURRENTS
302	338	0.60	PR	88-3A	I	166	260	038	95	5.0667	1	STOPPED FOR CREW BOAT TO TRANSFER PEOPLE SP166-196 WERE A SHOTS
338	638	3.00	LC			0	0		0	0.0000	0	CIRCLING TO TRANSFER PERSONNEL 0400-0410 TRANSFER PERSONNEL
638	752	1.24	LC			0	0		0	0.0000	0	EXTENDED FOR SATELLITE FIX
752	859	1.11	PR	88-3A	I	261	372	038	112	5.9741	2	SP230-260 WERE A SHOTS STOPPED FOR SHIP NOISE
859	1141	2.70	S			0	0		0	0.0000	0	CIRCLING FOR SHIP NOISE
1141	1352	2.19	S			0	0		0	0.0000	0	CIRCLING AGAIN FOR SHIP NOISE
1352	1414	0.36	PR	88-3A	I	342	406	038	65	3.4671	1	SP342-372 WERE A SHOTS CABLE OUT OF SPEC. DUE TO CURRENTS
1414	1743	3.49	TR			0	0		0	0.0000	0	CIRCLING FOR CURRENTS
1743	1757	0.23	PR	88-3A	I	0	0	038	0	0.0000	1	SP342-372 B SHOTS STOPPED FOR CABLE OUT OF SPEC. DUE TO CURRENTS
1757	1830	0.55	EN			0	0		0	0.0000	0	CIRCLING FOR NOISE DUE TO CURRENTS
1830	2130	3.00	OT			0	0		0	0.0000	0	STANDING BY FOR CLIENT ON WHAT TO DO NEXT
2130	2400	2.50	LC			0	0		0	0.0000	0	U/W TO LINE 88-4
** Subtotal **												
		24.00							272	14.5079	5	
** DATE: 08/29/88												
0	541	5.68	LC			0	0		0	0.0000	0	U/W TO LINE 88-4
541	1152	6.19	PR	88-4	I	101	870	315	770	41.0718	7	STOPPED DUE TO CURRENTS CABLE OUT OF SPEC.
1152	1400	2.13	EN			0	0		0	0.0000	0	CIRCLING FOR NOISE DUE TO CURRENTS
1400	1555	1.92	CI			0	0		0	0.0000	0	PICKING UP GEAR DANGER OF DAMAGING CABLE TO SHOOT MORE ON THIS LINE
1555	2003	4.13	TT			0	0		0	0.0000	0	CABLE ON BOARD U/W TO 88-2

CHRONOLOGICAL EVENT LOG - RESOLUTION
ATLANTIC GEOSCIENCE
NOVA SCOTIA

START TIME	END TIME	HOURS	CODE	LINE NAME	STATUS	FSP	LSP	HDG	TOTAL SHOTS	TOTAL KILOMETERS	TAPES USED	REMARKS
2003	2203	2.00	CI			0	0		0	0.0000	0	LAYING CABLE
2203	2400	1.95	LC			0	0		0	0.0000	0	CABLE OUT U/W TO LINE
** Subtotal **												
		24.00							770	41.0718	7	
** DATE: 08/30/88												
0	7	0.12	LC			0	0		0	0.0000	0	U/W TO LINE
7	715	7.13	PR	88-2A	I	101	1034	168	934	49.8196	8	STOPPED FOR NOISE DUE TO CURRENTS
715	1033	3.30	EN			0	0		0	0.0000	0	CIRCLING FOR NOISE DUE TO CURRENTS
1033	1100	0.45	PR	88-2A	I	1004	1052	168	49	2.6137	1	SP1004-1034 A SHOTS STOPPED FOR NOISE DUE TO CURRENTS
1100	1401	3.02	EN			0	0		0	0.0000	0	CIRCLING FOR NOISE DUE TO CURRENTS
1401	1748	3.78	PR	88-2A	I	1022	1516	168	495	26.4033	4	SP1022-1034 B SHOTS SP1035-1052 A SHOTS STOPPED FOR NOISE
1748	2040	2.87	EN			0	0		0	0.0000	0	CIRCLING FOR NOISE DUE TO CURRENTS
2040	2400	3.33	PR	88-2A	I	1486	1971	168	486	25.9232	3	LAST SHOT OF THE DAY
** Subtotal **												
		24.00							1964	104.7598	16	
** DATE: 08/31/88												
0	24	0.40	PR	88-2A	C	1972	2030	168	59	3.1471	1	LINE COMPLETE
24	224	2.00	CI			0	0		0	0.0000	0	PICKING UP GUNS AND CABLE
224	2400	21.60	TT			0	0		0	0.0000	0	CABLE ON BOARD U/W TO HALIFAX
** Subtotal **												
		24.00							59	3.1471	1	
*** Total ***												
		633.7							8632	599.0351	104	

TIME BREAK DOWN
(FIGURE A)



E. FIELD ACQUISITION PARAMETERS

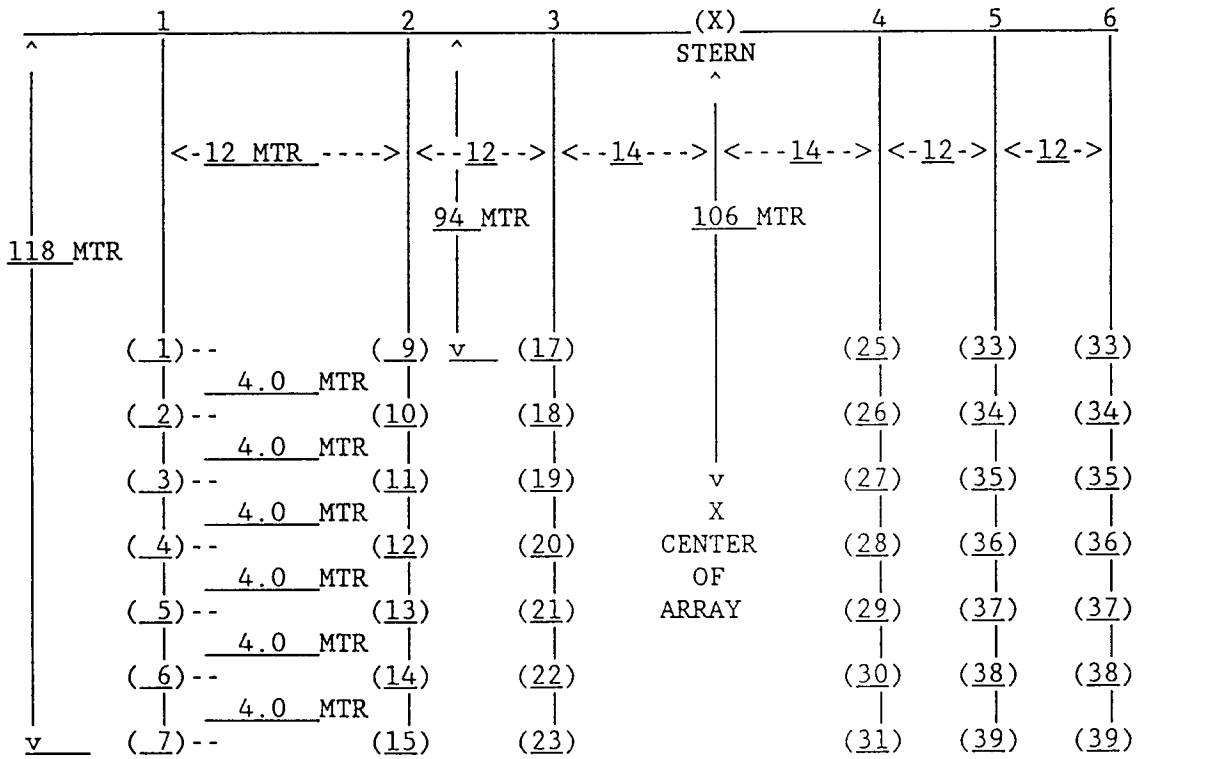
TYPE WESTERN LOW PRESSURE AIR GUNS. NO. GUNS 42

ARRAY VOLUME 8100 CU.IN. GUN ARRAY DEPTH 10 MTR

SHOTPOINT INTERVAL 80.00 MTR AIR PRESSURE 1800 PSI

SPECIAL INSTRUCTIONS: EACH SUBARRAY IS CONFIGURED THE SAME
(FIGURE 1) ENERGY SOURCE CONFIGURATION

NAVAGATION REFERENCE POINT (NRP) IS LOCATED AT CABLE STERN ROLLER



SUB ARRAY 1 & 2 ACTIVE			SUB ARRAY 3 ACTIVE			SUB ARRAY 4 ACTIVE			SUB ARRAY 5 & 6 ACTIVE		
Y	GUN 9	465 IN3	Y	GUN17	465 IN3	Y	GUN25	465 IN3	Y	GUN33	465 IN3
Y	GUN10	280 IN3	Y	GUN18	280 IN3	Y	GUN26	280 IN3	Y	GUN34	280 IN3
Y	GUN11	200 IN3	Y	GUN19	200 IN3	Y	GUN27	200 IN3	Y	GUN35	200 IN3
Y	GUN12	150 IN3	Y	GUN20	150 IN3	Y	GUN28	150 IN3	Y	GUN36	150 IN3
Y	GUN13	115 IN3	Y	GUN21	115 IN3	Y	GUN29	115 IN3	Y	GUN37	115 IN3
Y	GUN14	80 IN3	Y	GUN22	80 IN3	Y	GUN30	80 IN3	Y	GUN38	80 IN3
Y	GUN15	60 IN3	Y	GUN23	60 IN3	Y	GUN31	60 IN3	Y	GUN39	60 IN3

SYNTHETIC AIRGUN SIGNATURE - SETUP PARAMETERS
(FIGURE 2)

1350 IN**3 @1800 PSI AUG 86

GENERAL PHYSICAL PARAMETERS:

SOUND VELOCITY IN WATER	=	5000.	FT/SEC
DENSITY OF WATER	=	63.43	LBS/FT**3
ATMOSPHERIC PRESSURE	=	14.76	PSI
CHARACTERISTIC MODULUS	=	2500.	ATMOSPHERE
CHARACTERISTIC EXPONENT	=	8.0	NONDIMEN.
RATIO OF SPECIFIC HEATS	=	1.133	NONDIMEN.
SURFACE REFLECTION COEFF.	=	1.00	NONDIMEN.

CALCULATION PARAMETERS:

TIME STEP INCREMENT	=	10	MICROSECS
TIME STEP ACCELERATION	=	20	NONDIMEN.
SIGNATURE SAMPLING INT.	=	200	MICROSECS
BUBBLE INTERACTION FLAG	=	1	(0=NO, 1=YES)
GHOST INTERACTION FLAG	=	1	(0=NO, 1=YES)
GHOST CONTRIBUTION FLAG	=	1	(0=NO, 1=YES)
DISPLAY SAMPLING INT.	=	2000	MICROSECS

GENERAL AIRGUN PARAMETERS:

NUMBER OF GUNS IN ARRAY	=	7	
DAMPING COEFFICIENT #1	=	170.0	UNITS OF VISCOSITY
DAMPING COEFFICIENT #2	=	9.0	UNITS OF VISCOSITY/SEC
TYPE OF PORT CLOSURE	=	2	(0=IDEAL, 1=TIME, 2=PRESSURE)
AIR TEMPERATURE IN GUNS	=	60.0	DEGREES F

DESCRIPTION OF AIRGUN ARRAY:

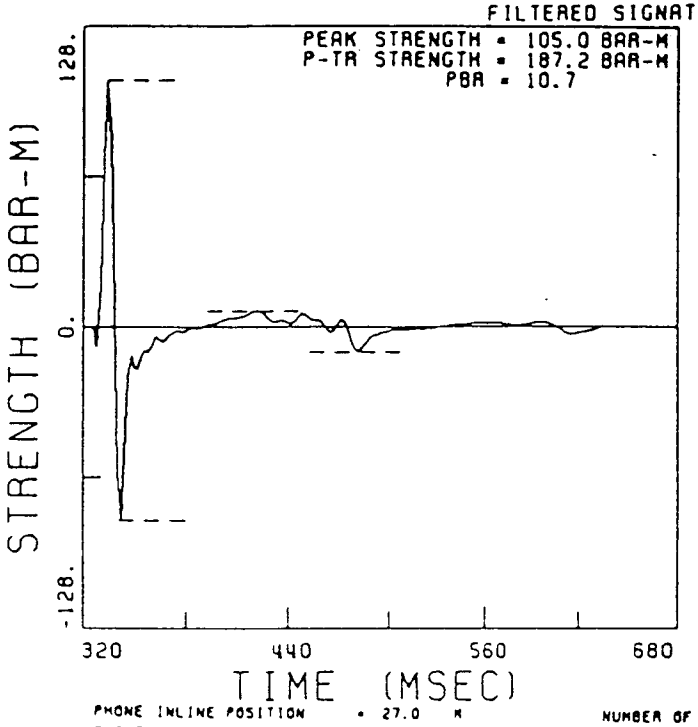
GUN #/ CONTRIB. FLAG	INLINE POSITION (FT)	CROSSLINE POSITION (FT)	GUN DEPTH (FT)	GUN VOLUME (IN**3)	INITIAL PRESSURE (PSI)	TIME DELAY (MSEC)	CLOSURE PRESSURE (PSI)	PORT AREA (IN**2)
1 / T	0.0	0.0	20.0	465.0	1800.	0.00	150.	19.00
2 / T	14.0	0.0	20.0	280.0	1800.	0.00	150.	19.00
3 / T	25.0	0.0	20.0	200.0	1800.	0.00	150.	19.00
4 / T	35.0	0.0	20.0	150.0	1800.	0.00	150.	19.00
5 / T	45.0	0.0	20.0	115.0	1800.	0.00	150.	19.00
6 / T	53.0	0.0	20.0	80.0	1800.	0.00	150.	6.60
7 / T	59.0	0.0	20.0	60.0	1800.	0.00	150.	6.60

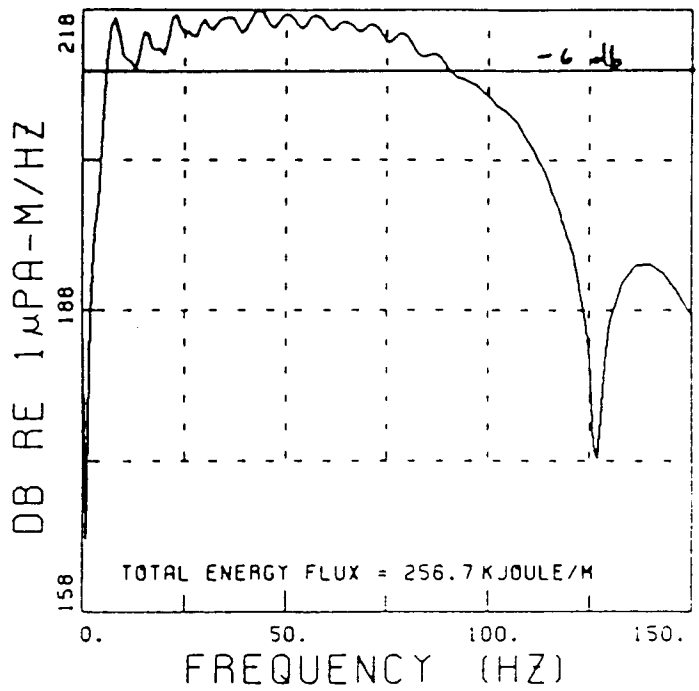
SYNTHETIC AIRGUN SIGNATURE - HYDROPHONE NO. 1

(FIGURE 3)

FILTER DESCRIPTION: LOW CUT = 0 HZ, SLOPE = 0 DB/OCTAVE; HIGH CUT = 128 HZ, SLOPE = 72 DB/OCTAVE

FILTERED SIGNATURE

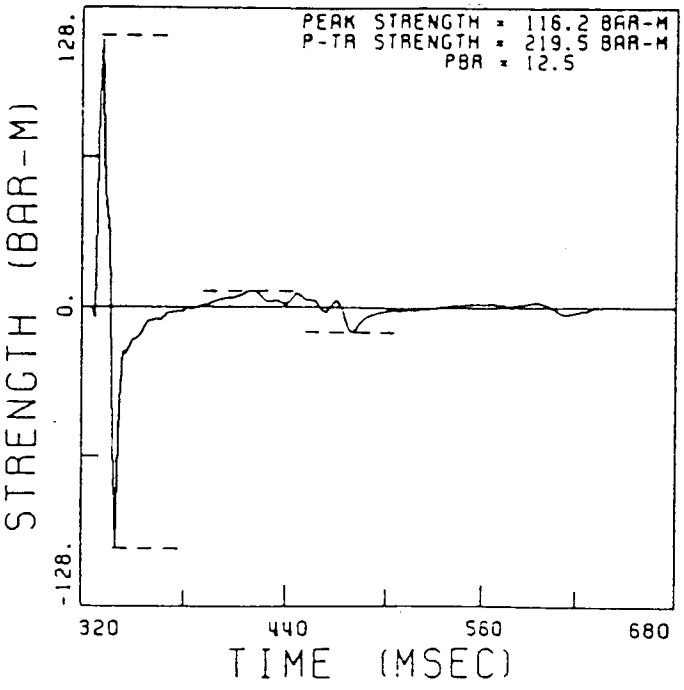


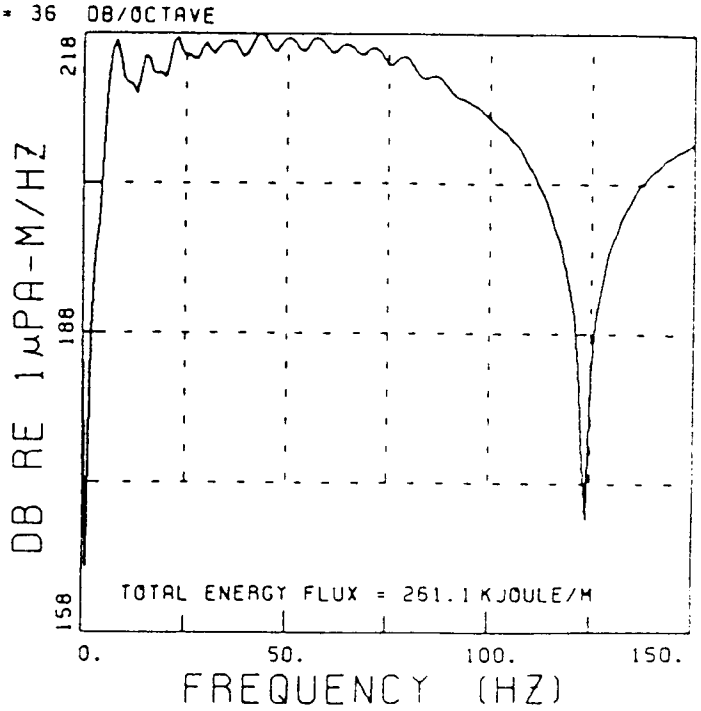


PHONE INLINE POSITION = 27.0 M
PHONE CROSSLINE POSITION = 0.0 M
PHONE DEPTH = 500.0 M

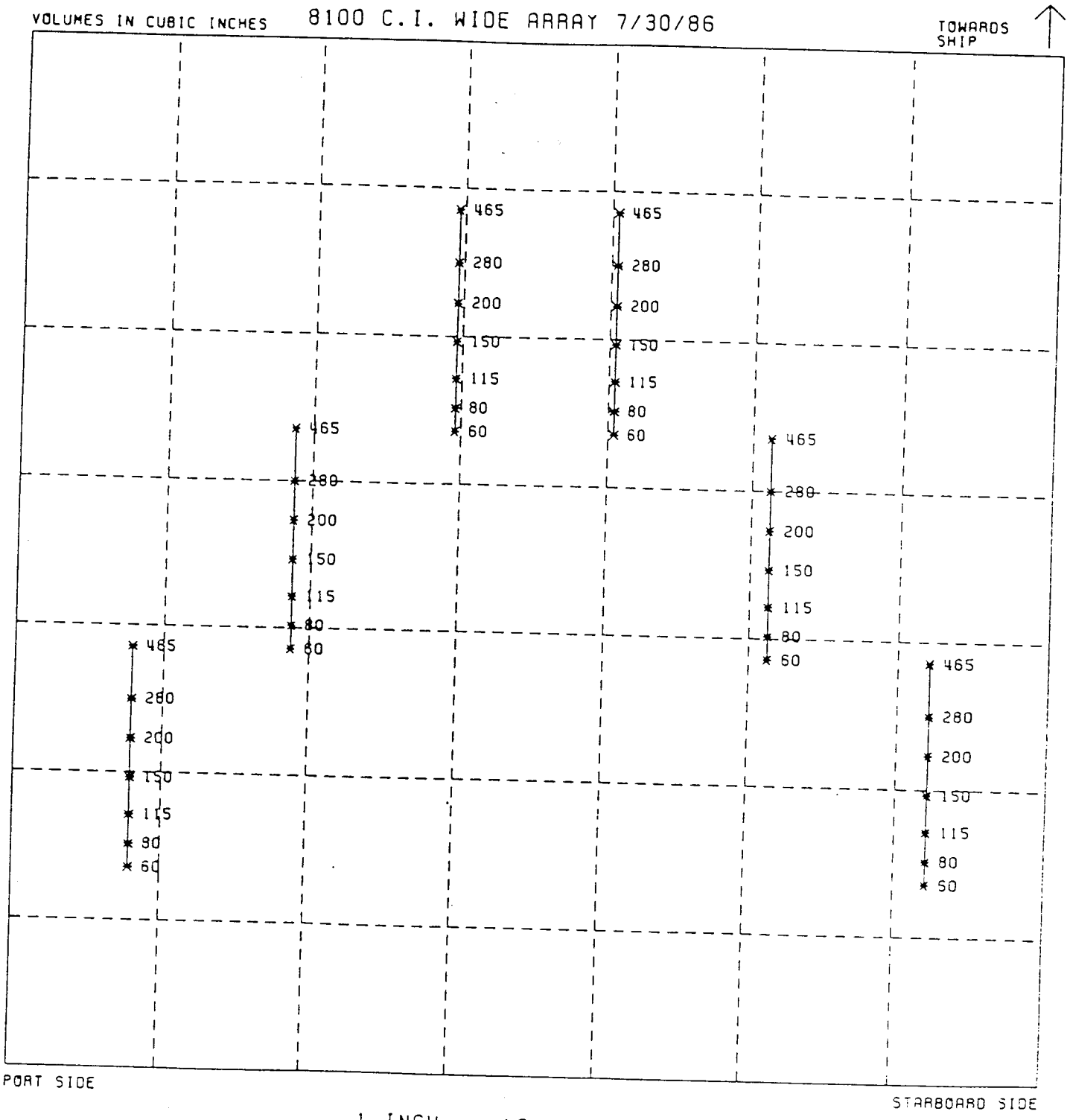
NUMBER OF GUNS = 42
TOTAL VOLUME = 8100 IN**3
AVERAGE GUN DEPTH = 6.1 M

ANTI-ALIAS HIGH CUT = 188 HZ, SLOPE = 36 DB/OCTAVE





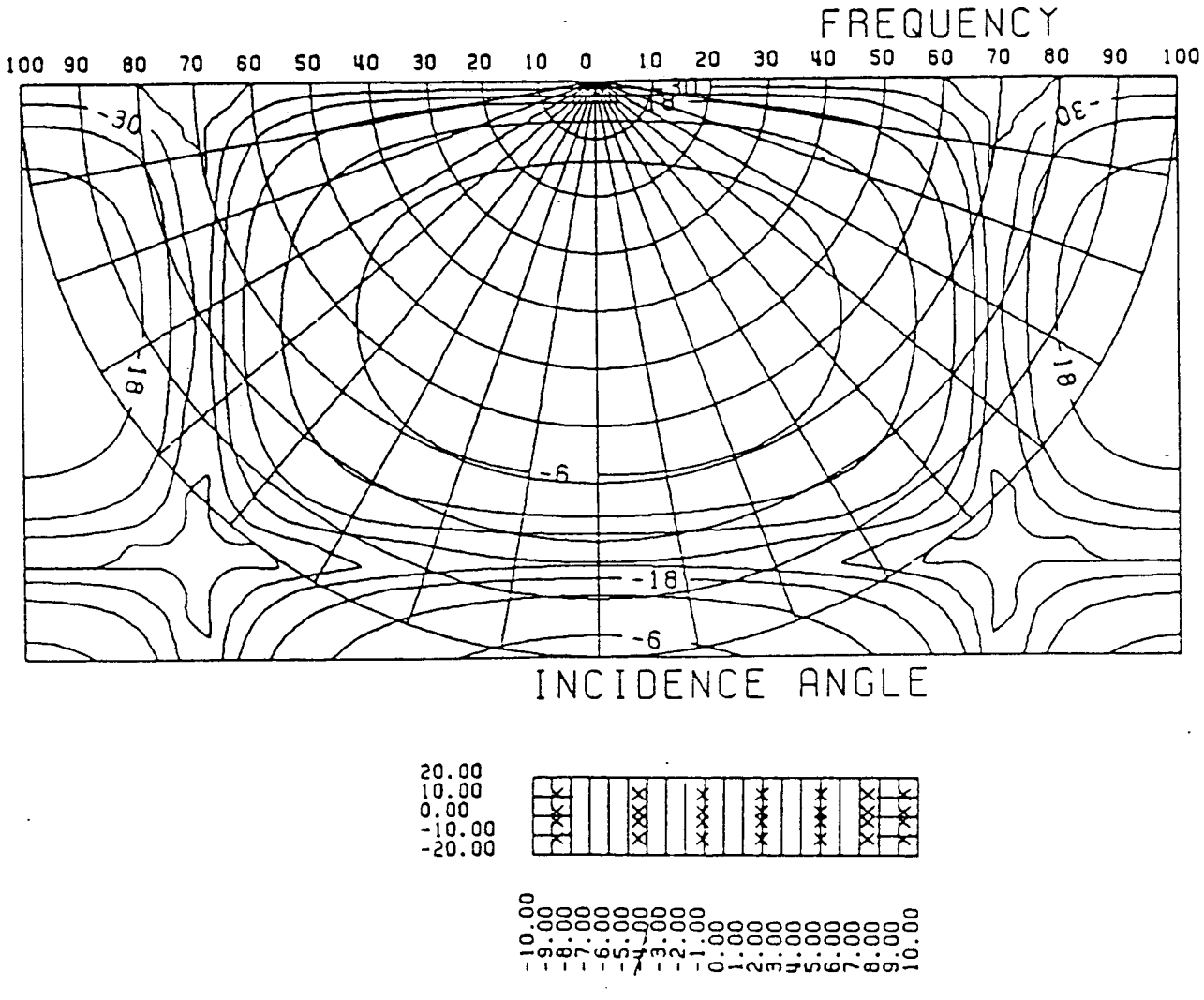
SOURCE CONFIGURATION - PLAN VIEW (ACTIVE GUNS ONLY)
(FIGURE 4)



SOURCE ARRAY RESPONSE

TOTAL LENGTH OF ARRAY:	23.77 meters
TOTAL WIDTH OF ARRAY:	30.00 meters
NUMBER OF ELEMENTS IN ARRAY:	28

(FIGURE 5)

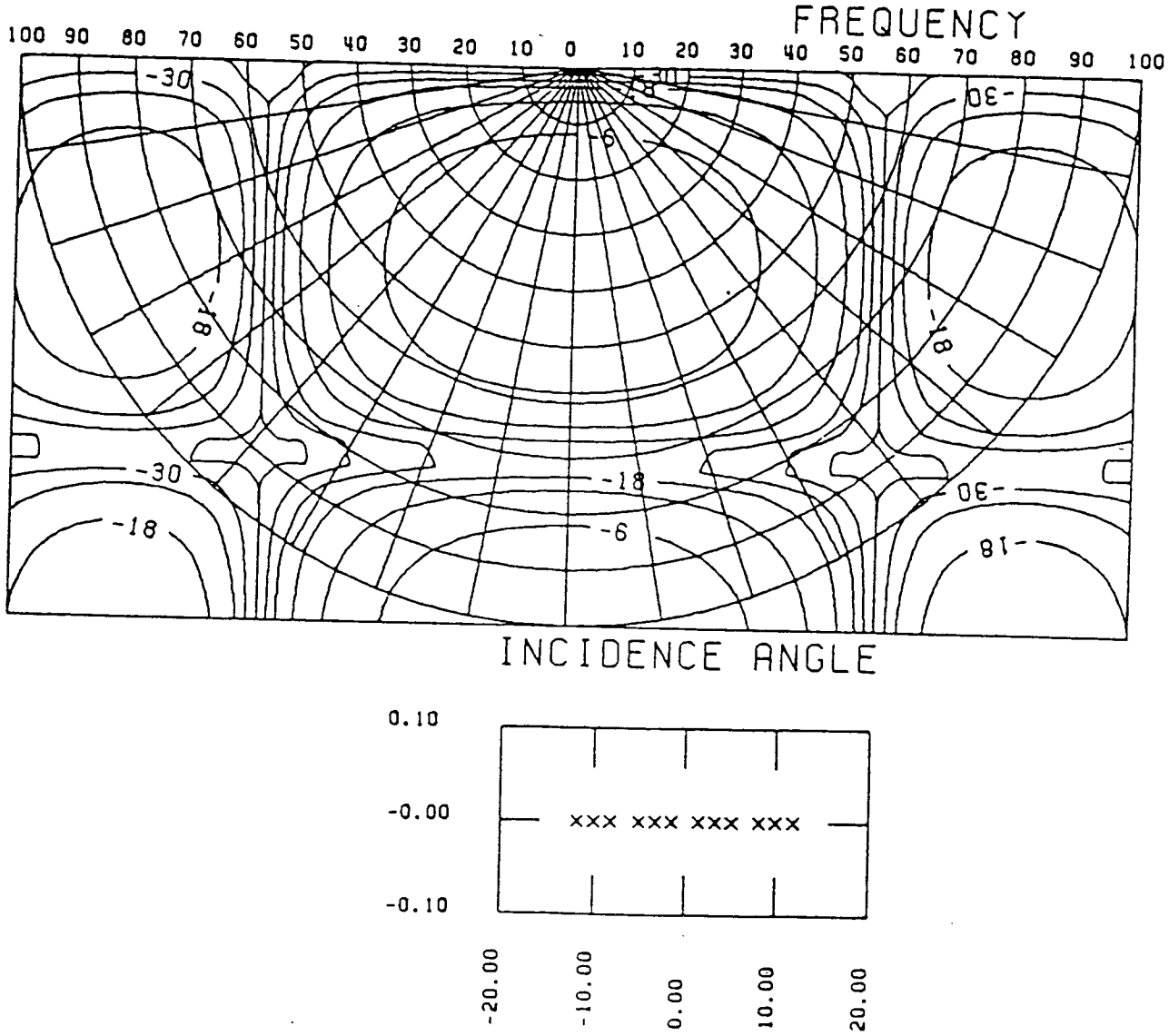


Source 7.62 meters
DB contour plot of array response on a plane inclined 0 degrees to the Z-Axis and rotated 0 degrees counter clockwise from the X-Axis.

RECEIVER ARRAY RESPONSE

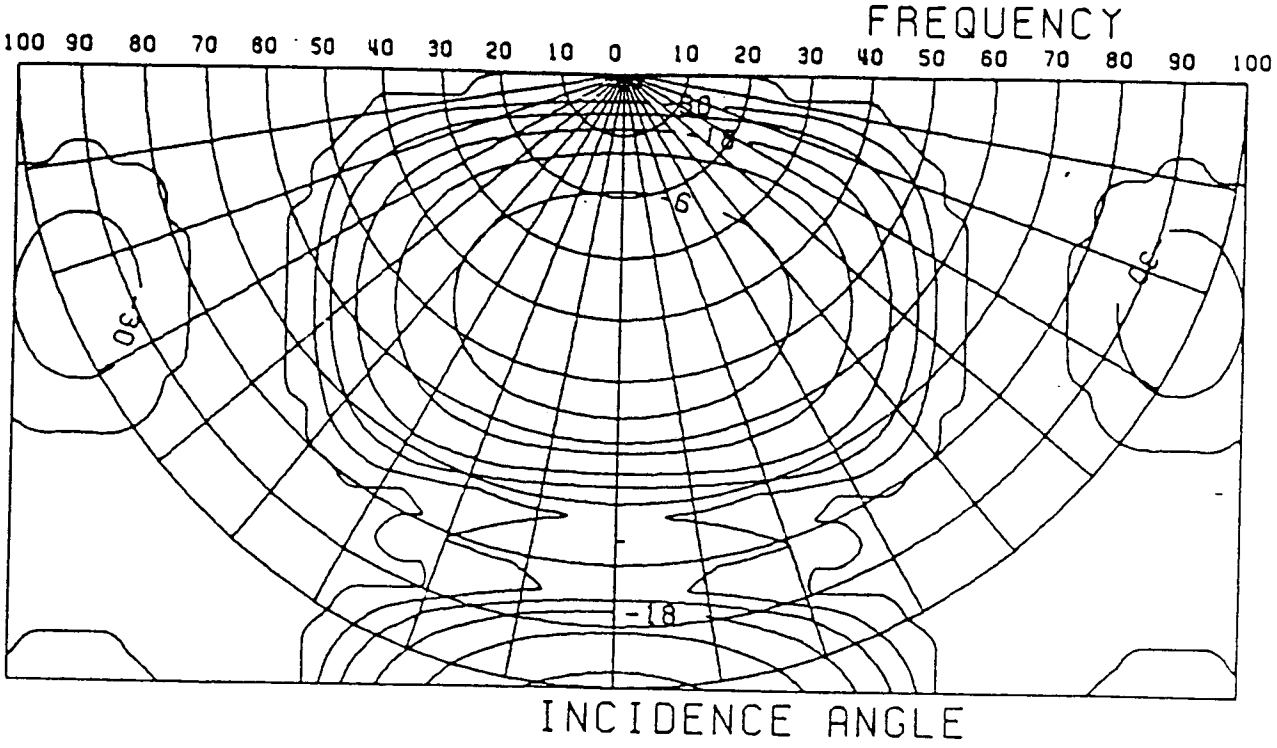
TOTAL LENGTH OF ARRAY:	23.70 meters
TOTAL WIDTH OF ARRAY:	00.00 meters
NUMBER OF ELEMENTS IN ARRAY:	12

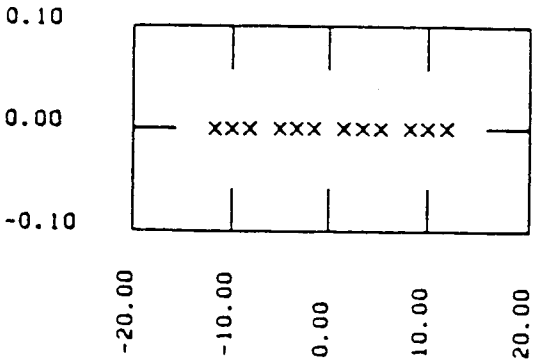
(FIGURE 6)

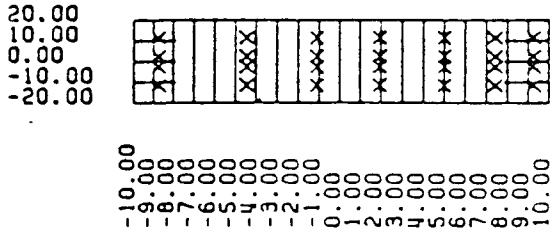


Cable 10.0 meters
DB contour plot of array response on a plane inclined 0 degrees to the Z-Axis and rotated 0 degrees counter clockwise from the X-Axis.

SOURCE AND RECEIVER GEOMETRY
(FIGURE 7)

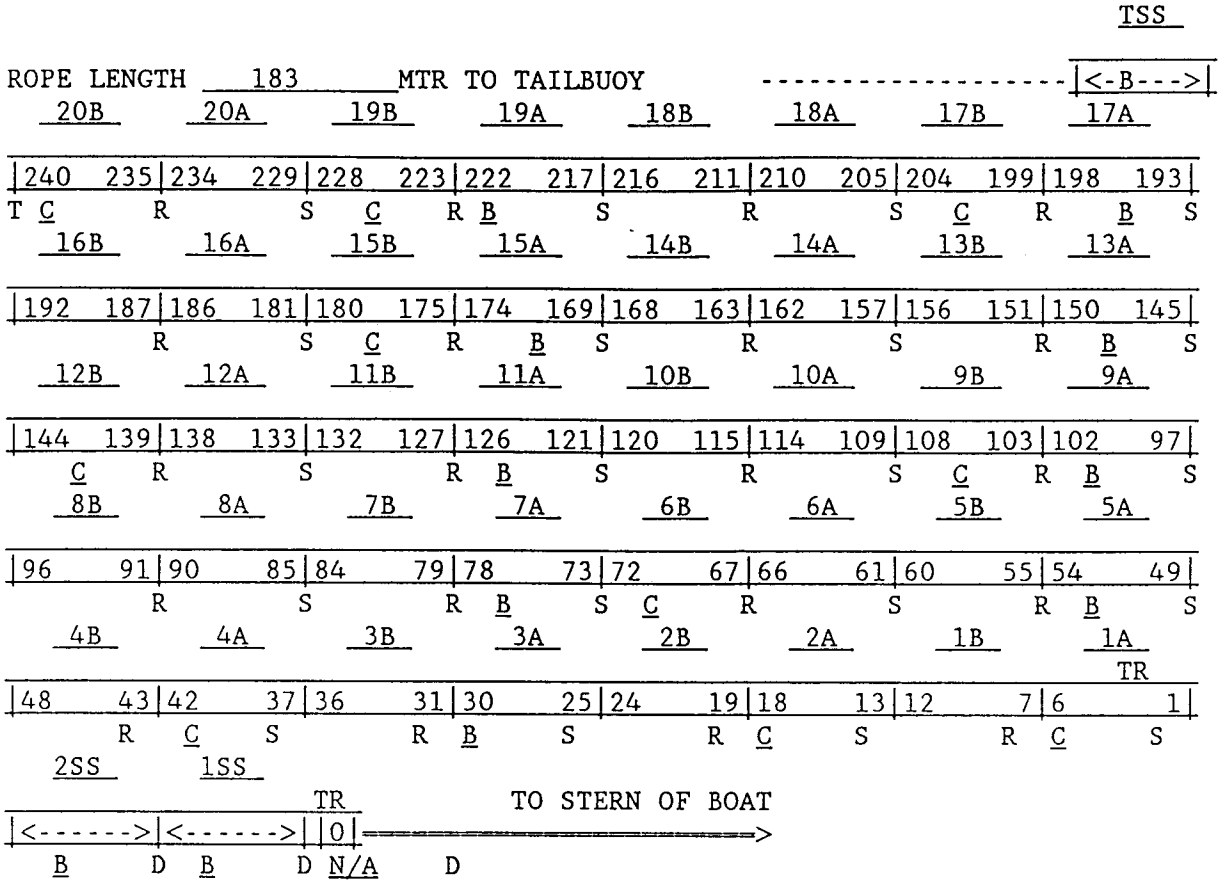






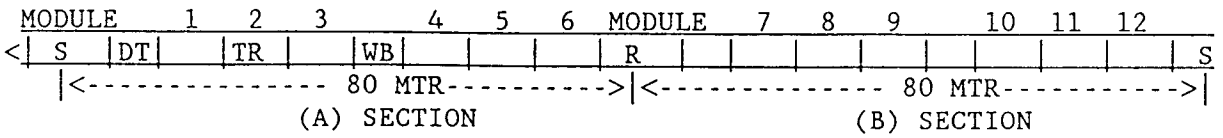
Cable 10.0 meters - Source 7.62 meters
DB contour plot of array response on a plane inclined 0 degrees to the Z-Axis and rotated 0 degrees counter clockwise from the X-Axis.

CABLE CONFIGURATION



USE LEGEND TO INDICATE LOCATION OF PERIPHERAL DEVICES	
CABLE CONTROLLER	(B)
CABLE COMPASS	(C)
STREAMER MODULE	S
COMMAND REPEATER MODULE	R
DATA/COMMAND REPEATER MODULE	D
TERMINATOR MODULE	T
0 OR CONVERTOR MODULE	0
TRILATERATION RECEIVER	TR

EXAMPLE: 240 CHANNEL CONFIGURATION

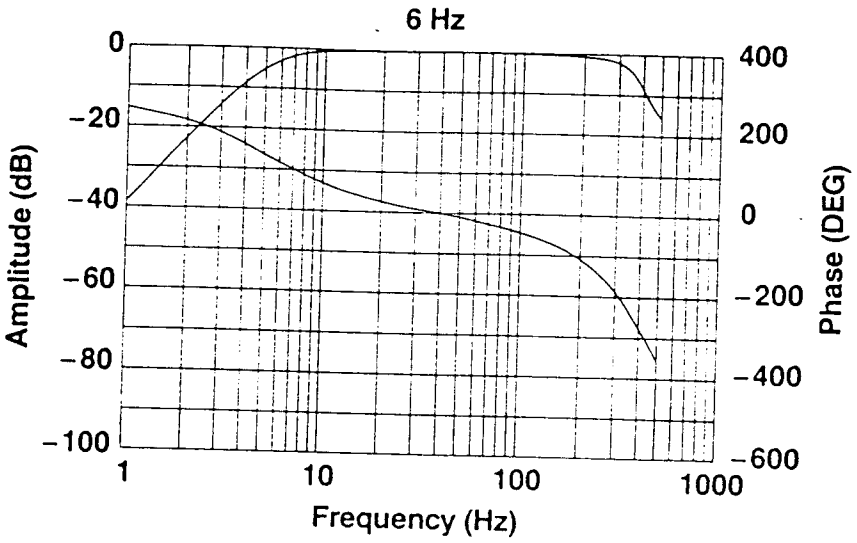


NOTE:
EACH (A) SECTION HAS A DEPTH TRANSDUCER (DT) CHANNEL AT THE HEAD.
EACH (A) SECTION HAS A WATER BREAK (WB) CHANNEL AT THE CENTER OF SECTION.

SEISMIC CHANNEL AMPLITUDE AND PHASE RESPONSE

LOWCUT FILTER: 6 Hz

(FIGURE 8)



PARAMETER AND EQUIPMENT REPORT

VESSEL WESTERN RESOLUTION CREW# 115

CLIENT ATLANTIC GEOSCIENCE CENTER AREA OFFSHORE NOVA SCOTIA

SURVEY DATES (INCLUSIVE) JUNE 13, 1988 TO AUGUST 5, 1988

STREAMER(S):

NO. OF CABLES USED 2 MFGR LRS TYPE KILOSEIS

NO. STRETCH SECTION AT HEAD 2 NO. ACTIVE SECTION ON CABLE 40 EACH

ACTIVE CABLE LENGTH 3200 MTR CABLE DEPTH 9.14 MTR

NO. RAW GROUPS/CABLE 240 RAW GROUP INT. 13.33 MTR

PORT / STBD

NO. PHONES/RAW GROUP 6 NEAR GROUP NO. 1 / 241

TYPE HYDROPHONES LRS 2510 PHONE SENSITIVITY (UV/UBAR) 27.0

NO. DEPTH CONTROLLERS/CABLE 17 EACH TYPE SYNTRON

LOCATION BTWN RAW GROUPS SS1 SS2; 29 30; 53;54 ; 77 78;101;102;125 126;
149 150;173 144;767 197;198 221;222 245 246 269;
270 293;294 317;318 341;342 ___;___ ___;___ ___;
___ ___;___ ___;___ ___;___ ___;___ ___;___ ___;

NO. COMPASSES/CABLE 14 EACH TYPE SYNTRAK

LOCATION BTWN RAW GROUPS 5 6 ; 17 18 ; 41 42 ; 71 72;107 108;143 144;
179 180;203 204;227 228;263 264;299 300;323 324;
347 348;359 360;___ ___;___ ___;___ ___;___ ___;
___ ___;___ ___;___ ___;___ ___;___ ___;___ ___;

NO. DEPTH DETECTORS/CABLE 30 EACH TYPE HPDT-207-1 (SEE CABLE CONFIGURATON PG. FOR LOCATIONS)

NO. WATER BREAK DETECTORS/CABLE 4 EA TYPE WMH-036

SPECIAL INSTRUCTIONS: _____

INSTRUMENTS

FATHOMETER: MFGR SIMRAD MODEL AR-805
PRINT IN (FT,FATH,MTR) MTR

SINGLE TRACE PROFILER: NO.USED 2
MFGR RAYTHEON MODEL 1800
ARRAY GROUP RECORDED/CABLE 3 /243

RECORDING SYSTEM: MFGR LRS MODEL LRS 16A
S/N #4

RECORDING PARAMETERS:

	RAW	ARRAY
RECORD LENGTH/SAMPLE RATE	NOT RECORDED	24 SEC/4 MILL
TAPE SPEED/DENSITY	" "	6250 BPI AT 125 IPS
SEG FORMAT/CODE	" "	SEG-D / 8024
TAPE DECK MFGR/MODEL	" "	TELEX 6253
NO. CH. RECORDED DATA/AUX	" "	180/4
USER HEADER RECORDED (Y/N)	" "	YES

USER HEADER FORMAT HE-10089 (384 BYTES)

ARRAY PROM CODE 43 = 180 ARRAY TRACES

ARRAY LENGTH = 2 RAW GRPS

ARRAY WEIGHTING 0.5 , 0.5 , 0 , 0 , , OVERLAP 50 %

FILTERS:
RAW: HI CUT N/R HZ N/R DB/OCT - LO CUT N/R HZ N/R DB/OCT
ARRAY: HI CUT 87 HZ 132 DB/OCT - LO CUT 6 HZ 24 DB/OCT

WGC QC PLOT SYS (Y/N) Y PLOT INTV 40 SP

OTHER FUNCTIONS POLARITY (QC & CAMERA) BREAKS DOWN

TAP BREAKS (UP/DN) DOWN SCRIBE TAPE (UP/DN) DOWN

NO. STREAMER MODULES/CABLE 20 EACH NO. REPEATER MODULES/CABLE 20 EACH

NO. DATA/COMMAND REPEATERS/CABLE 2 EACH

TELEMETRY ERROR CORRECTION (Y/N):SPIKE Y TIME BREAK VOL OR FIX VOL

AUX CH. ASSIGNMENTS: NO. AUX CHANNELS
1 GUNS 25,28,31 2 GUNS 26,29 3 GUNS 27,30 4 TIME BREAK
5 6 7 8

NAVIGATION

PRIMARY: TYPE LORAN MFGR/CONTRACTOR DIGITAL MARINE / WGC

SECONDARY: TYPE _____ MFGR/CONTRACTOR _____

NAV SPHEROID CLARKE 1866 DATUM SHIFT NAD (27)

STREAMER LOCATION: COMPASSES IN USE (Y/N) Y

TRILATERATION IN USE (Y/N) Y

TYPE SSTS

NAVIGATION REFERENCE POINT (NRP):

LOCATION DESCRIPTION: CENTER OF BACK DECK ROLLER AT STERN.

GRAVITY: N/A

MFGR _____ MODEL _____ S/N _____

DISTANCE FROM SENSOR TO BOW _____MTR TO STERN _____MTR

SPECIAL INSTRUCTIONS N/A

MAGNETOMETER: N/A

MFGR _____ MODEL _____ S/N _____

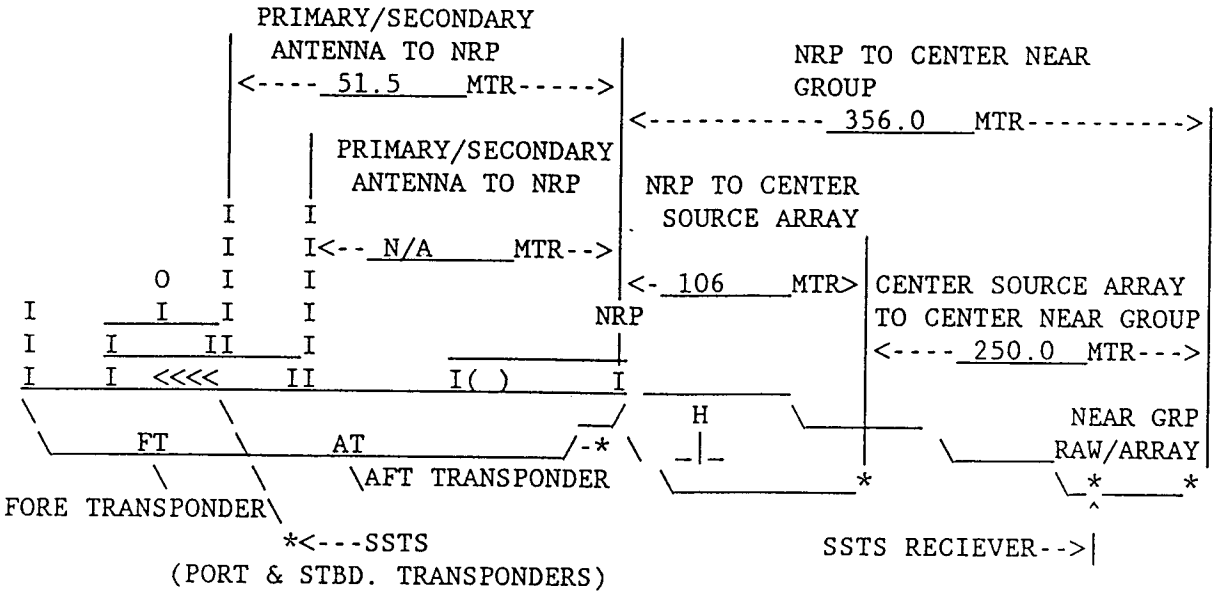
DISTANCE FROM NRP TO MASTER SENSOR _____MTR

DISTANCE FROM NRP TO SLAVE SENSOR _____MTR

SPECIAL INSTRUCTIONS N/A

NAVIGATION REFERENCE PAGE

(FIGURE 9)



REFERENCE OFFSETS:

LOCATE IN RELATION TO NAVIGATION REFERENCE POINT:	ABOVE (+) BELOW (-)	FORE (+) AFT (-)	STARBOARD (+) PORT (-)
CENTER GUN ARRAY	36ft +/- 3ft+H	-106.0 MTR	0 MTR
CENTER NEAR GRP RAW *	N/A MTR	N/A MTR	N/A MTR
CENTER NEAR GRP ARRAY*	45ft +/-6ft +H	-356 MTR	0 MTR
SATELLITE ANTENNA	+16.85 MTR	+51.97 MTR	-0.0 MTR
PRIMARY ANTENNA TYPE:LORAN C	+13.53 MTR	+51.47 MTR	-0.76 MTR
SECONDARY ANTENNA TYPE:	MTR	MTR	MTR
TRILATERATION (SSTS) COMPONENTS			
FORE HULL TRANSDUCER	-12.4 MTR	47.87 MTR	+.049 MTR
AFT HULL TRANSDUCER	-12.4 MTR	19.00 MTR	-.04 MTR
STBD TRANSPONDER	-16.0 MTR	35 MTR	25 MTR
PORT TRANSPONDER	-16.0 MTR	35 MTR	-25 MTR
FATHOMETER TRANSDUCER	-12.4 MTR	+49.0 MTR	-.04 MTR
WATER LINE	MTR	MTR	MTR

* INCLUDING STRETCH

NOTE: REFERENCE TO NEAR GROUP OFFSET WILL VARY SLIGHTLY. OFFSETS SUPPLIED ABOVE ARE USED AS DEFAULT VALUES WHEN TRILAT IS IN USE.

The following navigation equipment were utilized during the survey:

-WISDOM® (Western's Intergrated Survey Data Onboad Management) navigation computer system;
-Loran C

GEODETIC PARAMETERS:

Spheroid Code	2	
Spheroid Name	CLARKE (1866)	
Semimajor Axis	6378206.4000	Meters
Flattening	0.0033900753	
Local Datum	NAD-27	
Delta-X	41.000	Meters
Delta-Y	-147.00	Meters
Delta-Z	-181.00	
False Northing	0.0	
False Easting	500000.0	

M/V WESTERN RESOLUTION (P-115)

Name:	M/V Western Resolution
Owner:	Western Sea Services, Inc.
Flag:	Panama
Construction:	1982, Batservice Verft A/S, Mandel, Norway
Official Registration:	13129-NO
Call Sign:	HP-4602
Dimensions:	Length: 75.20 meters (246.70 ft.) Breadth: 15.60 meters (51.25 ft.) Draft: 5.90 meters (19.30 ft.) Net Tonnage: 147.00 Gross Tonnage: 1437.00
Speed:	13.00 knots cruisisng (clean bottom)
Fuel Capacity:	160,000 gallons
Fuel Endurance:	50 days (estimated running full speed)
Potable Water Capacity:	54,000 gal
Water Endurance:	Estimate 14 days (indefinite using watermaker)
Main Engine:	4 Bergen Diesel (9 cylinder)
Diesel Electric:	4 x 1550 BHP @ 720 RPM 3200 shaft horsepower
Electric Propulsion:	4 ASEA DC motor 600 kw, 720V, 880A
Propeller:	1 Hjelset-Controllable Pitch (9.7')
Main Generators:	4 ASEA 1450 Kva 1395 A 600V 60.0 Hz.
Emergency Generator:	Engine: Cummins 6 cylinder Gen.: Stamford 312.5 KVA 440V 410A 60.Hz.
Bow Thruster:	1 600 H.P.

Incinerator:	Yes
Sewage Treatment System:	Yes
Gyro:	
Auto Pilot:	Sperry Gyropilot
RADIOS:	
Radios-	1 x Icom (SSB) 150 watt 1 x Skanti (SSB) 750 watt 1 x Sailor RT-146 VHF 1 x Ratheon 66 VHF 1 x Dancom RT 408 VHF 1 x Simrad RW 105 Watchstander
Voice/Telex -	Alden Marinefax
Cellular Phone -	OKI 201 fitted with data
RADAR:	
Wheelhouse -	2 Sperry MK 4016 w/ Cas II 2 Sperry MK 227
Weather Fax:	Alden Marinefax
Fire Fighting Equip.:	Halon 1301,AFFF foam Fire Monitors

GEOPHYSICAL EQUIPMENT

RECORDING INSTRUMENTS:

LRS-16A, 480 channel with 4 auxillary traces
LRS-100, 64-Gun Synchronizer System

Raw Format:	Not Recorded
Array Format:	SEG-D
Number of Aux. Channels:	4
Time Break Channel:	1
Low-cut Filters:	6 Hz - 24 DB/OCT
Header Expander System:	MLHEU 8.8
Airgun Simulator Test Unit:	YES
ESM System:	YES
Line Scan Recorder:	Raytheon 1800
Compass System:	Syntron Model RCU-831

CABLE INFORMATION:

2 each LRS-16 KILOSEIS
240 raw channels, 120 array, 3200 meters
40, 80-meter sections

Raw Grup Interval:	13.333 meters
Array Group Interval:	26.67 meters
Depth Indicators:	20 LRS-16 internal
Depth Controllers:	12 Syntron RCL-3 individual remote control
Hydrophones:	WM2-036
Number Phones/Groups:	6
Crystal Capacitance:	.036UF %5

ENERGY SOURCE INFORMATION:

42 Bolt Low Pressure 40 ci" thru 485 ci"

Compressors:	Burkhardt: 2 Model B55 1400 SCFM 2 Model B5Q 750 SCFM

Distance Between Guns:	4 meters
Operating Pressure:	1800 psi
Dual Arrays:	no
Gun Depths at Normal Operation:	25 feet
Type of Phones Used for Gun Break:	WMH-036

NAVIGATION:

WISDOM® Version "E" with RESCU Box, Status Closure Panel

Satellite Receiver:	Magnavox MX1107-RS
Loran C:	Northstar 6000
3D-QC Package:	yes
Gravity Meter:	no
Magnetometer:	no
Doppler Sonar:	no
SSTS:	yes

G. LRS-16A TECHNICAL SPECIFICATIONS:

The following specifications are written based on use of the LRS-16A Shipboard Electronics Upgrade with standard LRS-16 cable sections and modules. In addition, the specifications include the assumption that the 125 ips, 6250 bpi Telex Tape systems for both raw and array data recording will be used.

General:

The LRS-16A is a microprocessor-based shipboard electronics enhancement to the existing LRS-16 system. It utilizes the Motorola 68000 microprocessor, the VMEbus standard, and Eurocard packing techniques. It is designed to easily incorporate future expansion as the LRS-16 seismic acquisition technology continues to develop. The system is designed to handle 480 seismic input channels at a 1-msec sample interval and process the data using the IEEE, 32-bit floating point format; this was done in order to work with future expansions in the area of higher resolution A/D converters.

Cable Configurations Support:

The system will service and acquire data in any increments of the following:

80 mts, 12 channel sections (480 channels, 3200 mts. max.)
160 mts, 12 channel sections (360 channels, 4800 mts. max.)
160 mts, 8 channel sections (240 channels, 4800 mts. max.)

NOTE:

Extension of the cable to 4800 meters and 360 channels (160 meter increments) requires a minor change in the delay line tap in the streamer modules. The modified modules cannot then be used in the 480 meter configuration for a single cable.

Raw Data Processor and Recording

Cable Sampling Interval: 1 msec

Recording Format: SEG-D Multiplexed format 2-byte, hexadecimal format Code 0040 (sign and magnitude) gapped data

Bytes per scan - Depends on number of channels

Scans per block - Depends on number of channels (bytes per block 65K)

Header size - 288 bytes + user header

Recording Sample Rates: 1-, 2-, or 4-msec

Anti-alias Filters -

1 msec.	-3 db @ 350 Hz 72 db/oct Module Analog approximates an Inverse Chebyshev
2 msec.	-3 db @ 188 Hz 156 db/oct Digital FIR (zero phase)
4 msec.	-3 db @ 87 Hz 132 db/oct Digital FIR (zero phase)

Low-Cut Filter: -3 db @ 6 or 12 Hz @ 24 db/oct (includes module low-cut)

Waterbreak Channels -

Number Recorded	4 nearest the vessel
Anti-alias Filter	None
Low-Cut Filter	Same as seismic channels
Recorded Sample Rate	Always 1 msec

Shipboard Auxiliary Channels:

Number Recorded	4 (from Cable Interface Electronics (CIE))
Filtering	Same as seismic channels except for auxiliary channel 4
Sampling Skew:	Module sampling skew-corrected using digital interpolation filter
Error Detection:	Errors are detected using an adaptive cubic polynomial function plus threshold window.
Error Correction:	Errors are corrected using predicted value if sample is determined to reside outside of acceptable limits.

Maximum Record Lengths:	240 Seismic	480 Seismic
1 msec	20	17
2 msec	20	20
4 msec	20	20

NOTE: These figures will change depending on the cable configuration, i.e., number of channels being recorded.

Playback:	Read-after-write data is processed and output to a galvo camera and seismic QC system for evaluation.
Seismic Channels - (Galvo Camera)	Up to 48 channels selected by the operator can be displayed in AGC or fixed-gain, 6 db steps.
Seismic Channels - (Seismic QC System)	All channels plotted simultaneously with operator-selectable programmed gains.
Auxiliary Channels - (Galvo Camera)	4 channels, fixed-gain, 6 db steps.

Array Data Processor and Recording

Input Data to Array Data Processor:

Data is input from the Raw Data Processor after having been

processed through the following: Data Mapping, Error Detection and Correction, Skew Correction, and Low-Cut Filtering.

Number of Input Data Channels:	960 (maximum)
Recording Format:	SEG-D Demultiplexed format, 2-byte, quaternary format Code 8024 (1's complement)
Header Size:	Depends on number of array output channels, number of coefficients, type of process, Beam Steering, time variant, etc.
Recording Sample Rates:	1-, 2-, or 4-msec.
Anti-Alias Filters:	1 msec. -3 db @ 375 Hz 156 db/oct Digital FIR (zero phase)
	2 msec. -3 db @ 188 Hz 156 db/oct Digital FIR (zero phase)
	4 msec. -3 db @ 87 Hz 132 db/oct Digital FIR (zero phase)
Auxiliary Channels:	
Number Recorded -	4 (from CIE)
Filtering -	Same as seismic channels except for auxiliary channel 4
Gun Phone Channels:	
Number Recorded -	Up to 64
Record Length -	Maximum of 512 samples
Filtering -	Low-Cut performed in Gun Monitor Unit; -3 db @ 6 Hz, 18 db/oct.
	Anti-alias filtering performed using the same digital filter as selected

for the Array Seismic Channels.

Number of Array Output Channels: 240 (maximum), 1 (minimum)

Maximum Length of Arrays: 16 @ 240 output channels
32 @ 120 output channels

Array Overlapping: Up to 8 arrays may reference the same inout channel; can be more depending on configuration.

Array Definition: Up to 4 configurations processed concurrently.

Maximum of 4 coefficients sets per configuration.

Maximum of 32 coefficients per set.

Dynamic Correction: Partial NMO correction performed on raw data channels used to form the output Array Channel.

Maximum Correctable Delay: 63 msec.

Time Variant Weighting: Up to 3 times windows per record within which the coefficients are computed by linear interpolation.

Maximum Record Lengths:	Overlapped (Seconds)	Non-Overlapped (Seconds)
1 msec	6	12
2 msec	12	24
4 msec	24	48

NOTE: These times are for a maximum of 240 channels and will be larger for fewer channels. Overlapped record indicates that another record can be started while the previous one is still being recorded on tape.

Playback: Read-after-write data is processed and output to the seismic QC system for evaluation.

Seismic Channels - (D/A Scope Display) Up to 60 channels selected by the operator can be displayed in AGC or fixed gain, 6 db steps.

Seismic Channels - (Seismic QC system)	All channels plotted simultaneously with operator-selectable programmed gains.
Auxiliary Channels - (D/A Scope Display)	4 channels, fixed-gain, 6 db steps.

LRS-16A SYSTEM 240-CHANNEL STREAMER CABLES

1. The active portion of the LRS-16 streamer cable consists of several types of cable sections and modules:

   Cable Sections

   1. Stretch
   2. Active
   3. Tail

   SSTS section zero module adapter with cross cable pingers.

   Modules

   1. Streamer
   2. Command Repeater
   3. Data/Command Repeater
   4. Terminator

   The active streamer sections are tied in directly behind the electronic modules and are 80 meters long measured center-to-center of the modules. Hydrophone groups are spaced evenly over the entire section length. Each section contains a water-break (signature) phone located in the center, a depth transducer toward the front, and an optional compass unit toward the rear. Each cable consists of 40 active cable sections and 20 streamer modules, each with 12 seismic data channels. Channels 1 to 6 represent hydrophone groups located directly downstream from the streamer module. Behind group 6 is a command repeater module that is used to buffer commands from the shipboard electronics to the next streamer module downstream.

   The Command Repeater Module also connects hydrophone channels 7 to 12, located directly downstream, to the streamer module upstream. This allows all active cable sections to be interchanged. Streamer modules in the cable are 160 meters apart.

The command repeater modules are located at the 80 meter point midway between two streamer modules. The streamer and command repeater modules are numbered 1 through 20 in stb cable, with number 1 module closest to the vessel and 21-40 in port cable, with number 21 closest to vessel. A data/command repeater module is located as a lead-in module between the lead-in and stretch sections. The data/command repeater module buffers signals over the extended distance between the shipboard electronics and streamer module 1.

2. Active Sections

Each of the 40 identical active sections is 80 meters long. Each section is located between a streamer and a command repeater module. Each active section contains 36 hydrophones in a configuration of 6 groups of 6 parallel connected phones. Each section contains a depth transducer between the electronics module and the first hydrophone, and a water-break detector at the 40 meter location between hydrophones 18 and 19.

Locations for compass units and depth controllers are between hydrophones 30 and 31, 33 and 34, respectively. These locations are marked with blue spacers for easy identification and monitoring of the external devices.

The tail end of each active section terminates in a Viking connector for attaching the next module downstream. All active sections are filled with oil and balanced for buoyancy. Each section contains the basis complement of wires plus 16 additional pairs.

3. Tail Section

A terminator module connected behind the last active section provides signal line terminations. The tail section is 80 meters long and connects to the tail end of the terminator module via a Viking connector. The aft end of the tail section is connected to a tail swivel which attaches the towing rope for the tail buoy. The tail section, like the active sections, is oil-filled and balanced for buoyancy. The only wires running through the tail section are the two 26-gauge twisted-pair depth controller lines, which are terminated in open sea at the tail swivel for a seawater ground return to the control module on-board the recording vessel.

4. Active Section Elements

a) Hydrophones

Thirty-six LRS-2510 series hydrophones, Model WM2-036, are used in each active section of the streamer cable, parallel connected in 6 groups of 6. The hydrophone is a pressure-sensitive device with a sensitivity of 27 volts/bar + 5%, a maximum recommended working depth of 60 meters, and dimensions of 58 x 23 x 31 mm.

b) Water-break Detector

One LRS-2510 series hydrophone, model WMH-036, is installed in each active section for use as a water-break detector. This single hydrophone, located at the center of the cable section, detects the very high frequency direct arrivals from the energy source. The water-break hydrophone is not used in sections aft of a command repeater module.

c) Depth Transducer

An open sea type depth transducer is installed on each active cable section approximately 1 meter behind the electronic module. The depth transducer is a two-element amplitude modulation device which receives a 500 Hz square wave signal from the module for transducer power.

The square wave is converted to a sine wave for returning an amplitude-modulated signal to the module amplifier. The depth transducer is not used in sections aft of a command repeater module.

d) Depth Controller

Toward the tail end of each active section, an isolation point is provided for attaching a Syntron Depth Controller. The approximately 2 meter long isolation point, which has an oil block at each end, is located approximately 6 meters from the aft end of the cable section. Five blue spacers are used to identify the isolation point. The basic wire complement of the LRS-16 cable sections include two spare lines of 26-gauge twisted-pair wire for use with depth control devices. RCL 2's and RCL 3's are used.

The lines run through the terminator module and tail section to the tail swivel for seawater (ground) return.

e) Compass

Each active cable section contains an isolation portion for use with a Syntron exterior-mounted compass unit. Approximately 12 meters from the tail end of the section, three 3 meter long stainless steel wire ropes are spliced in to replace the three galvanized wire rope stress members. Oil blocks also are used for isolation fore and aft of the compass location. The basic wire complement of the LRS-16 cable sections contained two 22-gauge compass lines, one for an interior compass and one for an exterior-mounted compass.

5. LRS-16 Modules

a) Each electronic streamer module is a data acquisition system operating remotely at the hydrophone input. Each module contains the circuitry required to amplify, sample, gain, digitize, and telemeter local data, as well as the circuitry for repeating downstream data. Other major circuits include command decode, bypass control, and test and power. Hybrid circuits are used extensively because of their reduced size and weight and their high performed.

Transformer coupling for the hydrophone inputs are eliminated by using a charge-couple amplifier for each channel. This is a current-type device that directly connects to the hydrophone by wire and provides excellent signal-to-noise ratio.

Incoming local data are filtered, pre-amplified, anti-aliased, and output to the instantaneous gain-ranging circuitry. High speed (12 bits in 12 microseconds) analog-to-digital conversion is performed and the di-phase encoded data are output to the data line via an output transformer. Emmiter-coupled logic (ECL) is used to drive the signals in current mode at very high speed.

The module is controlled by synchronization (SYNC) and interrogation pulses (IP) from the shipboard electronics. A patented system of polling the modules eliminates the need for any special module addressing and means that each streamer module is identical and interchangeable.

During a seismic record, 1 SYNC and 14 IP's are transmitted every millisecond to the 15 channels of each module. A 20-bit burst of data is transmitted from the module for each sample of each channel, an artificial delay being used to separate the data burst from module to module. The streamer module has 15 available channels.

CHANNEL NUMBER	ASSIGNED FUNCTION
0	Quality Control
1	Water-break
2 - 13	Seismic Data
14	Depth Transducer

In addition to the SYNC/IP line, there are two command lines for module control. Command A is for IP blocking and Command B is for bypass. Bypass control can be used for troubleshooting purposes and for disabling a malfunctioning module. Module bypass is accomplished electromechanically by commanding module n-1 to turn off module n.

A test circuit in the streamer module receives a 31.25 Hz precision signal from the shipboard electronics and outputs the signal to the hydrophones for accurate calibration. In the test mode, the calibrate signal is recorded on tape in place of the water-break signal.

A 2 KHz signal, synchronous to the shipboard electronics master sampling oscillator, is used for module power. The 2 KHz signal is outside of the pass band and allows for small current transformer to be series connected in each module.

b) Command Repeater Module

Command repeater modules, which are used alternately with streamer modules, connect two active cable sections and allow each of the 40 sections to be built identically. The main function of the command repeater module is to buffer commands from the streamer module upstream to the next streamer module downstream. Deterioration of the SYNC and IP is prevented by maintaining accurate pulse widths.

Downstream seismic channels 1 through 6 are wired in the command repeater module to become channels 7 through 12 in the streamer module upstream. Physical

construction of the command repeater module is identical to that of the streamer module, except that the only one active PC board is used; two are blank.

6. Cable Depth Monitor (CDM)

The CDM provides two main display functions:

a) A profile depth display of all active cable sections, relative to sea level.

b) A raw hydrophone group channel display; the video image includes all seismic channels (480); the operator can scan for a selected cable section to observe the 12 seismic channels of a particular module.

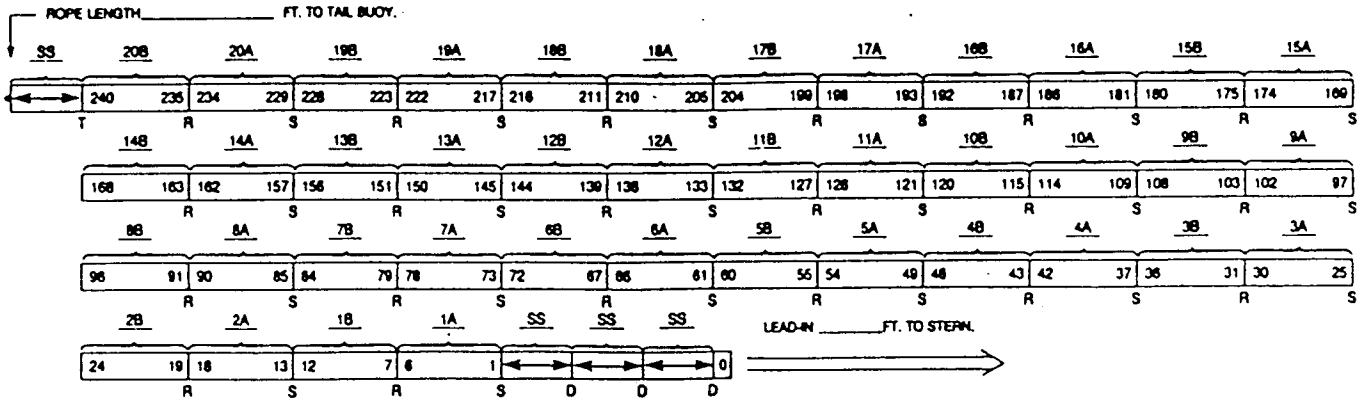
The CDM also performs depth transducer calibration for the cable depth display.

The depth output board interfaces with external equipment and provides a depth data output in BCD byte format: 1 byte (per module) contains two 4-bit BCD digits representing cable depth in feet. This information can be included in the external header and fed back into the LRS-16 via the RDP (raw data) and DMM (array data) for recording on tape. The depth output board also outputs composite video data for a remote CRT.

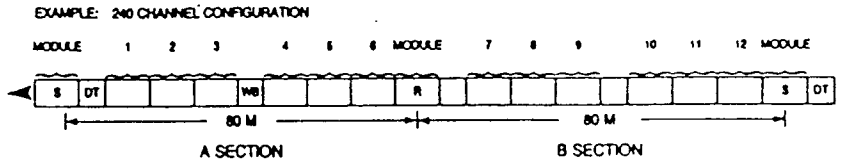
7. Seismic Quality Control (SQC)

The SQC contains a file memory, arithmetic unit, and microcomputer control. Read-after-write data from the RFT and ATF are input to the SQC for verification. The seismic record is analyzed for noise and data quality. At intervals of approximately 10 shots, the SQC output is displayed on a plotter.

STREAMER CONFIGURATION
(FIGURE 10)



USE LEGEND TO INDICATE LOCATION OF PERIPHERAL DEVICES.	
CABLE CONTROLLER	(B)
CABLE COMPASS	(C)
STREAMER MODULE	S
COMMAND REPEATER MODULE	R
DATA/COMMAND REPEATER MODULE	D
TERMINATOR MODULE	T
O or CONVERTOR MODULE	O



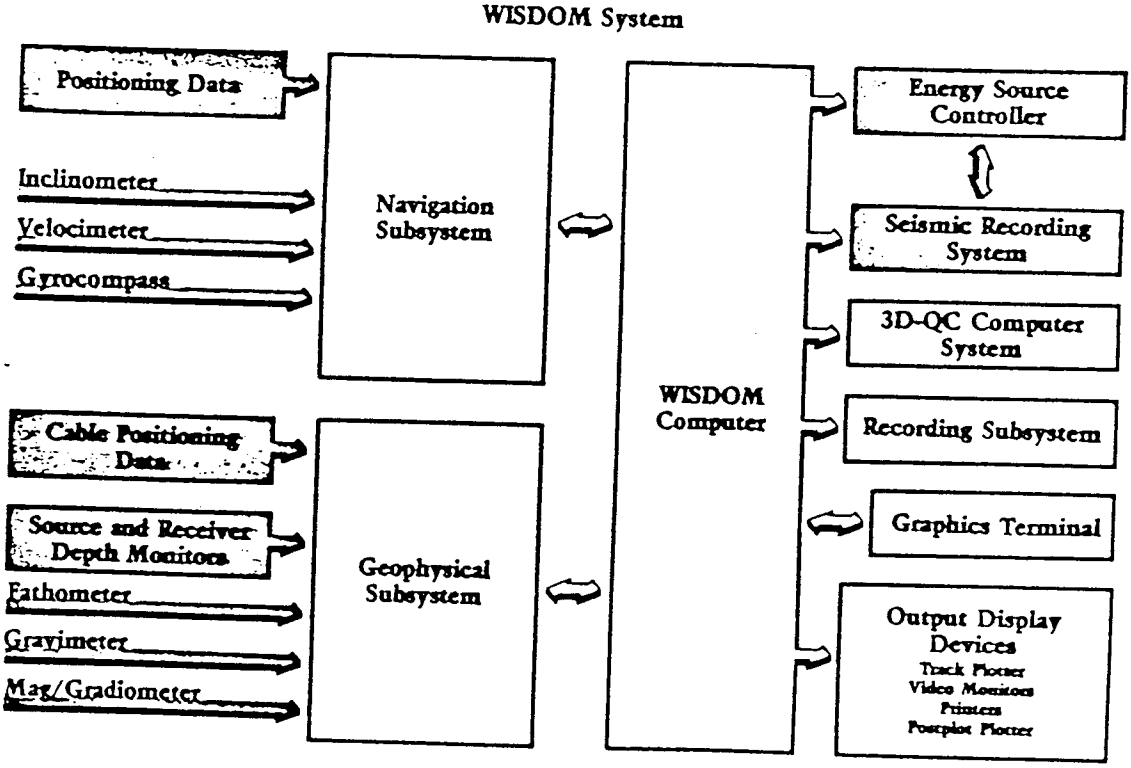
NOTE:
EACH A SECTION HAS DEPTH TRANSDUCER AT THE HEAD.
EACH A SECTION HAS WATER BREAK AT CENTER OF SECTION.

H. WESTERN INTEGRATED SURVEY DATA ONBOARD MANAGEMENT (WISDOM®)

1. General

The standard WISDOM® System is a computer-based system integrated with an interface (GDU) to which a variety of auxiliary navigation sensors can be connected. The system consists of an HP2117F computer (CPU), an HP2649C Operator Terminal with Graphics Display, a 9-track 800 BPI Tape Deck and a Line Printer. The system integrates a Magnavox MX1107 Dual Channel Satellite Receiver, a Magnavox MX610 Doppler Sonar, and High Precision Radio Positioning. The WISDOM® System computes precise firing locations for the energy source in either distances-along-the-line or velocity-based time intervals. It records all non-seismic data and displays continuously a summary of navigation data.

(FIGURE 11)



2. The Satellite Sub-System

A Magnavox MX1107 Dual Channel Satellite Navigator provides continuous real time satellite navigation from the Navy Navigation Satellite System (NNSS). The receiver passes raw satellite data to the central processor (HP2117F) for reduction by the WISDOM® operating system. The Magnavox receiver also provides a stand-alone fix computation as well as satellite pass predictions.

3. The Geoscience Data Unit Sub-System (GDU)

The GDU maintains synchronous data ports for all non-seismic data such as gravity, magnetics, depth, streamer heading sensors and depths, gun depths, gun synchronization information, tail buoy data, and all radio navigation data. The GDU also outputs closures for gravity and magnetic event markers, and reformats data for the seismic system. All data which is channelled through the GDU passes to the WISDOM® System for recording on the WISDOM® tape.

4. Radio Navigation Sub-Systems

Radio navigation sub-systems give radio ranges to the GDU and to the WISDOM®. The WISDOM® accepts as many as 16 radio patterns from available positioning systems. Signal conditioning for the raw patterns includes spike editing, filtering, and static corrections.

All 16 radio patterns are recorded at two-second intervals and at each pop. Filtered values are recorded at ten-second intervals as well as at each pop.

Up to 6 independent solutions can be selected from any two through six of the 16 possible input radio patterns. These solutions can be geodetically absolute or the data can be used for velocity sensing between satellite fixes. Each absolute solution is based on the various range data and their standard deviations. Thus, relatively noisy data are suppressed. The solution is accompanied by a quality-of-solution parameter for the multi-range data. For radio positioning geodetic quality control, the operator can confirm geodetic parameters against pre-plots through static checks.

Vessel position, course, and later deviation of the vessel from pre-plot track are continuously displayed on video

units located both on the vessel's bridge and in the navigation recording room. Quality control data such as base stations intersect angle, multi-solution fix-error, cable attitude, post line histograms displaying cross course deviation, shotpoint spacing and residual of fix resolutions are displayed on the operator's graphics terminal.

A permanent printed log is provide through a Diablo printer. All data are recorded on magnetic tape through a Pertec tape transport.

These types of radio positioning systems' outputs, range, phase and time, can be interfaced to the WISDOM® system. Range types include Shoran, Syledis, Maxiran, Trisponder, Del North, Microphase, and Miniranger. Phase (lane) types, circular or hyperbolic, include Argo, Lorac, Raydist, and Hi-fix. Time types include Accufix (Loran-C), Pulse/8, and Toran.

I. TESTS AND CALIBRATION

Prior to the start of the survey, a semi-monthly instrument test is performed on the LRS-16 recording system. Test data is analyzed by field systems QC of Western Research. In addition, daily system tests were run through the survey to insure seismic instrument integrity. Also a series of diagnostics were performed on all remaining shipboard systems.

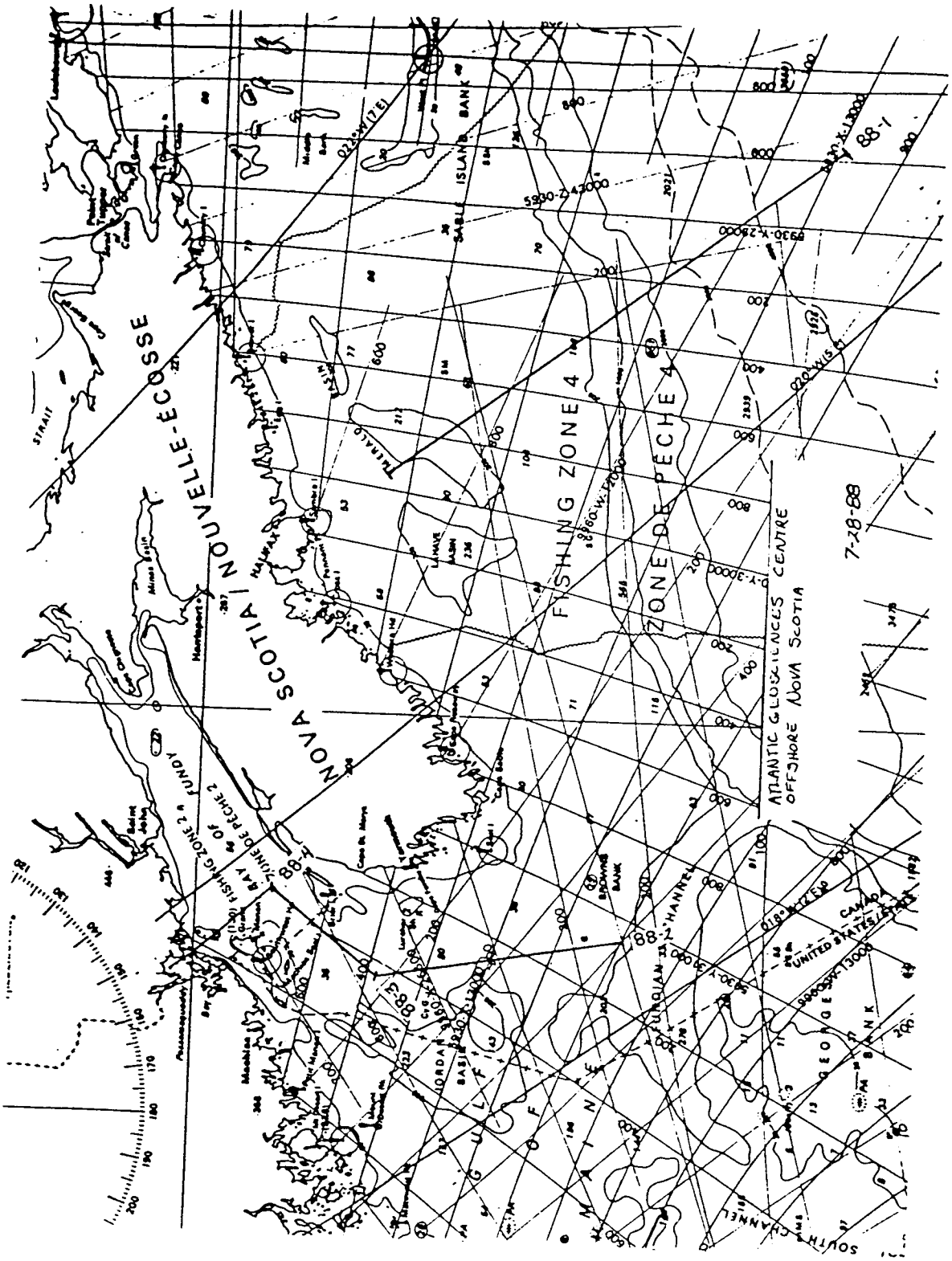
I. SURVEY PARAMETERS AND LINE INFORMATION

1. Definition of Survey Lines :

LINE	SHOT POINTS FSP	LSP	INITIAL POSITION NORTHING	EASTING	FINAL POSITION NORTHING	EASTING
88-1	100	4441	41 34 0.00	-60 37 0.00	44 4 0.34	-63 10 0.36
88-2	100	1982	42 40 0.00	-66 40 0.00	43 59 59.46	-66 59 59.86
88-3	100	1148	44 0 0.00	-67 0 0.00	44 34 59.49	-66 20 0.59
88-4	100	894	44 35 0.00	-66 20 0.00	44 59 59.36	-66 52 59.15
88-4	100	1093	44 59 59.36	-66 52 59.15	45 7 0.03	-67 0 0.03

Grid Projection:	Transverse Mercator
Origin Latitude:	0.0°
Origin Longitude:	0.0°
False Northing:	0.0 meters
False Easting:	500000.0 meters
Scale Factor:	.9996
Spheroid Name:	Clarke (1866)
Semi-Major Axis:	6378206.4 meters
Flattening:	0.003300753 meters
Local Datum:	NAD 27
X Shift:	41.0 meters
Y Shift:	-147.0 meters
Z Shift:	-181.0 meters

AREA SURVEY MAP
(FIGURE 12)



K. SUMMARY

The survey was completed on August 31, 1988 to a total of 583.2177 kilometers of 30 fold seismic data with both seismic and navigation data being shipped to Western's Calgary office for processing.

Despite the slow commencement due to the generator failure, the survey progressed fairly smoothly once under way. Weather was not a factor in delays, but the naturally strong currents in parts of the prospect area did create noise and high feathering angles which were grounds for standing by and re-shooting. Also, fishing activity caused some delays in production.

Close to all of the pre-plotted seismic line was shot despite the acquisition obstacles and this was done staying within the client's budget.