

056001



Bass Basin part XII

OPERATIONS REPORT
MARINE SEISMIC SURVEY

SOUTH AUSTRALIA, VICTORIA AND TASMANIA, AUSTRALIA
(O 70A, B 70A, ^{T70C}~~F~~ 71A, G 71A)

for

ESSO STANDARD OIL (AUSTRALIA) LTD.
G.P.O. Box 4047, Sydney, N.S.W.
Client Representatives : I. Criss
A. Martens

by

GEOPHYSICAL SERVICE INTERNATIONAL
P.O. Box 437, Crows Nest, N.S.W.
Party 909 M.V. "R.C. Dunlap"
Operations Supervisor : C. Rowell
Quality Control Seismologist : T. Kerlin
December 12th, 1970 - February 5th, 1971

OR-012



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SECTION I.

INTRODUCTION :

A seismic reflection survey was conducted by the M/V "R.C. Dunlap" in areas offshore South Australia, Victoria and Tasmania for Esso Standard Oil (Australia) Ltd., between December 12, 1970 and February 5, 1971.

Approximately 2500 miles of 24-fold reflection coverage were shot utilizing a 2400 meter, 48 live group streamer under continuous tow in conjunction with a pneumatic acoustic energy source (airguns) operating 24 hours per day.

All recordings were made using two sets of 24 trace DFS III's, with 3 tape transports recording on 1" magnetic tape in 21 track TIAC* Binary Gain Digital Format. Normal record length was 5.0 seconds, except in deep water where record length was increased, as necessary, to maintain a minimum of 3.0 seconds of seismic data below the water bottom. In all instances the sample rate was 4 ms.

The ship's position off Victoria was determined by Offshore Navigation Inc's XR Shoran system occupying various land based survey stations, as specified by Esso.

Texas Instruments Geo Nav II Satellite Navigation system was used to position five lines shot off South Australia and one line shot off the west coast of Tasmania.

Adverse weather conditions were occasionally encountered which hindered overall operations and in several instances warranted complete shutdown until more favourable conditions prevailed.

* Trademark of Texas Instruments



SECTION II.

OPERATION PROCEDURES :

(A) Fathometer Survey

Two fathometers were used, a Ross Continuous Recording Echo Sounder (0 - 400 fathoms) in water depths up to 400 fathoms and an ELAC DENEK LAZ-17DDL (0 - 2200 fathoms) in water depths greater than 400 fathoms. Each fathogram was identified by line number, direction shot, time and date of first shotpoint and scale used. An automatic mark was made on the fathograms every fourth airgun "pop" starting with the first "pop" on the line. The fathograms were labelled every 10 shotpoints; i.e., 40 airgun "pops".

The transducers for the fathometers are located 8.6 meters forward from two XR Shoran Antennae, and 11 feet below the mean water line of the vessel. The zero line for the Ross fathometer fathograms was not corrected for the ship's draft. The zero line for the ELAC fathometer fathograms was corrected for the ship's draft.



(B) Instrument and Noise Tests

Instrument tests were carried out prior to each day's operations and the results examined in an analogue form in the field. These tests consisted of Dynamic Range Determination, Amplifier Noise Test and an Automatic Gain Control (AGC) Oscillator Test.

Monthly instrument tests were recorded on tape and forwarded to GSI's Sydney Processing Center for computer analysis.

These tests or measurements included Harmonic Distortion, Gain Linearity, Periodic Calibration Checks, Skew Checks and the aforementioned daily instrument tests.

In addition, a complete set of instrument tests were run prior to the start of the project in conjunction with standard Esso tests. These tests were carried out under the supervision of Esso's representatives B. Stone and I. Criss.

A Streamer Noise Analysis was made at the beginning and at the end of each line shot. Some of these tests were recorded on tape.



(C) Energy Source (Airguns)

An Electro-Pneumatic Acoustic Energy Source known as "Airguns" was used for all reflection work.

The airgun has basically two moving parts, the shuttle and the solenoid. Compressed air is supplied to this unit at a pressure of 2000 lbs., per square inch. The shuttle is forced to close on initial application of pressure. Compressed air fills the reservoir chamber through a central orifice in the shuttle. To discharge the gun an electrical current activates the solenoid and retracts a plunger thus enabling compressed air to pass through a port hole to the underside of a flange at the top of the shuttle. The pressure difference above and below the shuttle then thrusts it open. The air from the chamber then escapes through four port holes near the center of the gun and expands rapidly through the water producing a single bubble and resultant shock wave. The air bubble collapses in a manner similar to that caused by explosives with one notable exception that its period is controllable and is placed in the desired seismic frequency band.

There are three variables used to control the frequency content of the shock wave :

- i) the depth of the airgun in the water
- ii) the pressure at which the gun is operated, and
- iii) the size of the chambers used on the gun.



Using different guns of various chamber sizes broadens and flattens the frequency spectrum of the pulse.

The depth of the airguns were 30 feet and were operated at a pressure of 2000 lbs., per square inch. The individual airguns were arranged to produce a 860 cubic inch array. This array consisted of :

- i) 1 x 240 cubic inch array; using
6 x 40 cubic inch guns,
- ii) 2 x 80 cubic inch array; using
2 x 40 cubic inch guns,
- iii) 3 x 40 cubic inch array; using
1 x 40 cubic inch gun,
- iv) 5 x 20 cubic inch array; using
1 x 20 cubic inch gun.

These arrays were arranged and spaced so as to operate as a tuned array which yielded a flat frequency spectrum between 8 and 60 Hz. (Plate III).

The time co-ordinator unit triggered the Digital Field System which in turn discharged the Texas Instrument Airgun Control Unit (blaster) causing a current to flow simultaneously through all the solenoids, resulting in the guns firing. The guns were fired every 50 meters giving a 24-fold coverage using the 2400 meter streamer. The airgun array was mounted on two, one port astern and the other starboard astern, metal frames (Fish) and towed behind the recording vessel at a distance of 62 feet.



(D) Recording

The recording was done using a Texas Instruments' Digital Field System, two sets of DFS III's, with 3 tape transports. Direct (RAW) monitors were generated every shotpoint and Amplifier monitors every tenth shotpoint for quality control purposes.

The 2400 meter, neutrally buoyant, continuous tow streamer consisted of 48 live sections each 50 meters in length and 6 Waterbreak/Depth Transducer sections each 2 meters in length, placed immediately in front of group 48, between groups 40 and 41, 30 and 31, 20 and 21, 10 and 11 and 2 and 3. Six nylon stretch sections were placed between group 48 and the recording vessel to attenuate ship generated noise.

One nylon stretch section followed group 1 and was joined to the tailbuoy by 400 feet of nylon rope. Tailbuoy bearings were taken by radar every 10 shotpoints to ensure that the cable was inline. Five Condep* cable depth controllers were placed between the depth transducers on the streamer at the center of a live group where the hydrophone spacing is greatest.

The average streamer depth was 45 feet.

The setback (Shoran antenna to shot distance) was 49.4 meters for all shotpoints.

* Trademark of Continental Oil Company



2400 Meter All Live Streamer (Plate 2)

Type cable : 48 live group,
neutrally buoyant
universal gland
streamer.

Length of live section : 50 meters.

Length of depth transducer
section : 2 meters.

Distance group 1 to 48
(centers) : 2360 meters

Group Interval : 50 meters

Seismometers per group : 10

Seismometer Interval : Linear, 13'8" except
center two which are
27'4".

Texas Instruments DFS III - Dual System

System I - ODD groups 1 to 47 Serial No. 105

System II - EVEN groups 2 to 48 Serial No. 106

Instrument settings were kept the same on both systems.



Reflection recording settings :

Gain Mode : Binary Gain

Record Length : Normal 5.0 seconds,
greater in deep
water

Sample Rate : 4 milliseconds

Gain Constant : 30 db

Attack Rate : 1500 db/sec.

Final Gain : 120 db

Trip : As necessary

Initial Gains : 42 db

Upper Set Limit : 62.5%

Lower Set Limit : 18.75%

Filters -

 Low cut : 8 Hz, 18 db/octave

 High cut : 62 Hz, 72 db/octave

Release Rate : Fast 94 db/sec.

Delay time for RAW Monitors
caused by displacement of
RAW and record heads : 15.0 milliseconds



Tape Channel Allocations :

<u>Function</u>	<u>Trace No.</u>	<u>System</u>	<u>Tape Channel</u>
Timing	-	both	0
Streamer Odd groups 1 - 47	1 - 24	System I	1 - 24
Streamer Even groups 2 - 48	31 - 54	System II	1 - 24
Water Break 1 (in front of 48)	30	both	31
Water Break 2 (between groups 40 and 41)	27	both	28
Water Break 3 (between groups 30 and 31)	28	both	29
Water Break 4 (between groups 20 and 21)	30	both	31
Water Break 5 (between groups 10 and 11)	26	both	27
Water Break 6 (between groups 2 and 3)	27	both	28
Field Time Break	4	System I	-
Field Time Break	34	System II	-
DFS Synthetic Time Break	8	System I	-
DFS Synthetic Time Break	36	System II	-



(E) Survey

- (i) Geo Nav (Satellite) Survey : A separate report covering the Geo Nav (satellite) Survey carried out for five lines in Otway and one line off the West Coast of Tasmania has been provided. The report also discusses the seven Bass Basin lines which were controlled by both Shoran and Geo Nav. These lines were post plotted for both systems to provide a comparison between the Geo Nav and Shoran Navigation Systems.
- (ii) Shoran Survey : Two separate reports have been provided by Offshore Navigation Inc., one covering the Bass Basin Survey and the second covering the Gippsland Survey.

Preplots and Postplots were provided by Engineering Computer Services of Sydney, Australia.

(F) Magnetometer Survey

The survey was carried out over approximately 500 line miles using a Varian Proton Magnetometer Model V-4970. The magnetometer was employed for one line off Tasmania, five lines off South Australia, and lines 1 to 5 in Gippsland. The sensor was towed 145 meters behind the Shoran Antenna to avoid any possible distortion of the data by the ship's metal hull. The depth of the sensor was approximately 30 feet.

A base magnetometer was not in operation during the survey.



SECTION III.

RECORD QUALITY :

Reflection quality throughout the prospect was generally good. Visual inspections of field records insured that recording was achieved at maximum capability of seismic instrumentation.

Within areas of the Gippsland Basin, primarily around the Marlin "A" platform, a predominate, low frequency wave trains after first energy arrivals was noted, and contributed to a near surface refraction layer possessing low velocity characteristics. No instrument changes were effective in alleviating this particular condition.

Average streamer noise level for the duration of the project was less than $10\mu v$, and 7 to $8\mu v$ not being uncommon. Average instrument noise was less than or equal to $.22\mu v$.

Respectfully submitted,
GEOPHYSICAL SERVICE INTERNATIONAL

John Bragg

John T. Kerlin
Quality Control Seismologist

APPENDIX A.KEY PERSONNEL

Operations Supervisor	C.I. Rowell
Administrator	I. Jones
Party Manager	R.L. Hart
Quality Control Seismologist	T.E. Kerlin
Instrument Engineers	J.A. Sira
	C. Pedro
Geo Nav Engineer	P. Chappell
Geo Nav Technician	R.S. Pender
Chief Airgun Mechanic	P.M. Reichle
Cableman	M. Tacticos
Captain	J.R. Bradley
ONI Survey Party Chief	D. Easterbrook
ONI Mobil Operator	G. Owen



APPENDIX B.

EQUIPMENT

M/V "R.C. DUNLAP"

Length (overall)	:	165 feet
Beam	:	36 feet
Draft	:	11 feet
Gross Tonnage (with helicopter deck)	:	475 tons
No. Shafts	:	2
Main Engines	:	2 - General Motors Diesels 1600 h.p. each
Berthing Facilities	:	30
Radar	:	Decca RM-326. Range 48 miles Raymarc. Range 48 miles
Auto Pilot		
Radio Direction Finder		
Gyrocompass	:	Sperry Rand MK-227 Geo Nav II.
Endurance	:	25 days
Radios	:	(1) Collins SSB Model MR-102. 150; 400; 1000 watts. Direct contact with KUK Dallas. (2) Simrad Radiotelephone (AM). (3) RF 6 SFB-SSB radio; 125 watts 5 Crystal Frequencies. (4) VHF RF Comm. Inc. Radiotelephone 14 channels.



- Fathometers : (1) Ross Continuous Recording Echo Sounder. 0 - 400 fathoms range.
- : (2) Simrad Look-ahead Sonar Model SB-2. Sweep - straight ahead to 30⁰ down. Azimuth 0 to 360⁰. Range approximately ½ mile.
- : (3) ELAC DNEB LAZ-17 0 - 2200 fathoms.
- Ship's Crew : 10
- Seismic Crew : 14 to 16 including 2 Geo Nav II Operators.

RECORDING EQUIPMENT

- Digital Recording Instruments : 2 sets of 24 channel Texas Instruments DFS III's (Binary Gain) with three tape transports for 48 trace recording. 2500 foot one-inch tapes, 21 tracks, TIAC tape format.
- Streamers : (1) 2400 meter, 48 traces with 10 Texas Instruments Hydrophones per trace.
- : (2) 1600 meter, 24 traces with 21 Texas Instruments Hydrophones per trace.
(Tapered array - convertible to 2400 meters):
- Six waterbreak amplifiers.
- Six depth transducers with separate meters.
- Six Condep* Fins for depth control.

Tailbuoy with radar reflector

* Trademark of Continental Oil Company



Air Compressors : Three General Motors Model G71 diesels with three Chicago P.B.-44 Compressors (2000 psi).

Texas Instruments Airgun Control Unit - Model 30. : Pressure monitors for individual airguns.

Tuned Array of Airguns (diagram attached) : Consisting of 35 guns with spares mounted on two fish for 620 or 860 cubic inch arrays.

Explosives Shooting : Radios, blasters and firing lines (capable of single boat explosives work).

Varian Marine Proton Magnetometer.

Texas Instruments Servo-writer II profiler unit providing an onboard single trace display.

SIE VR0-10 photo-oscillograph with 54 galvos - to provide field playbacks or monitors for quality control.

NAVIGATION EQUIPMENT

Geo Nav II Satellite Navigation or conventional shore based systems as required.

APPENDIX C.OPERATIONS STATISTICS

Prospect : Otway (070A), Bass (B70A),
Tasmania (T70C) and Gippsland
(G71A).

Operational Period : December 12, 1970 to
February 5, 1971

Time Spent on Prospect : 55 days

Time Spent on Recording : 40 days

Time Lost due to Bad Weather : 6 days

Time Lost due to Equipment,
Navigational Failure, and
Anchorage : 2 days

Travel between Areas : 7 days

Total Miles Shot : 2,527.34 miles



Prospect : Otway (070A)

Operational Period : December 12 and 13, 1970
February 1 to 5, 1971

Time Spent on Prospect : 7 days

Time Spent on Recording : 4 days

Time Lost due to Bad Weather : 3 days

Time Lost due to Equipment,
Navigational Failures, and
Anchorage : 0 days

Total Miles Shot : 141.47 miles

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Prospect : Bass (B70A)

Operational Period : December 16, 1970 to January 1, 1971

Time Spent on Prospect : 17 days

Time Spent on Recording : 17 days

Time Lost due to Bad Weather : 0 days

Time Lost due to Equipment,
Navigational Failure and
Anchorage : 0 days

Total Miles Shot : 1,437.00 miles



Prospect : Tasmania (T70C)

Operational Period : January 2 and 3, 1971

Time Spent on Prospect : 2 days

Time Spent on Recording : 2 days

Time Lost due to Bad Weather: 0 days

Time Lost due to Equipment,
Navigational Failure and
Anchorage : 0 days

Total Miles Shot : 46.70 miles

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Prospect : Gippsland (G71A)

Operational Period : January 7 to 28, 1971

Time Spent on Prospect : 22 days

Time Spent on Recording : 17 days

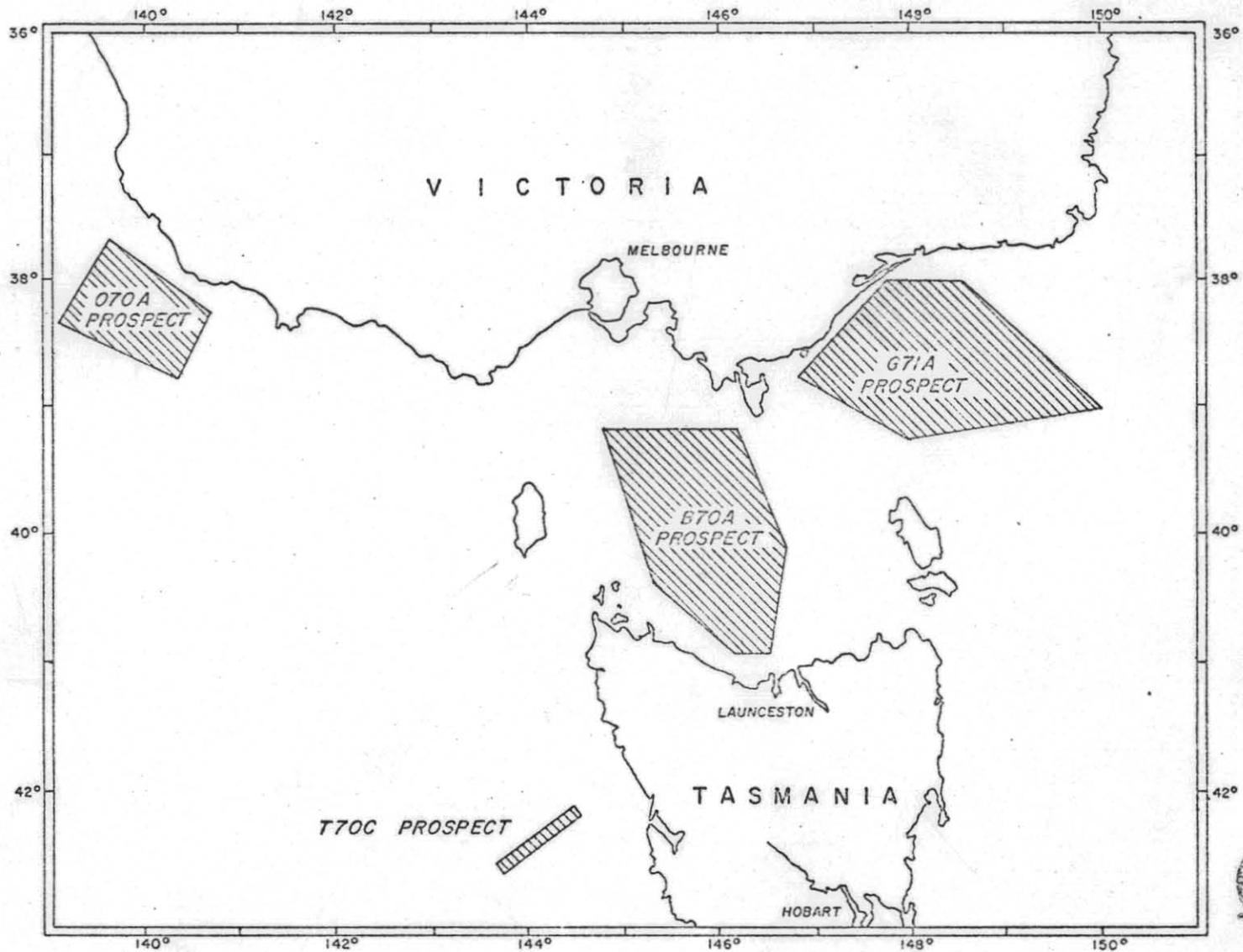
Time Lost due to Bad Weather : 3 days

Time Lost due to Equipment,
Navigational Failure and
Anchorage : 2 days

Total Miles Shot : 902.17 miles

CSI-709

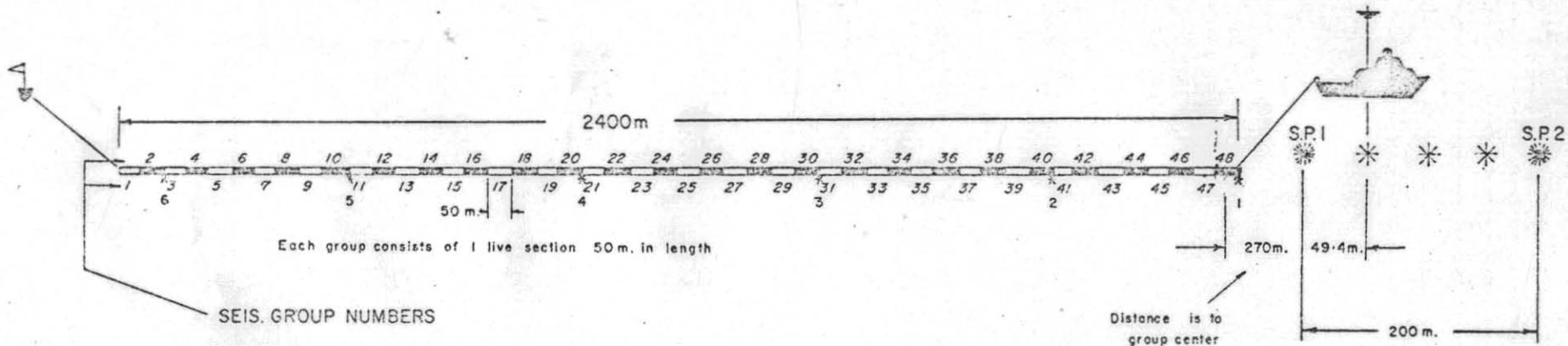
ESSO STANDARD OIL (AUSTRALIA) LTD.
1970-1971 MARINE SEISMIC SURVEY
GEOPHYSICAL SERVICE INTERNATIONAL PARTY 909



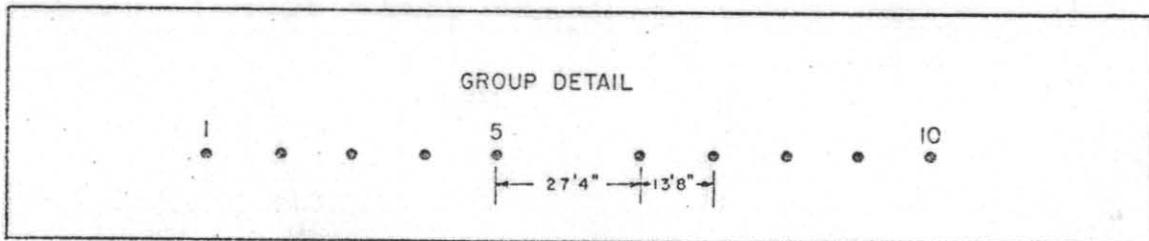
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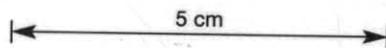
Plate 1



* STREAMER DEPTH TRANSDUCERS & WATERBREAK PHONE LOCATION



WATER BREAKS	DISPLAYED ON SEISMOGRAM TRACES	RECORDED ON TAPE CHANNELS
1	7 / 8	31
2	3 / 4	28
3	5 / 6	29
4	7 / 8	31
5	1 / 2	27
6	3 / 4	28

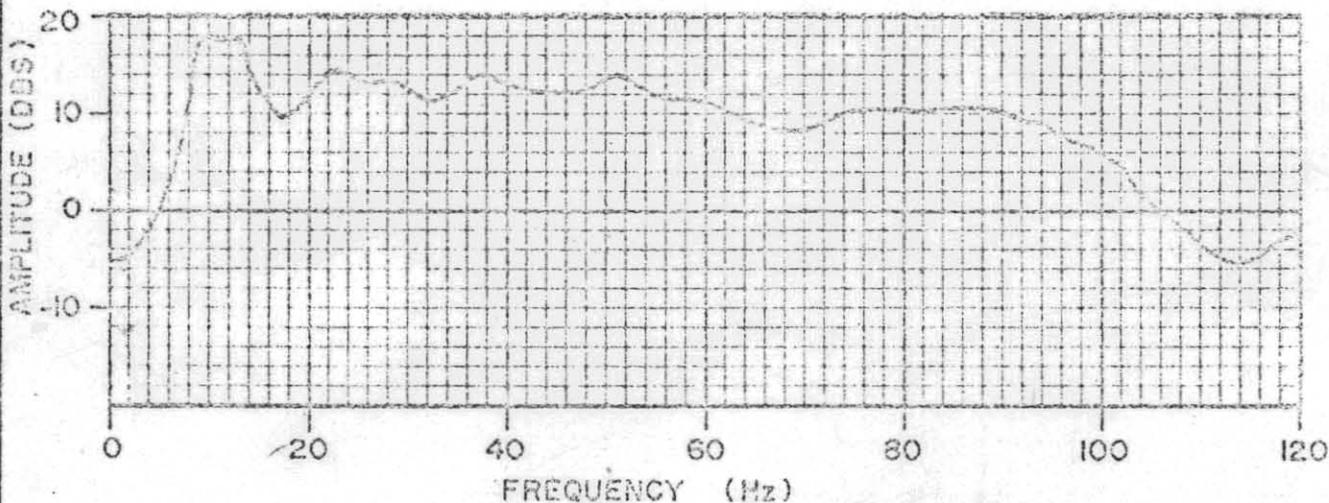
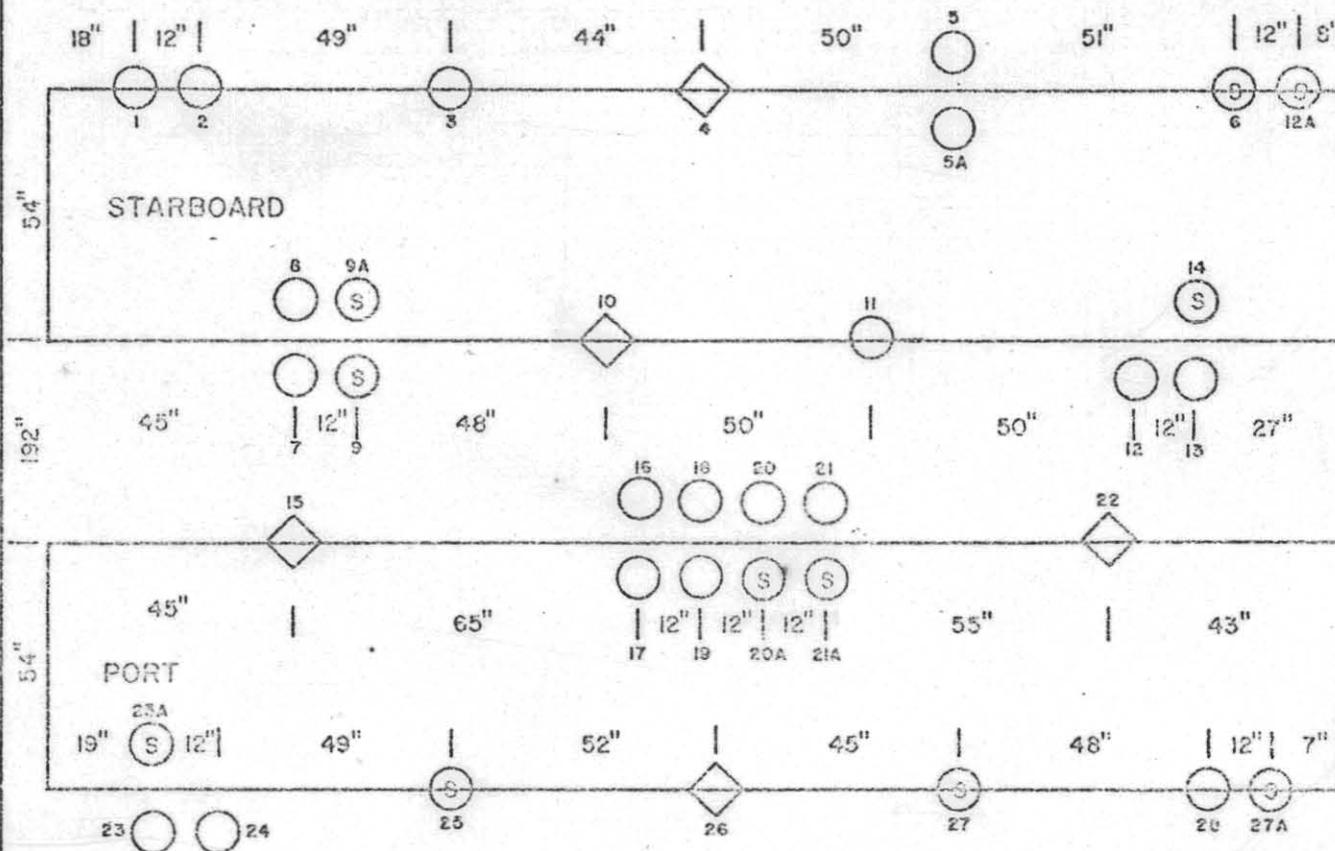


MARINE CABLE DIAGRAM
 "2400 METER"
 (OFF END SPREAD - 48 GROUPS)
 GSI Party 909
 Ship M/V R.C. DUNLAP
 Client ESSO STANDARD OIL
 Area AUSTRALIA
 Date DEC 1970 - FEB 1971

056022



○ = 40 cu ins □ = 20 cu ins S = Spare Gun



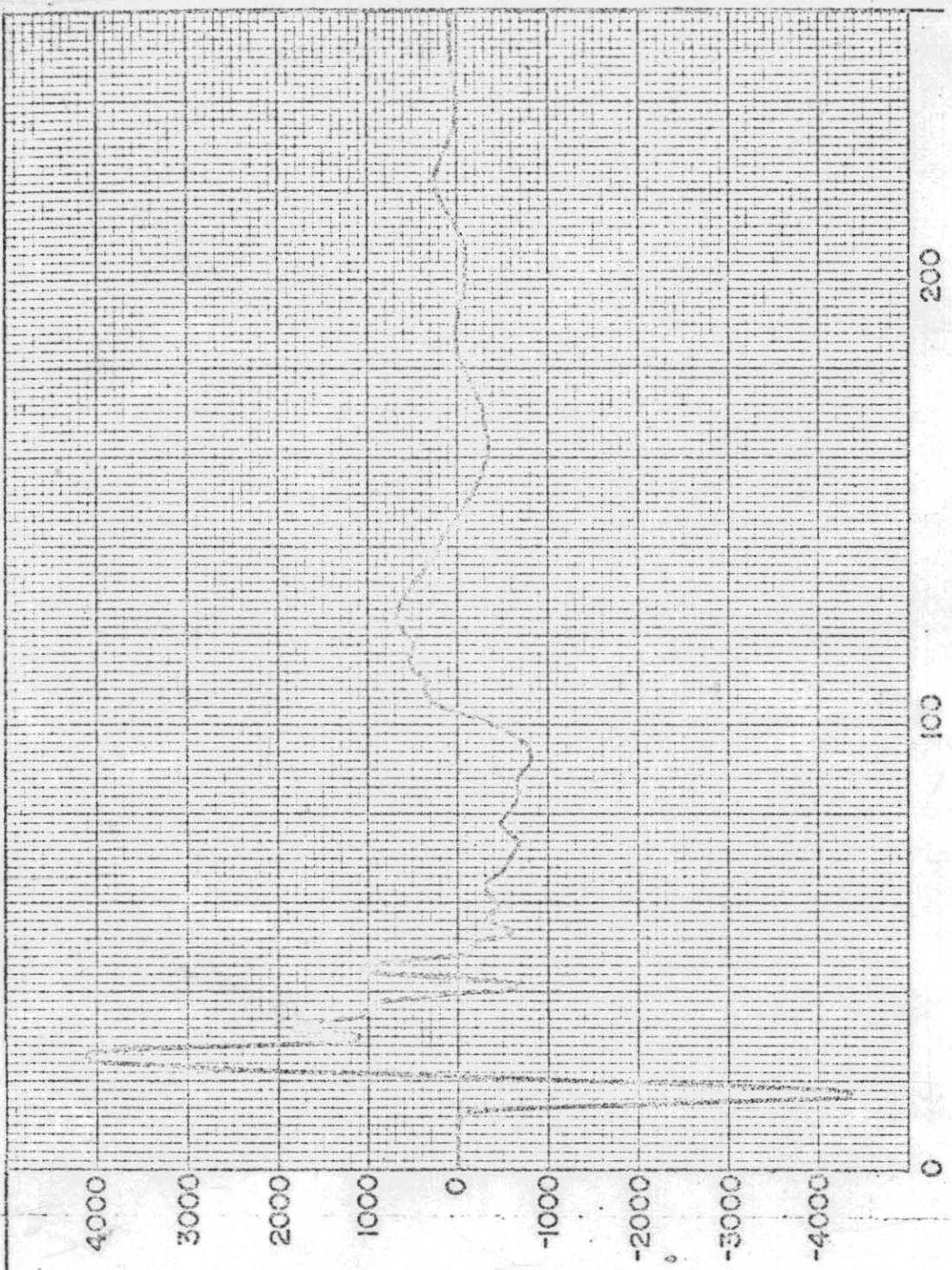
- 1 - 240 in
- 5 - 80 in
- 3 - 40 in
- 5 - 20 in

M/V R.C. DUNLAP

860 cu. in. AIRGUN ARRAY
&
SPECTRUM

Date: Sept 1970

056024



MILLIVOLTS

200

MILLISECONDS

100

0

4000

3000

2000

1000

0

-1000

-2000

-3000

-4000

1 - 240 in
 5 - 80 in
 3 - 40 in
 5 - 20 in

M/V R.C. DUNLAP

PULSE FOR 860 cu in

AIRGUN ARRAY

Date: Sept 1970

Plate 3a

GSI-709