

*Tasmania Inc Dept*

Bass Basin part XIII

FINAL REPORT  
 OFFSHORE NAVIGATION, INC.  
 PROJECT 507

for

GEOPHYSICAL SERVICE INTERNATIONAL  
 ESSO STANDARD OIL (AUSTRALIA) LIMITED

BASS STRAIT AUSTRALIA  
 DECEMBER 1971 - JANUARY 1972

B71A SEISMIC SURVEY

*OR-013 (VOL. 1.)*



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GEOPHYSICAL SERVICE INTERNATIONAL  
PARTY 909

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A B S T R A C T

Project 507 was a Shoran positioned and controlled marine seismic survey for potential mineral deposits in the Bass Strait off the southern coast of Victoria and the northern coast of Tasmania, Australia.

The principal was ESSO Standard Oil (Australia) Limited (ESSO)..

Geophysical Service International (GSI) was the prime contractor and operator.

Offshore Navigation, Inc. (ONI) employed a Shoran radiolocation system to provide horizontal control for the survey.

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I. THE SHORAN RADIOPOSITIONING SYSTEM

The Shoran system is a radar transponder type of radio-positioning system. The Shoran mobile station equipment measures the distance from its location to those of two fixed ground beacon stations. The position of the mobile unit is thus fixed at the intersection of the two circular distance or range arcs so determined. The position of the ground beacon stations or base stations is normally accurately known, so that the corresponding position of the mobile station can be accurately computed or determined by graphical methods. Should the position coordinates of the base stations not be accurately known, the mobile station may still be positioned relative to the baseline determined by the base station locations.

The Shoran mobile unit measures the distance <sup>from each of</sup> of the two base stations by measuring the time required for pulses of radio signals to travel from the mobile station to each base station and return. The time intervals so measured are related to the corresponding distances by using the highly constant velocity characteristic of radio waves in air through the simple relationship:

Total distance covered = Elapsed time x velocity.

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

Because of this relationship, it is possible to graduate the indicating dials in the mobile unit in terms of distance rather than elapsed time. For example, using radio waves which have a velocity of approximately 186,000 miles per second, the scale of the time-interval measuring system is graduated so that when the time interval required for a round trip of the signal is 1/1000 second, the scale reads 93 miles. (The total distance traveled by the radio signals in 1/1000 second is 186 miles. Since this is round trip distance, it must be halved to obtain the distance between mobile and base stations.) The Shoran dials are graduated in terms of statute miles rather than nautical miles.

The basic equipment units used to create the round trip signals paths originating and terminating at the mobile station are shown in Figure 1. This equipment consists of a signal source (labeled pulse generator in Figure 1), a transmitter, receiver and indicator unit comprising the mobile station, and a receiver coupled to a transmitter at each base station.

MOBILE STATION

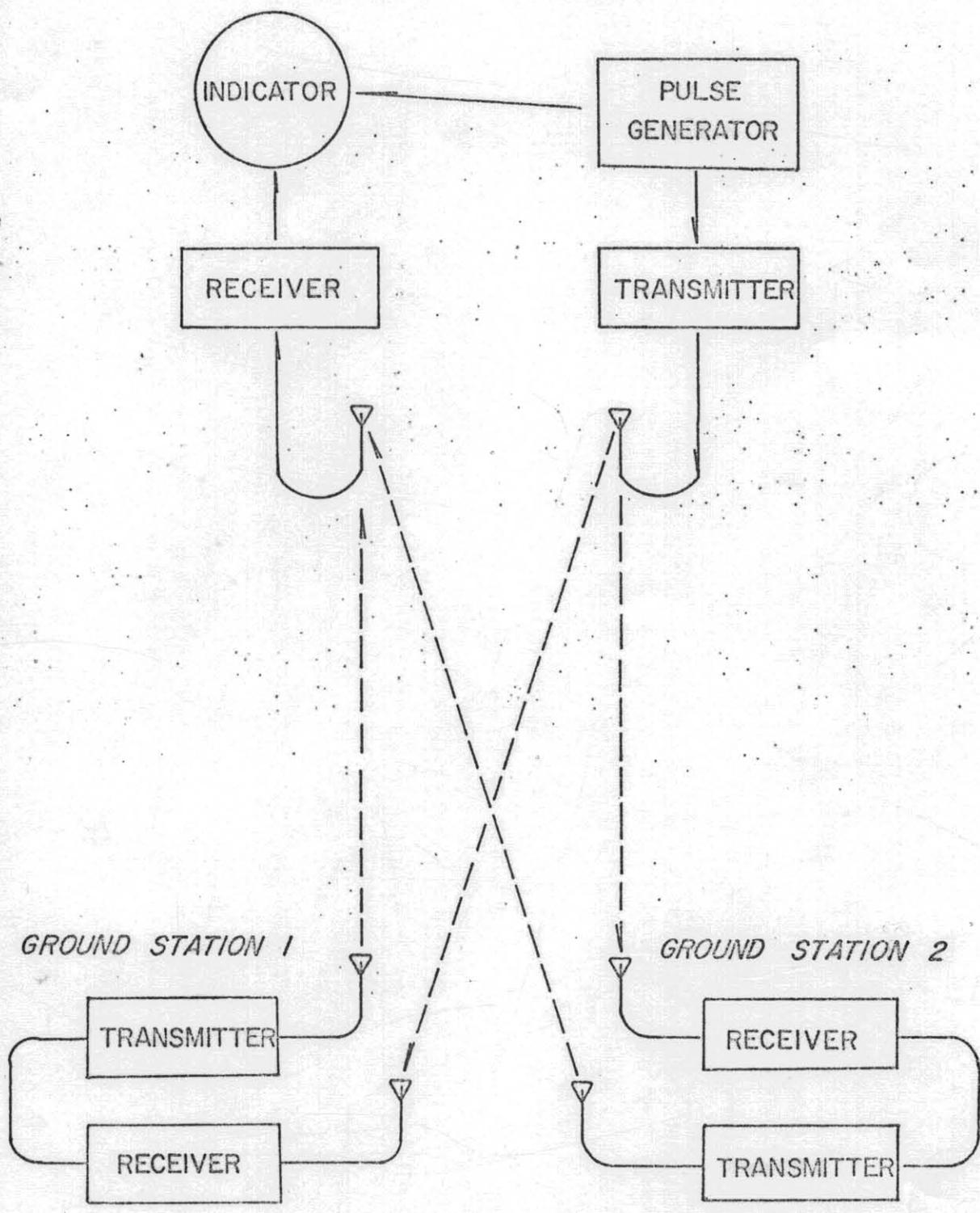


FIGURE 1  
SIMPLIFIED BLOCK DIAGRAM OF BASIC RADIO  
EQUIPMENT OF A SHORAN SYSTEM

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

Pulse signals originating at the mobile station are radiated from the mobile transmitter and received by one of the base stations. At this base station, the pulse is sent from the output of the receiver to the input of the transmitter, and is then retransmitted back to the mobile station. After passing through the mobile receiver, the pulse is routed to an indicating circuit where its time lag, or lapse, with respect to the original outgoing pulse is determined, and indicated in terms of distance rather than units of time.

Other pulses are transmitted to the second base station, using a different radio frequency to permit their discrimination from those intended for the first base station. These pulses are received and retransmitted by the second base station, and on their return to the mobile station are similarly sent through the indicating circuits for measurement of the time required for their round trip and the indication of corresponding distance. Thus, the equipment provides continuous, essentially simultaneous, indications of the distances to both base stations.

The Shoran system operates in the VHF/UHF portion of the

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

radio spectrum. Normally, three separate frequencies are used. Two of these are transmitted alternately by the mobile station to interrogate each base station in turn, as previously described. The third frequency is utilized by the base stations to retransmit the received pulses back to the mobile station. Both base stations transmit on the single frequency in order to utilize a single receiver at the mobile station.

The propagation characteristics of VHF/UHF radio signals is such that they tend to travel in straight lines. While they are refracted in the atmosphere to some small extent, they do not tend to follow the earth's curvature as do radio signals of considerable lower frequency. They lack the ability to "see" beyond the radio horizon. Thus the Shoran system is essentially a "line of sight" system, with the maximum range being limited, to a large extent, by the heights of the mobile and base station antennas.

The range of the system under particular conditions may be estimated from the relationship

$$d = k (\sqrt{h_1} + \sqrt{h_2})$$

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

where,

- d = estimated maximum range, in miles  
h<sub>1</sub> = height of mobile station antenna, in feet, above sea level  
h<sub>2</sub> = height of base station antenna, in feet, above sea level  
k = empirical range factor

The factor, k, depends upon several factors among which are included antenna gain, receiver sensitivity, transmitter power and atmospheric refractive index. It will vary in value from 1.5 to 2.5, under normally encountered conditions.

The range formula presumes no obstructions between mobile and base stations. The presence of intervening hills or other obstructions can reduce the otherwise obtainable range.

Under certain conditions, abnormally long Shoran ranges can be obtained by exploiting the existence of an atmospheric phenomenon known as a temperature inversion layer. This is a layer of high refractive index occurring with the first few thousand feet of the atmosphere. It has the effect of confining the radio waves near the earth's

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

surface, and acts as a duct to bend radio waves around the curvature of the earth. Under these conditions the factor,  $k$ , may be several times greater than normal. In some marine areas of the world, this phenomenon occurs quite regularly during certain seasons.

The instrumental accuracy of the Shoran equipment, when properly calibrated, is  $\pm 50-75$  feet on a single range. The overall position accuracy is related to the range accuracy by the angle of intersection, at the mobile station, between the two Shoran range circles. This is illustrated in Figure 2. In normal geophysical operations, this angle of intersection is held between 30 and 150 degrees. Refer to Appendix A for examples of areas of coverage for different angles of intersection of the Shoran range circles.

The range accuracy of the Shoran system can be improved, possibly by a factor of 2, by correcting the propagation velocity slightly under varying meteorological conditions, and by the application of more rigid calibration and operating specifications. For most operations, this

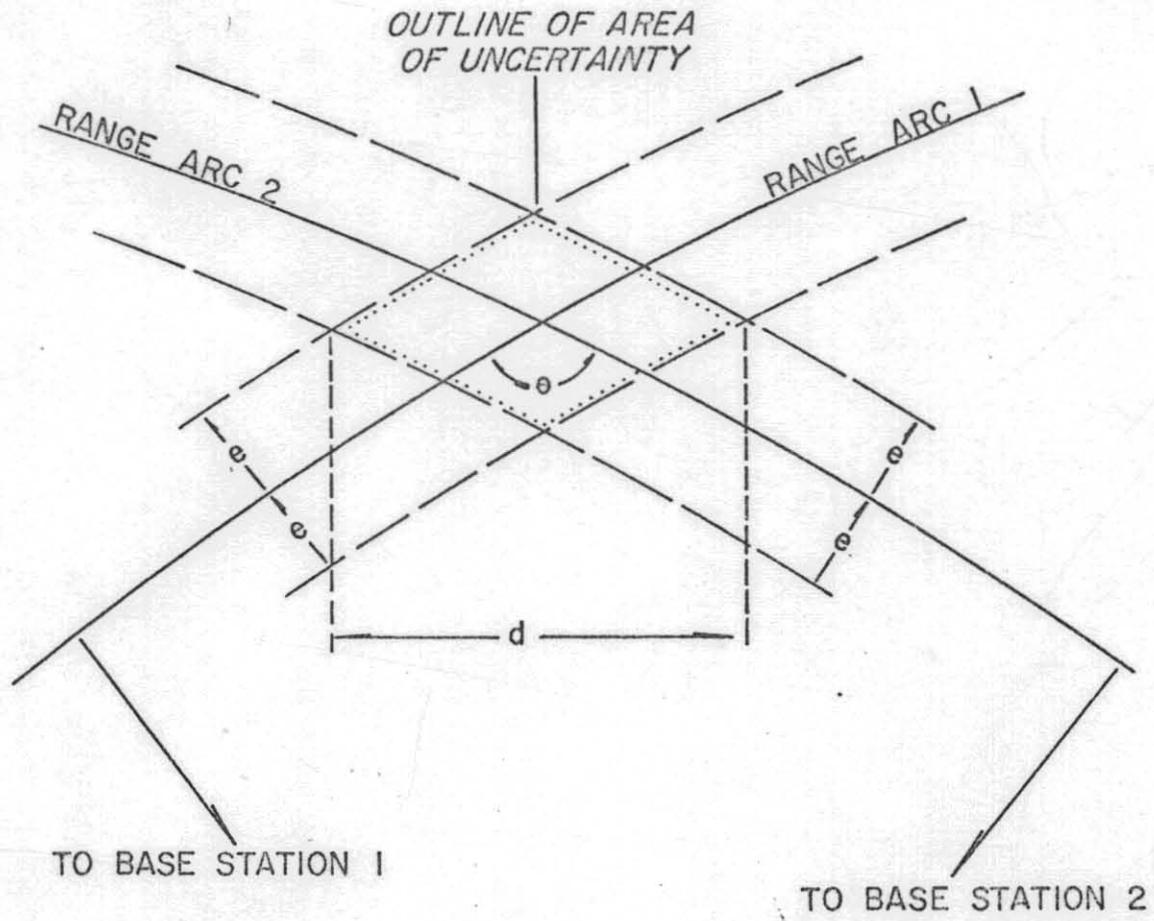
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I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

additional accuracy cannot be economically justified.

In computing (or determining graphically) the position from a pair of Shoran ranges, cognizance must be maintained that a position ambiguity may exist. Each pair of ranges (one to each base station) actually determines two independent positions, one on each side of the Shoran baseline, as illustrated in Figure 3. One position is the "mirror image," so to speak, of the other. Further, the Shoran mileage dials repeat every 100 miles of range. To eliminate this ambiguity one must know, from other means, the correct side of the baseline and the distance to each base station within the proper multiple of 100 miles.



$$d = \frac{2e}{\sin \frac{\theta}{2}} \text{ where}$$

$e$  = RANGE ERROR

$\theta$  = INTERSECTION ANGLE OF RANGE CIRCLES

5 cm

FIGURE 2

AREA OF UNCERTAINTY OF POSITION  
DUE TO ERROR IN RANGE MEASUREMENT

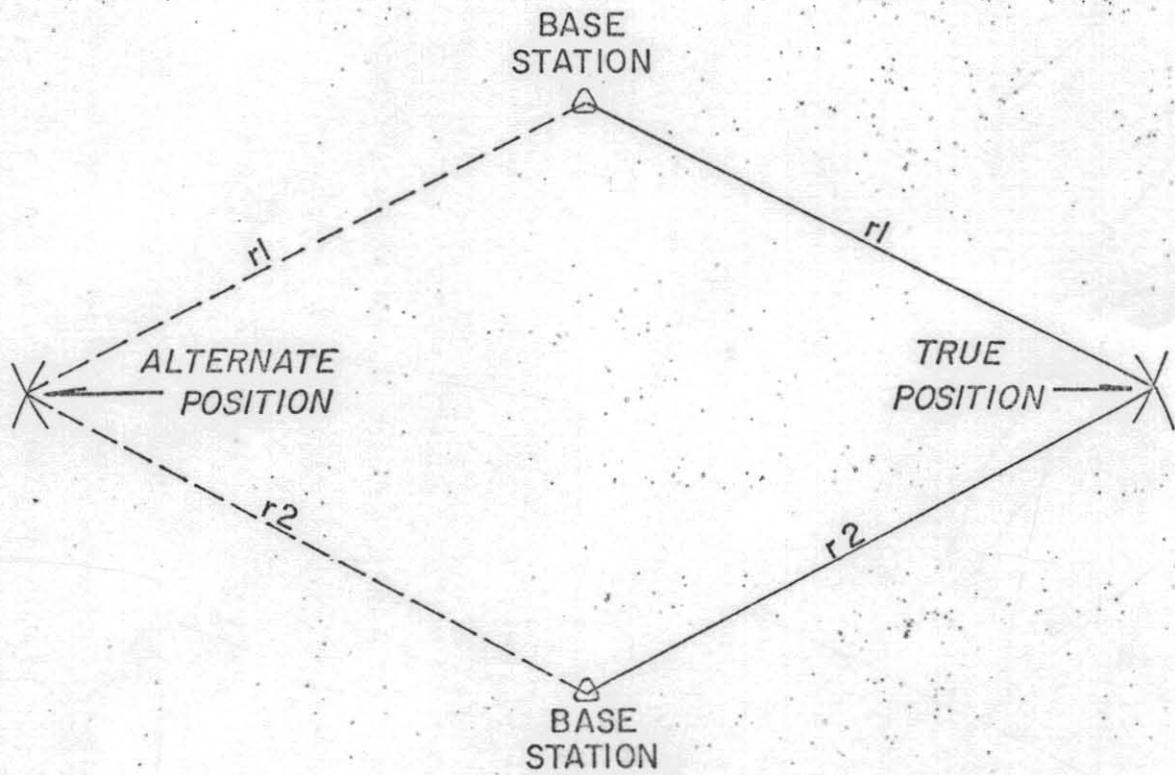
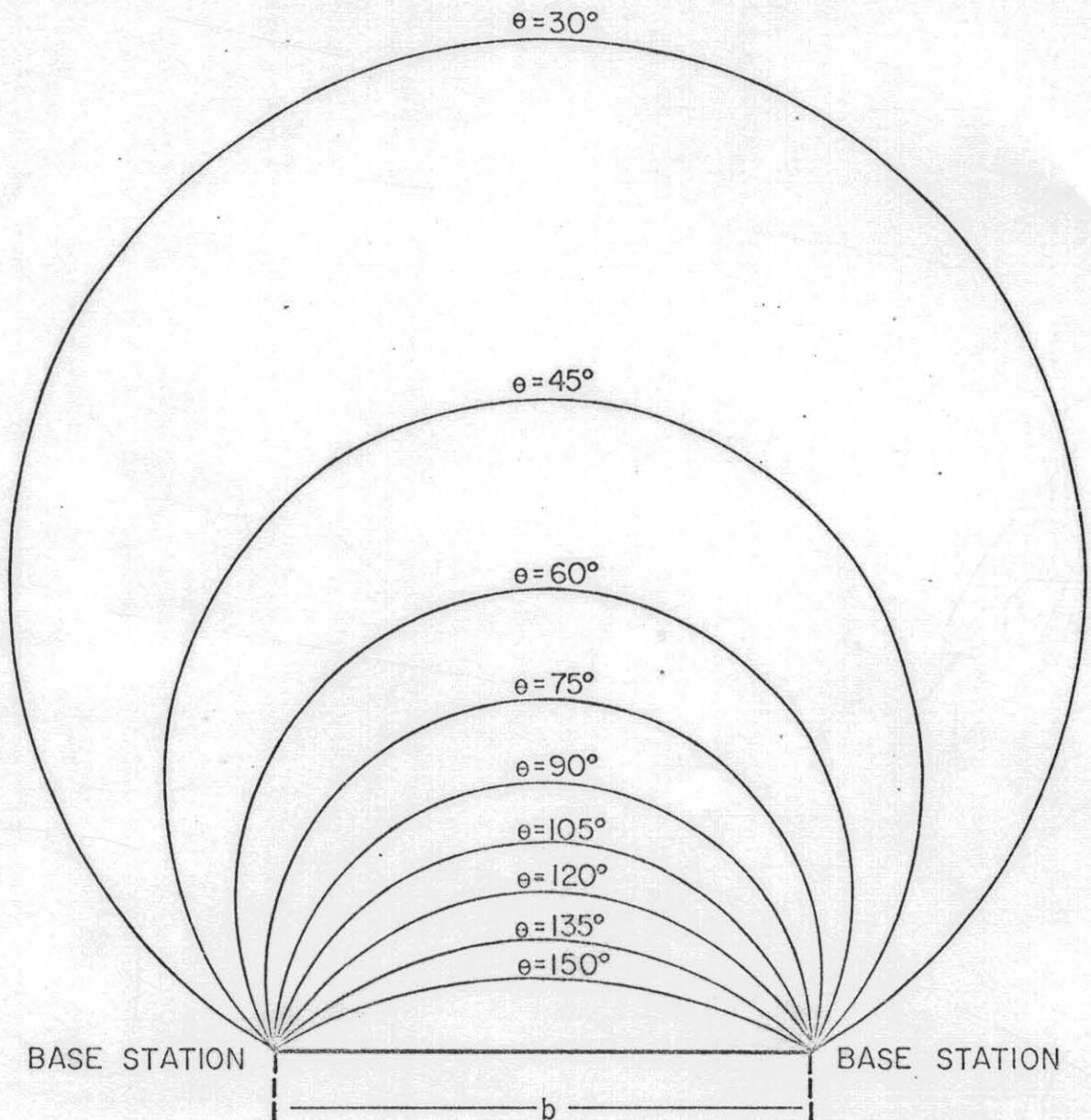


FIGURE 3

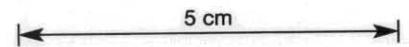
POSITION AMBIGUITY IN CIRCULAR RANGE  
SYSTEM



ALL ARCS ARE PORTIONS OF CIRCLES THROUGH BASE STATION POSITIONS OF RADIUS GIVEN BY

$$r = \frac{b}{2 \sin \theta}$$

WHERE  $\theta$  IS ANGLE OF INTERSECTION BETWEEN RANGE CIRCLES



## RELATIVE AREA OF COVERAGE CIRCULAR RANGING SYSTEM

## II. AREA OF OPERATIONS

The program area was located in the Bass Strait southeast from Melbourn, Victoria and north of Tasmania, Australia. The work area extended approximately 160 miles off the coast.

The ONI base of operation for this survey was established at Devonport, Tasmania 6 December 1971. From this location, radiocommunications were maintained with the recording vessel and Shoran base stations throughout the survey period.

## III. FIELD OPERATIONS RECAP

This operation was conducted immediately following a survey in an adjacent area, and the initial Shoran base station installations were begun as the previous survey was being completed. The two initial base station installations were completed 5 December 1971 and were operational 6 December 1971.

The recording vessel, M/V R.C. DUNLAP, was previously

III. FIELD OPERATIONS RECAP (continued)

equipped with a Shoran mobile indicating unit. The vessel arrived in the survey area 5 December 1971 from Gippsland area and began geophysical operations 6 December 1971.

The third Shoran base station was installed and operational 7 December 1971 and remained operational until 11 December 1971 when it was moved from Waterhouse, Tasmania to the fourth site occupied to control this survey at Cape Schank, Victoria.

Geophysical operations were interrupted several times due to adverse weather conditions. Operations continued until 9 January 1972 when the final Shoran readings were observed.

The Shoran base stations were dismantled 9 January 1972 and transported to Melbourn, Victoria. The M/V R.C. DUNLAP departed on this date for the next prospect area in the Otway Basin. From Melbourne, two of the Shoran base station installations were transported to the next prospect area and the third Shoran base

III. FIELD OPERATIONS RECAP (continued)

was returned to the ONI Sydney, Australia warehouse.

The ONI base of operations was closed 8 January 1972.

All ONI personnel were retained for further operations to be conducted under GSI control.

Geophysical operations were temporarily discontinued 26 December 1971 to 29 December, and also 8 January 1972 and 9 January 1972 while the M/V R.C. DUNLAP was transferred to operations for Hematite Petroleum Limited using the same Shoran base station sites for horizontal control.

IV. GENERAL INFORMATION

## A. Shoran frequencies used were:

Mobile Transmitter	230/250 Mhz
Base Transmitter	300 Mhz

B. Satisfactory radiotelephone communications between all Shoran installations were maintained on the frequency of 4637.5 kilocycles.

C. The Shoran field data was turned over to Mr. I. Jones, GSI representative, periodically during the survey period.

D. Three Shoran base station installations were provided by ONI for this survey.

D. Four Shoran base station sites were occupied during this operation. They were:

STATION CAPE SCHANK

STATION MOUNT OBERON

STATION WALKERS LOOKOUT

STATION WATERHOUSE CAPE (OFFSET)

IV. GENERAL INFORMATION (continued)

F. Maximum Shoran range observed during the survey was 160 miles.

G. In addition to the standard Shoran system, Range Extension (XR) equipment was provided by ONI for this survey. The XR components provided consisted primarily of improved antenna system, transmission lines, receivers, signal processing and power system. All stations were also provided with a solid state pre-amplifier.

H. Shoran base station equipment was checked for proper calibration prior to its departure from New Orleans, Louisiana by use of a Range Calibration from a surveyed site at the ONI New Orleans office and a site located on the new municipal water tower in Mandeville, Louisiana. The base station equipment was adjusted to read the computed range of 29.893 miles.

IV. GENERAL INFORMATION (continued)

- I. The Shoran mobile indicating unit was checked daily during the operation for proper zero set.
- J. ONI provided the following peripheral equipment for this survey:
- Pulse Follower
  - Digital Printer
  - Digital Track Plotter
  - Dual Antenna System
- K. No operational time was lost due to Shoran equipment malfunction during this survey period.

V. MAPPING

Prior to the commencement of the field operations, machine computed Shoran preplots indicating the Shoran and grid coordinates of each shotpoint location to be occupied to control this survey, were provided by GSI, Sydney, Australia.

No final mapping of this survey was accomplished by ONI. All Shoran field data was turned over to Mr. I. Jones, GSI representative, periodically during the survey period.

VI. BASIC CONTROL

The following Shoran base stations, along with their coordinates, were occupied to control this survey.

Universal Transverse Mercator Projection  
 Australian National Spheroid  
 Zone 55  
 Central Meridian 147° East

STATION CAPE SCHANK:

Latitude	38°27'43"77 S	N = 5,740,804 meters
Longitude	144°54'03"42 E	E = 316,862 meters
Elevation	157 meters	

STATION MOUNT OBERON:

Latitude	39°02'30"59 S	N = 5,678,362 meters ✓
Longitude	146°20'36"80 E	E = 443,190 meters
Elevation	564 meters ? 4,507	

STATION WALKERS LOOKOUT:

Latitude	40°03'27"53 S	N = 5,565,271 meters ✓
Longitude	148°04'46"40 E	E = 592,074 meters
Elevation	414 meters ✓	

STATION WATERHOUSE CAPE (OFFSET):

Latitude	40°52'02"92 S	N = 5,475,748 meters
Longitude	147°37'43"05 E	E = 552,974 meters
Elevation	118 meters	

VII. SHORAN BASELINE MEASUREMENTS

The following Shoran Baseline Measurements were observed during this survey period:

Stations Mount Oberon/Cape Schank Baseline:

Observed range = 87.597 miles

Station Mount Oberon/Walkers Lookout Baseline:

Observed range = 116.217 miles

VIII. PERSONNEL

NAME	POSITION
Esterbrook, I.	Party Chief
Carney, P.	Mobile Operator
Jarvis, J.	Mobile Operator
MacLean, A.	Base Operator
O'Reilly, J.	Base Operator
Rolfe-Smith, G.	Base Operator

IX. DISTRIBUTION

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 AUSTRALIA

One copy

STATION: CAPE SCHANK

LOCATED: Station Cape Schank is located on the southeastern end of Mornington Peninsula, Victoria, Australia.

ACCESS: From the township of Rosebud on the Mornington Peninsula, take the road south which is sign-posted "Cape Schank, Flinders". After 8 miles there is a signpost on the left marked "Cape Schank". Four-hundred yards before this turnoff, there is a dirt road on the right leading past a farmhouse. Follow this track for 200 yards until reaching a fence and then turn left. The trig site is 200 yards further and can be seen from this point.

MARKER: The trig marker is a standard 10 foot steel tripod.

ELEVATION: 157 meters

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		UTM PROJ., AUST. NAT. SPHEROID ZONE 55, C.M. 147° EAST	
Latitude	Longitude	North	East
38°27'43".77 S	144°54'03".42 E	5,740,804 meters	316,862 meters



STATION: MOUNT OBERON

LOCATED: On the southern end of Wilson Promontroy, Victoria, Australia.

ACCESS: Travel south from Foster, Victoria to the Wilsons Promontory National Park Reserve, heading for the township of Tidal River. Approximately 40 miles from Foster, proceed past the turnoff to Tidal River on your right. After one and a half miles, there is a car park and a P.M.G. gate on the right. This road leads to P.M.G. microwave station on Mount Oberon. The trig site and summit are 200 yards further up a dirt track.

The P.M.G. road is well drained and in good condition to drive a truck as far as the P.M.G. compound.

MARKER: The trig marker is a 4 inch diameter brass disc cemented in the rock at the highest point.

GENERAL: Permission to occupy this station must be in the form of a written permit from the Victorian National Parks head office in Melbourne and must be held by the base operator to be shown on demand of any local ranger in the area.

The key required to open the gate to the P.M.G. road (and repeater enclosure) is obtainable from the Superintendent Technician for the P.M.G. at Foster, Mr. Tom Lambert. (If after hours, he lives in Foster and number is in the phone book.) Permission should be asked to retain the key for the duration of occupancy to store oil and petrol in the wire enclosure and use of the water tank on the mountain.

The equipment must be carried 200 yards to the summit and station site and requires six men

STATION: MOUNT OBERON (continued)

for about three hours to set the station. A 10 foot top tower section only is necessary for good signals.

The station site must be left immaculately clean during the after occupancy and inspected by the local ranger before it is left.

ELEVATION: 564 meters

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		UTM PROJ., AUST. NAT. SPHEROID ZONE 55, C.M. 147° EAST	
Latitude	Longitude	North	East
39°02'30"59 S	146°20'36"80 E	5,678,362 meters	443,190 meters

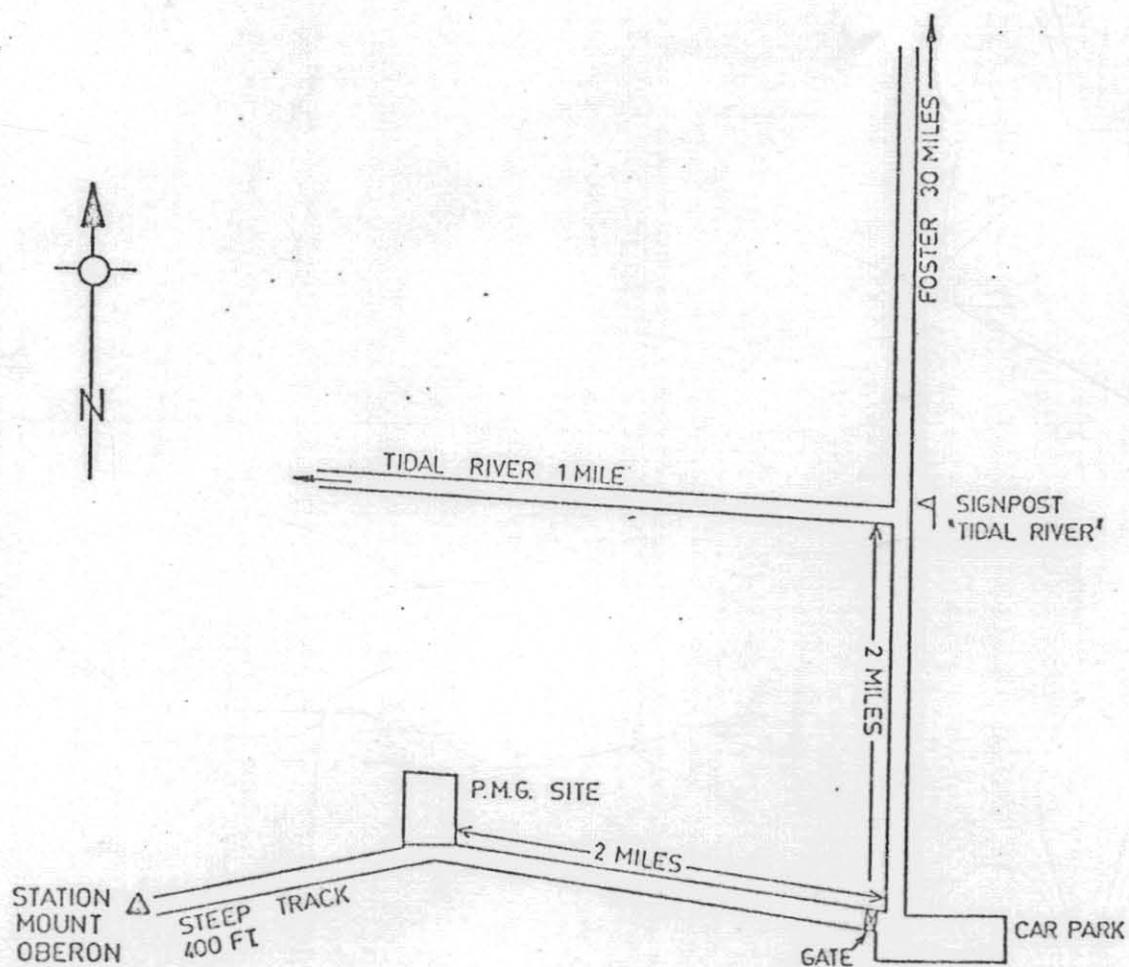
# STATION MOUNT OBERON - AUSTRALIA

LAT.  $39^{\circ} 02' 30'' \cdot 59$  S N. 5, 678, 362 METERS

LONG.  $146^{\circ} 20' 36'' \cdot 80$  E E. 443, 190 METERS

ELEV. 564 METERS

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, AUSTRALIAN NATIONAL SPHEROID  
ZONE 55 CENTRAL MERIDIAN  $147^{\circ}$  E



STATION: WALKERS LOOKOUT

LOCATED: Station Walkers Lookout is located in the central region of Flinders Island in the Bass Strait, Australia.

ACCESS: Equipment must be flown to Whitemark Airport from Victoria or Tasmania. Follow the road from the airport to Whitemark until Memana turnoff is reached. Follow the turnoff until a dirt road is seen on the right about two miles from the turnoff. Follow this road to the top of the hill and trig point, a distance of three miles.

MARKER: A wooden post with a four-gallon drum on top. There are two T.V. towers beside the trig marker.

GENERAL: Mr. Walker, a contractor in Whitemark, is available to transport equipment. Water and supplies must be carried from Whitemark.

ELEVATION: 414 meters

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		UTM PROJ., AUST. NAT. SPHEROID ZONE 55, C.M. 147° EAST	
Latitude	Longitude	North	East
40°03'27"53 S	148°04'46"40 E	5,565,271 meters	592,074 meters

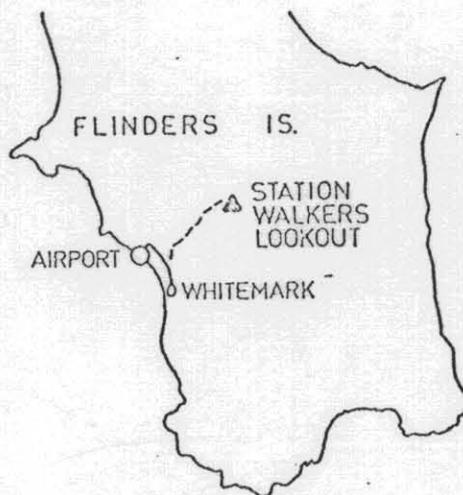
# STATION WALKERS LOOKOUT - AUSTRALIA

LAT.  $40^{\circ} 03' 27'' \cdot 53$  S N. 5,565,271 METERS

LONG.  $148^{\circ} 04' 46'' \cdot 40$  E E. 592,074 METERS

ELEV. 414 METERS

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, AUSTRALIAN NATIONAL SPHEROID  
ZONE 55 CENTRAL MERIDIAN  $147^{\circ}$  E



BASS  
STRAIT

**STATION:** WATERHOUSE CAPE (OFFSET)

**LOCATED:** Station Waterhouse Cape (Offset) is located on the northwest coast of Tasmania, Australia.

**ACCESS:** From Scottsdale, on the road to Bridport, turn right at the "T" junction 1 mile from Bridport. Approximately 14 miles along this road, after crossing a bridge, there is a dirt road on the left signposted "Waterhouse". Follow this road past the farmhouse on the left to the top of the hill on which is a 300 foot P.M.G. tower.

The trig marker is located outside the southeast corner of the P.M.G. compound fence. A power pole with a large transformer is close to the marker.

**MARKER:** The Shoran tower must be OFFSET 90 feet at  $025^\circ$  from the trig marker due to the danger of the tower striking the nearby high voltage power line.

The tower jib-pole was connected to the base of the power pole for lifting the tower which was laid out in a westerly direction.

**GENERAL:** Permission to occupy this site must be obtained from the P.M.G. Department in Launchston, Tasmania.

**ELEVATION:** 118 meters

**SKETCH:** See next page.

GEOGRAPHICAL COORDINATES		UTM PROJ., AUST. NAT. SPHEROID ZONE 55. C.M. $147^\circ$ EAST	
Latitude	Longitude	North	East
$40^\circ 52' 02''.92$ S	$147^\circ 37' 43''.05$ E	5,475,748 meters	552,974 meters

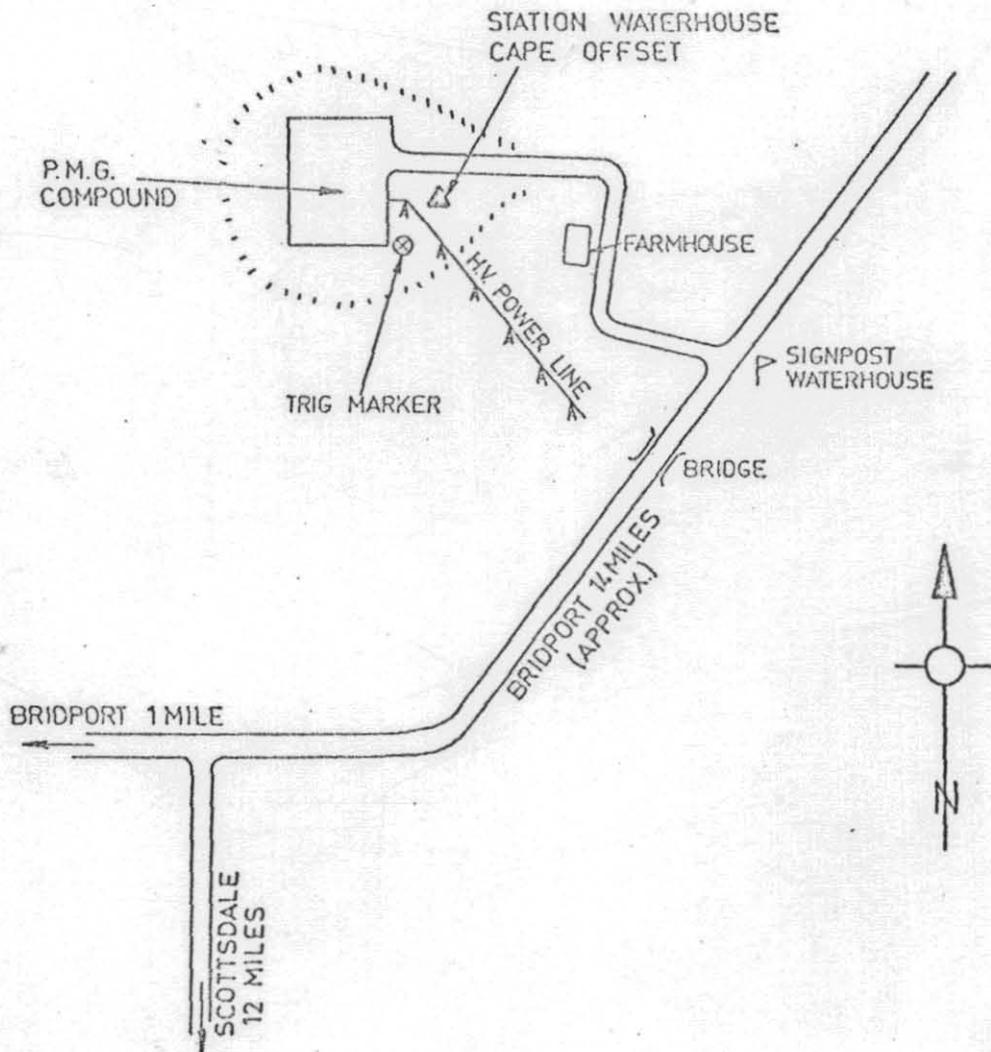
# STATION WATERHOUSE CAPE OFFSET - AUSTRALIA

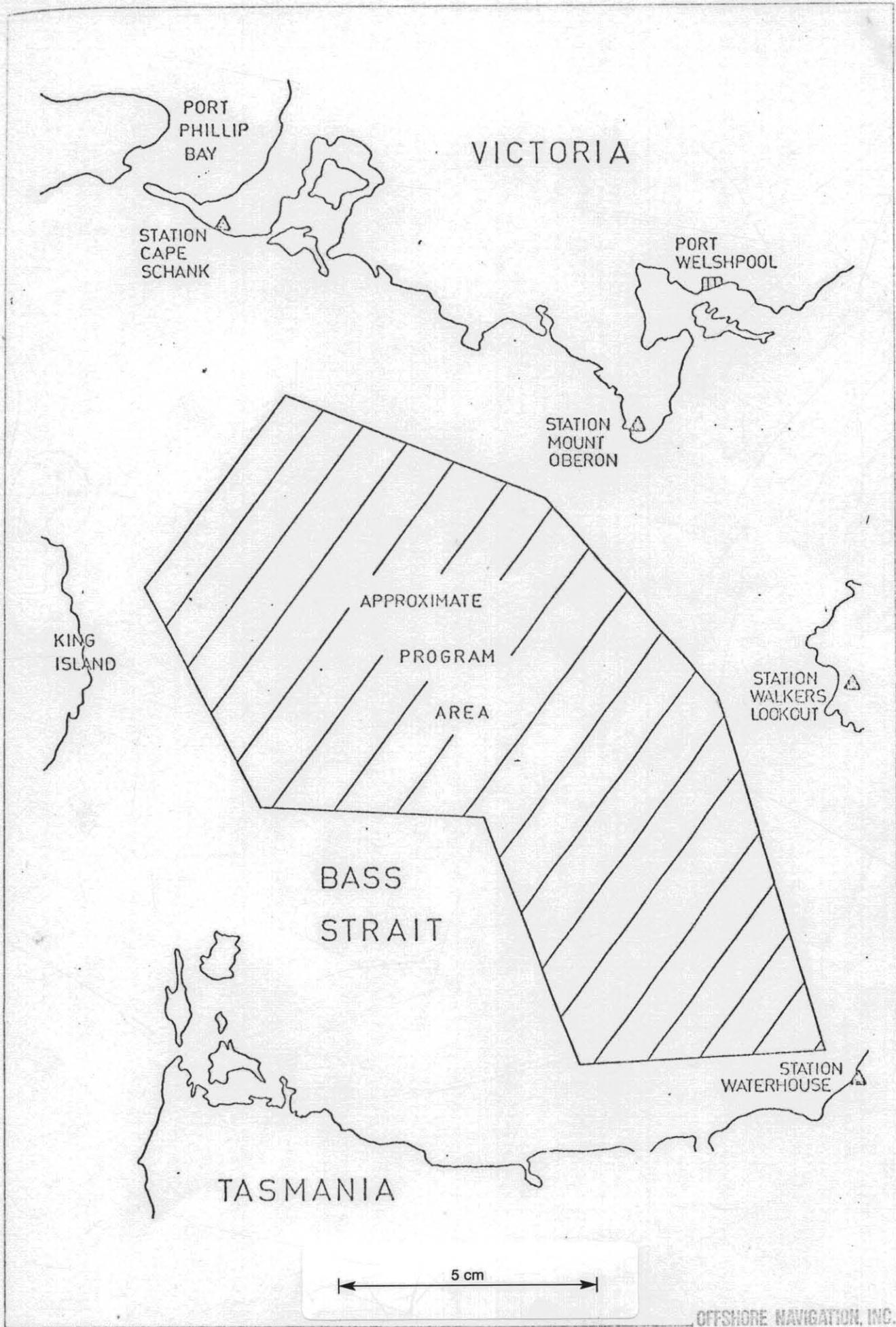
LAT.  $40^{\circ} 52' 02''.92$  S N. 5,475,748 METERS

LONG.  $147^{\circ} 37' 43''.05$  E E. 552,974 METERS

ELEV. 118 METERS

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, AUSTRALIAN NATIONAL SPHEROID  
ZONE 55 CENTRAL MERIDIAN  $147^{\circ}$  E





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Bass Basin part XIII

OPERATIONS REPORT  
MARINE SEISMIC SURVEY  
SOUTH AUSTRALIA, VICTORIA AND TASMANIA, /  
(072A, G71B, B71A)

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OR-013

057037



OPERATIONS REPORT  
MARINE SEISMIC SURVEY  
SOUTH AUSTRALIA, VICTORIA AND TASMANIA, AUSTRALIA  
(072A, G71B, B71A)

FOR

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Operations Supervisor : J. Quisenberry  
Quality Control Seismologist : A. Chan

November 26th, 1971 - January 20th, 1972



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5	AIRGUN ARRAY (590 CUBIC INCH)
6	PULSE AND AMPLITUDE SPECTRUM (1300 CUBIC INCH)



## 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 Australia Limited, between November 26th, 1971 and January 20th, 1972. (Plate 1.)

Approximately 1850 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 (a tuned array of airguns). A further 260 miles of 12-fold reflection coverage were recorded using a 600 meter, 24 live group streamer.

All 24-fold 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. The 12-fold data, however, utilized only the one DFS III system. Record length was 5.0 seconds with a sample rate of 4 milliseconds except on the 12-fold data where a record length of 4.0 seconds, sampled every 2 milliseconds, was employed.

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

Adverse weather conditions were encountered in the Bass Basin project which hindered overall operations, and in a few instances, forced a complete shutdown until more favourable conditions prevailed.

\* Trademark of Texas Instruments Inc.



## 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 LV-17B/L (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 draught. The zero line for the ELAC fathometer fathograms was corrected for the ship's draught.

#### (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 G.S.I.'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 was 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.

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 was 30 feet and were operated at a pressure of 2000 lbs. per square inch. The individual airguns were arranged to produce a 1300 cubic inch array. This array consisted of :

- i) 1 x 400 cubic inch array; using  
4 x 100 cubic inch guns.
- ii) 1 x 240 cubic inch array; using  
2 x 100 cubic inch guns, plus  
1 x 40 cubic inch gun.
- iii) 2 x 120 cubic inch array; using  
1 x 100 cubic inch guns, plus  
1 x 20 cubic inch gun.
- iv) 2 x 80 cubic inch array; using  
1 x 80 cubic inch gun.
- v) 4 x 40 cubic inch array; using  
1 x 40 cubic inch gun.
- vi) 4 x 20 cubic inch array; using  
1 x 20 cubic inch gun.
- vii) 2 x 10 cubic inch array; using  
1 x 10 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 4.)



\* Time break recorded from geophones  
strapped to Gun hoses.

The time co-ordinator unit triggered the Digital Field System which in turn discharged the Texas Instruments 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.

For the Bass Basin 12-fold data, a 590 cubic inch gun array replaced the standard 1300 cubic inch array. This array was not tuned and was obtained by switching off the 80 and 100 cubic inch guns of the 1300 cubic inch tuned array, and using the remaining 10, 20 and 40 cubic inch guns. Thus the guns were fired every 25 meters giving 12-fold coverage using the 600 meter streamer with a group interval of 25 meters.

The guns were operated at a depth of 30 feet and a pressure of 1800 lbs. per square inch. (Plate 5.)

(D) Recording :

(1) 24-Fold Data.

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. Five 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 50.8 meters for all shotpoints.

(2) 12-Fold Data.

In this instance, the recording was done using a Texas Instruments Digital Field System with only one set of DFS III.

\*\* (N.B. Static length of these stretch sections is 109 ft. Under tow they stretch to approximately 125 ft.)

\*\*\* Trademark of Continental Oil Company.



The 600 meter, neutrally buoyant, continuous tow streamer consisted of 24 live sections each 25 meters in length and 6 Waterbreak sections, placed immediately in front of group 24, between groups 20 and 21, 15 and 16, 10 and 11, 5 and 6 and 1 and 2. Two Depth Transducers were located between groups 5 and 6 and 20 and 21. Two nylon stretch sections were placed between group 24 and the recording vessel.

Two Condep cable depth controllers were placed between groups 5 and 6 and 15 and 16. The average streamer depth was 40 feet. The setback (Shoran antenna to shot distance) was 50.8 meters for all shotpoints.

2400 Meter All Live Streamer (Plate 2)

Type cable	: 48 live group, neutrally buoyant universal gland streamer.
Type of Detector	: Payey acceleration cancelling.
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	: 30
Seismometer Interval	: Linear, 3'9" 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.

600 Meter All Live Streamer (Plate 3)

Type cable	: 24 live group, neutrally buoyant universal gland streamer.
Type of Detector	: Pavey acceleration cancelling.
Length of live section	: 25 meters
Length of depth transducer section	: 2 meters
Distance group 1 to 24 (centers)	: 579 meters
Group Interval	: 25 meters
Seismometers per group	: 15
Seismometer Interval	: Linear, 3'9" except center two which are 27'4".

Texas Instruments DFS III

System I - groups 1 to 24 Serial No. 106.



Reflection Recording Settings : 24-Fold Data

Gain Mode : Binary Gain

Record Length : 5.0 seconds

Sample Rate : 4 milliseconds

Gain Constant : 30 db

Attack Rate : 1500 db/sec.

Final Gain : 90 db

Trip : As necessary

Initial Gains -

1-4, 25-28 : 48 db

5-8, 29-32 : 42 db

9-12, 33-36 : 42 db

13-16, 37-40 : 36 db

17-20, 41-44 : 36 db

21-24, 45-48 : 36 db

Upper Set Limit : 62.5%

Lower Set Limit : 18.75%

Filters -

Low cut : 8 Hz, 18 db/oct.

High cut : 62 Hz, 72 db/oct.

(N.B. On Bass lines B71A-59, 59A and 67 the  
low cut filter was accidentally set  
at 12 Hz.)

Gain Expansion Rate : Fast, 94 db/sec.

Delay time for RAW monitors  
caused by displacement of  
RAW and record heads : 26.7 milliseconds.



Reflection Recording Settings : 12-Fold Data

Gain Mode : Binary Gain

Record Length : 4.0 seconds

Sample Rate : 2 milliseconds

Gain Constant : 30 db

Attack Rate : 1500 db/sec.

Final Gain : 90 db

Trip : As necessary

Initial Gain : 36 db

Upper Set Limit : 62.5%

Lower Set Limit : 18.75%

Filters -

    Low cut : 12 Hz, 18 db/oct.

    High cut : 124 Hz, 72 db/oct.

Gain Expansion Rate : Fast, 188 db/sec.

Delay time for RAW monitors  
caused by displacement of  
RAW and record heads : 13.3 milliseconds



## Tape Channel Allocations : 24-Fold Data

<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 (gun break) 4		System I	25
Field Time Break (gun break) 34		System II	25
DFS Synthetic Time Break 8		System I	-
DFS Synthetic Time Break 36		System II	-

\* (N.B. For this survey, field time break was recorded from the output of a geophone strapped to the front end of the port-side fish)



## Tape Channel Allocations : 12-Fold Data

<u>Function</u>	<u>Trace No.</u>	<u>System</u>	<u>Tape Channel</u>
Timing	-	System II	0
Streamer all groups	1 - 24	System II	1 - 24
Water Break 1 (in front of 24)	30	System II	31
Water Break 2 (between groups 20 and 21)	27	System II	28
Water Break 3 (between groups 15 and 16)	28	System II	29
Water Break 4 (between groups 10 and 11)	30	System II	31
Water Break 5 (between groups 5 and 6)	26	System II	27
Water Break 6 (between groups 1 and 2)	27	System II	28
*Field Time Break (gun break)	34	System II	25
DFS Synthetic Time Break	36	System II	-

\* (N.B. For this survey, field time break was recorded from the output of a geophone strapped to the front end of the port-side fish)



(E) Survey :

Shoran Survey: A separate report has been provided by Offshore Navigation Inc.

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

(F) Magnetometer Survey :

The magnetometer was employed throughout the Bass B71A Survey only, using a Varian Proton Magnetometer Model V-4970. 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. Due to instrument failure, magnetometer was not recorded on lines B71A-44 (SP 919-1461), 48, 61, 61A, 22S, 38S, 42S, 43S and part of B71A-56, ~~Part of B71A-44S~~.

A base magnetometer was not in operation during the survey.

SECTION IIIRECORD QUALITY

Reflection quality throughout the prospect was generally good. On board, visual inspections of field records ensured a close quality control check of the data and maintained maximum capability of seismic instrumentation.

Strong multiple energy was observed in parts of the Bass and Otway prospects.

Despite heavy intermittent swell encountered in all three prospects, average cable noise for the duration of the project was approximately 10  $\mu$ V. Average instrument noise was less than or equal to 0.25  $\mu$ V.

Respectfully submitted,  
GEOPHYSICAL SERVICE INTERNATIONAL

*Kenneth W. Howard*

*for* A. Chan,  
Quality Control Seismologist.



APPENDIX A

FIELD TAPE LOGS

PROSPECT - GIPPSLAND

<u>Tape Number</u>	<u>S.P. Numbers</u>	<u>Tape Number</u>	<u>S.P. Numbers</u>
5010	1-86	5030	933-935A
5011	1-107	5031	935B-1041
5012	87-180	5032	970-1077
5013	108-218	5033	1042-1147
5014	181-277	5034	1078-1185
5015	219-318	5035	1148-1253
5016	278-381	5036	1186-1292
5017	319-429	5037	1254-1356
5018	382-489	5038	1293-1394
5019	430-496	5039	1357-1463
	489A-520	5040	1395-1502
5020	490-496	5041	1464-1570
	489A-580	5042	1503-1610
5021	521-627	5043	1571-1675
5022	581-687	5044	1611-1715
5023	628-702	5045	1676-1780
	704-731	5046	1716-1821
5024	688-702	5047	1781-1888
	704-797	5048	1822-1920
5025	732-793		1922-1930
5026	794-858	5049	1889-1920
5027	798-825		1922-1948
5028	826-932		1941A-1988
5029	859-969	5050	1931-1948
			1941A-2027

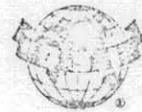


<u>Tape Number</u>	<u>S.P. Numbers</u>	<u>Tape Number</u>	<u>S.P. Numbers</u>
5051	1989-2092	5073	2960-3064
5052	2028-2134	5074	2984-3090
5053	2093-2199	5075	3065-3172
5054	2135-2240	5076	3091-3192
5055	2200-2305	5077	3173-3231
5056	2241-2345		3238-3263
5057	2306-2412	5078	3193-3231
5058	2346-2451		3238-3287
5059	2413-2521	5079	3264-3360
5060	2452-2505	5080	3288-3393
5061	2506-2539	5081	3361-3454
5062	2522-2557	5082	3394-3500
5063	2540-2643	5083	3455-3561
5064	2558-2559	5084	3501-3604
5065	2560-2666	5085	3562-3647
5066	2644-2645B	5086	3605-3647
	2667-2668A		3663-3712
5067	2645C-2675	5087	3663-3724
	2693-2743	5088	3713-3724
5068	2668B-2675		
	2693-2769		
5069	2744-2851		
5070	2770-2877		
5071	2852-2959		
5072	2878-2983		



PROSPECT - BASS (LONG CABLE)

<u>Tape Number</u>	<u>S.P. Numbers</u>	<u>Tape Number</u>	<u>S.P. Numbers</u>
5089	1-71	5114	1231-1338
5090	1-107	5115	1300-1404
5091	72-178	5116	1339-1447
5092	108-215	5117	1405-1512
5093	179-286	5118	1448-1556
5094	216-324	5119	1513-1617
5095	287-395	5120	1557-1664
5096	325-431	5121	1618-1668
5097	396-501		1674-1725
5098	432-537	5122	1665-1668
5099	502-610		1674-1771
5100	538-559B	5123	1726-1833
5101	559C-667	5124	1772-1840
5102	611-718	5125	1834-1840
5103	668-776		1900-1937
5104	719-826	5126	1900-1984
5105	777-883	5127	1938-2045
5106	827-918	5128	1985-2084
5107	884-992	5129	2046-2153
5108	919-1027	5130	2085-2189
5109	993-1038	5131	2154-2262
	1026A-1089	5132	2190-2297
5110	1028-1038	5133	2263-2371
	1026A-1121	5134	2298-2406
5111	1090-1195	5135	2372-2479
5112	1122-1230	5136	2407-2517
5113	1196-1299	5137	2480-2588



<u>Tape Number</u>	<u>S.P. Numbers</u>	<u>Tape Number</u>	<u>S.P. Numbers</u>
5138	2518-2626	5164	3791-3811
5139	2589-2697		3792A-3854
5140	2627-2732		3856-3878
5141	2698-2796	5165	3847-3854
5142	2733-2839		3856-3953
5143	2797-2896	5166	3879-3979
5144	2840-2947	5167	3954-4061
5145	2897-3006	5168	3980-4089
5146	2948-3052	5169	4062-4171
5147	3007-3113	5170	4090-4199
5148	3053-3156	5171	4172-4274
5149	3114-3171	5172	4200-4306
5150	3157-3171	5173	4275-4376
5151	3172-3252	5174	4307-4409
5152	3172-3277	5175	4377-4486
5153	3253-3359	5176	4410-4517
5154	3278-3387	5177	4487-4595
5155	3360-3463	5178	4518-4627
5156	3388-3493	5179	4596-4700
5157	3464-3497	5180	4628-4726
	3489B-3549	5181	4701-4805
5158	3494-3497	5182	4727-4831
	3489B-3578	5183	4806-4915
5159	3550-3657	5184	4832-4934
5160	3579-3684	5185	4916-5019
5161	3658-3765	5186	4935-5042
5162	3685-3790	5187	5020-5126
5163	3766-3811	5188	5043-5148
	3792A-3846	5189	5127-5222



<u>Tape Number</u>	<u>S.P. Numbers</u>	<u>Tape Number</u>	<u>S.P. Numbers</u>
5190	5149-5252	5223	6909-7016
5191	5223-5325	5224	6957-7065
5192	5253-5356	5225	7017-7114
5193	5326-5431	5226	7066-7165
5194	5357-5463	5227	7115-7224
5195	5432-5538	5 228	7166-7270
5196	5464-5572	5229	7225-7325
5197	5539-5620	5230	7271-7373
	5643-5647	5231	7326-7434
5198	5573-5620	5232	7374-7483
	5643-5677	5 233	7435-7539
5199	5648-5748		7545-7546
5200	5678-5778	5234	7484-7539
5201	5749-5847		7545-7591
5202	5779-5884	5235	7547-7654
5203	5848-5957	5236	7592-7699
5204	5885-5995	5237	7655-7760
5 205	5958-6067	5 238	7700-7800
5206	5996-6103	5 239	7761-7861
5207	6068-6168	5 240	7801-7908
5 208	6104-6208	5 241	7862-7970
5209	6169-6276	5 242	7909-7986
5210	6209-6314		7976A-8007
5211	6277-6376	5243	7971-7986
5212	6315-6421		7976A-8067
5213	6377-6482	5 244	8008-8115
5214	6422-6530	5 245	8068-8172
5215	6483-6592	5246	8116-8224
5216	6531-6639	5247	8173-8279
5217	6593-6700	5248	8225-8333
5218	6640-6743	5249	8280-8389
5219	6701-6805	5250	8334-8443
5220	6744-6849	5251	8390-8470
5221	6806-6908	5252	8444-8470
5222	6850-6956		



PROSPECT - BASS (SHORT CABLE)

<u>Tape Number</u>	<u>S.P. Numbers</u>	<u>Tape Number</u>	<u>S.P. Numbers</u>
5267	1-33	5297	1002-1034
5268	34-68	5298	1035-1069
5269	69-102	5299	1070-1105
5270	103-137	5300	1106-1140
5271	138-145	5301	1141-1175
5276	317-339	5302	1176-1210
5277	340-373	5303	1211-1246
5278	374-407	5304	1247-1280
5279	408-442	5305	1281-1313
5280	443-478	5306	1314-1346
5281	479-509	5307	1347-1380
5282	512-545	5308	1381-1412
5283	546-571	5309	1413-1445
	557A-563A	5310	1446-1478
5284	564A-597	5311	1479-1511
5285	598-631	5312	1512-1544
5286	632-665	5313	1545-1577
5287	666-699	5314	1578-1610
5288	700-734	5315	1611-1645
5289	735-769	5316	1646-1680
5290	770-804	5317	1681-1714
5291	805-839	5318	1715-1750
5292	840-874	5319	1751-1783
5293	875-909	5320	1784-1817
5294	910-943	5321	1818-1850
5295	944-977	5322	1851-1884
5296	978-1001	5323	1885-1918



<u>Tape Number</u>	<u>S.P. Numbers</u>	<u>Tape Number</u>	<u>S.P. Numbers</u>
5324	1919-1929	5328	2048-2083
	859B-858B	5329	2084-2119
	1930A-1948	5330	2120-2154
5325	1949-1984	5331	2155-2188
5326	1985-2004	5332	2189-2222
5327	143B-145B	5333	2223-2256
	2044, 2046,	5334	2257-2291
	2047.	5335	2292-2318

PROSPECT - OTWAY

<u>Tape Number</u>	<u>S.P. Numbers</u>	<u>Tape Number</u>	<u>S.P. Numbers</u>
5350	1-74	5378	1425-1483
5351	1-104		1477A-1527
5352	75-182	5379	1457-1483
5353	105-213		1477A-1556
5354	183-294	5380	1528-1634
5355	214-300	5381	1557-1664
5356	295-300	5382	1635-1741
	335-397	5383	1665-1773
5357	335-422	5384	1742-1803
5358	398-491	5385	1774-1883
5359	423-516	5386	1804-1909
5360	492-595	5387	1884-1989
5361	517-623	5388	1910-2017
5362	596-701	5389	1990-2097
5363	624-711	5390	2018-2125
	705A-718	5391	2098-2204
5364	702-711	5392	2126-2233
	705A-793	5393	2205-2309
5365	719-823	5394	2234-2339
5366	794-900	5395	2310-2416
5367	824-930	5396	2340-2449
5368	901-1008	5397	2417-2524
5369	931-1036	5398	2450-2555
5370	1009-1105	5399	2525-2631
5371	1037-1135	5400	2556-2662
5372	1106-1210	5401	2632-2739
5373	1136-1242	5402	2663-2766
5374	1211-1317	5403	2740-2840
5375	1243-1348	5404	2767-2874
5376	1318-1424	5405	2841-2944
5377	1349-1456	5406	2875-2944

APPENDIX BKEY PERSONNEL

Operations Supervisor	J. Quisenberry
Administrators	B. Schaefer I. Jones
Party Manager	T. Kerlin
Quality Control Seismologists	A. Chan B. Beer
Instrument Engineers	D. Neil D. Lanyon
Airgun Mechanics	J. Karhu A. Raitano J. Laranga
Cableman	M. Tacticos
Captain	J.R. Bradley
O.N.I. Survey Party Chief	D. Easterbrook
O.N.I. Mobil Operators	M. Carney G. Barnes J. Molly

APPENDIX CEQUIPMENTM.V. "R.C. DUNLAP"

Length (overall)	: 165 feet
Beam	: 36 feet
Draught	: 10 feet
Gross Tonnage (with helicopter deck)	: 476 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 30° down. Azimuth 0 to 360°. Range approximately ½ mile.
- : (3) ELAC DNEB LV-17B/L. 0 - 2200 fathoms.
- Ship's Crew : 10
- Seismic Crew : 14 to 16.

#### 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 30 Pavey acceleration cancelling hydrophones per trace.
- NOT USED - THIS SURVEY* → (2) 1600 meter, 24 traces with 21 Texas Instruments Hydrophones per trace.  
(Tapered array - convertible to 2400 meters.)
- Six Water Break 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 23 guns with spares mounted on two fish for 1300 cubic inch arrays.
- Untuned Array of Airguns : Conversion of above (see diagram).
- Explosives Shooting : Radios, blasters and firing lines  
(NOT USED THIS SURVEY) (capable of single boat explosives work).
- Varian Marine Proton Magnetometer.
- Texas Instruments Servo-writer II profiler unit providing an onboard single trace display.
- SIE VRO-10 photo-oscillograph with 54 galyos - to provide field playbacks or monitors for quality control.

#### NAVIGATION EQUIPMENT

Geo Nav II Satellite Navigation or conventional shore based systems as required.  
ONLY XR SHORAN USED

APPENDIX DOPERATIONS STATISTICS

Prospect : Gippsland G71B; Bass B71A;  
Otway 072A.

Operational Period : November 26th, 1971 to  
January 20th, 1972.

Time Spent on Prospect : 52 days

Time Spent on Recording : 33 days

Time Lost due to Bad Weather : 8 days

Time Lost due to Equipment,  
Navigational Failure and  
Anchorage : 5 days

Travel between Areas : 6 days

Total Miles Shot : 2115.88

(2116.17)  
Esso



Prospect : Gippsland G71B.

Operational Period : November 26th to December 5th,  
1971.

Time Spent on Prospect : 10 days

Time Spent on Recording : 8 days

Time Lost due to Bad Weather : 0 days

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

Total Miles Shot : 456.87 (457.09)

.....

Prospect : Bass B71A (24-Fold Data).

Operational Period : December 6th-25th, 1971.

Time Spent on Prospect : 20 days

Time Spent on Recording : 13 days

Time Lost due to Bad Weather : 4 days

Time Lost due to Equipment,  
Navigational Failure and  
Anchorage : 3 days

Total Miles Shot : 1,036.51



Prospect : Bass B71A (12-Fold Data).

Operational Period : December 29th, 1971 to  
January 8th, 1972.

Time Spent on Prospect : 11 days

Time Spent on Recording : 7 days

Time Lost due to Bad Weather : 4 days

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

Total Miles Shot : 261.68

.....

Prospect : Otway C72A

Operational Period : January 16th-20th, 1972.

Time Spent on Prospect : 5 days

Time Spent on Recording : 5 days

Time Lost due to Bad Weather : 0 days

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

Total Miles Shot : 360.82

51 709

<p>ESSO AUSTRALIA LTD.</p>
<p>1971 - 1972 MARINE SEISMIC SURVEY</p>
<p>GEOPHYSICAL SERVICE INTERNATIONAL PARTY 909</p>

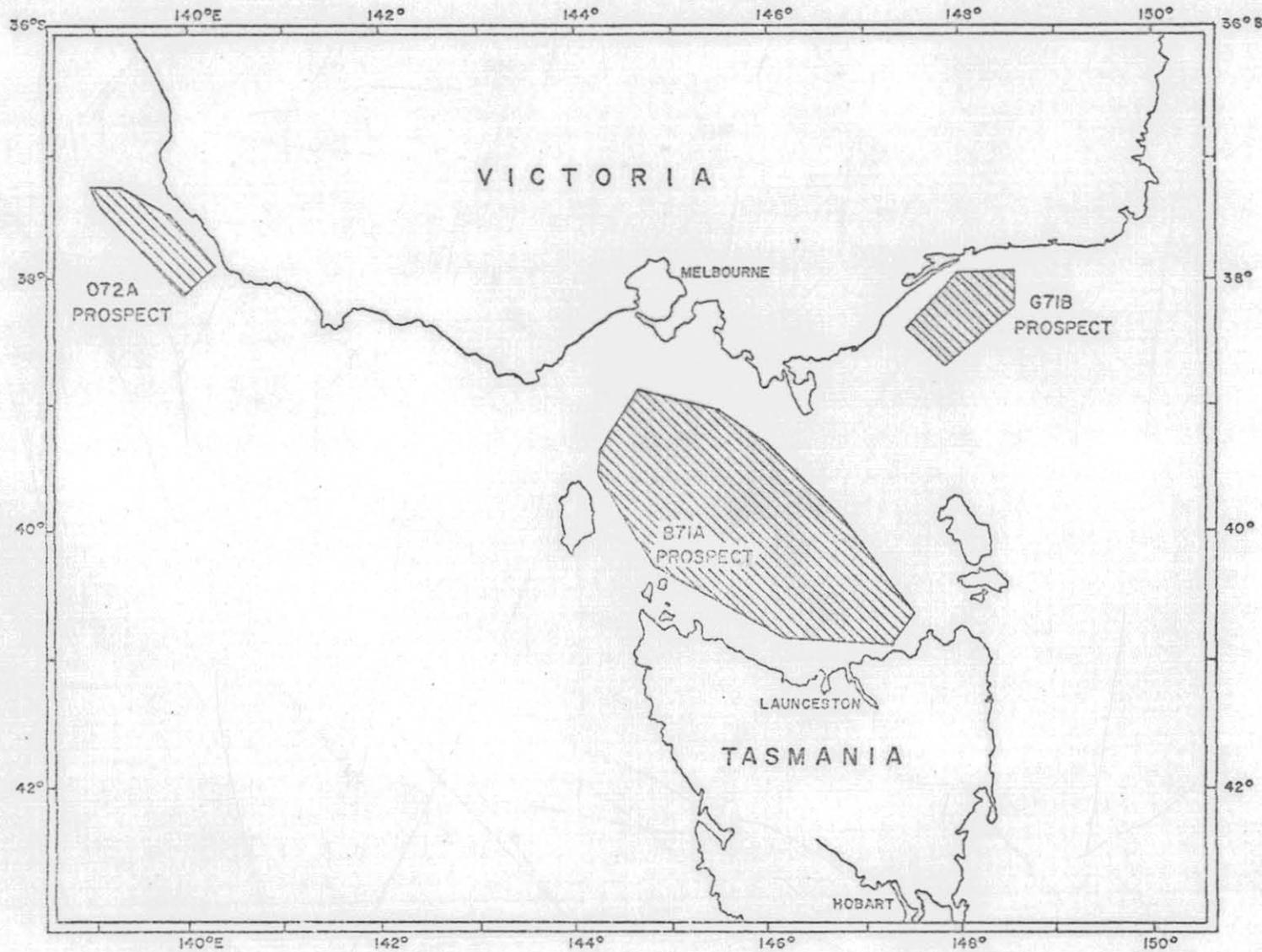
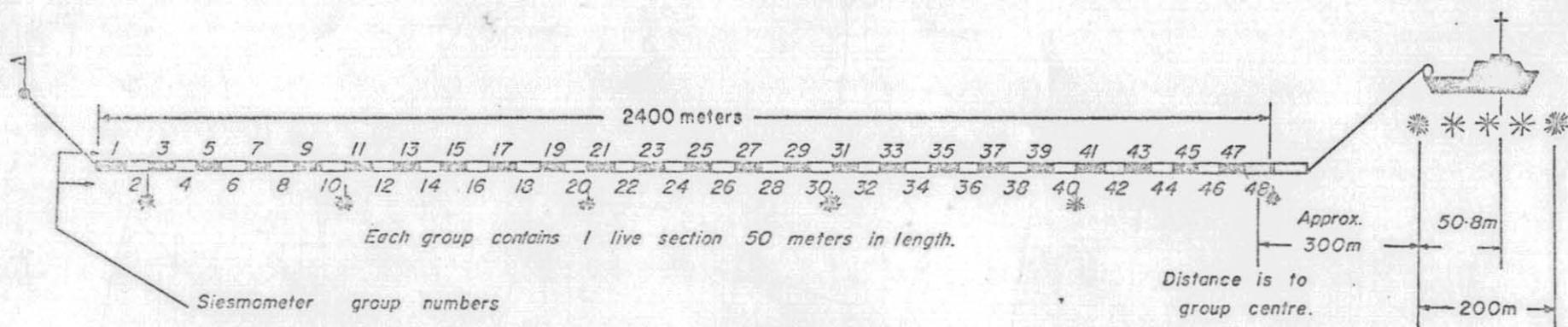


PLATE 1

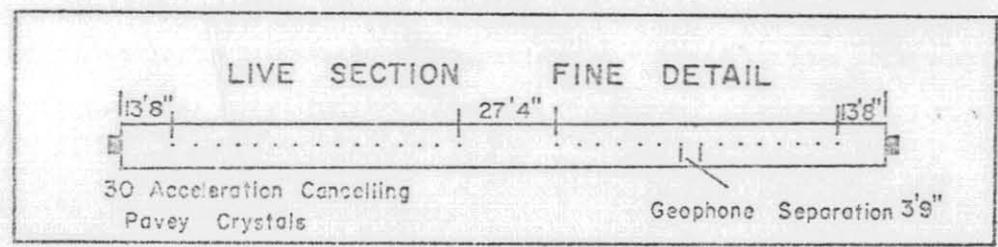
5 cm



507-707

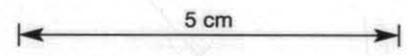


\* STREAMER DEPTH TRANSDUCER  
WATER BREAK PHONE LOCATION



FISH STBD	cu. inch.	120	80	40	20	10	= 530 cu. inch
	guns	2	2	2	2	1	
FISH PORT	cu. inch	400	240	40	20	10	= 770 cu. inch.
	guns	1	1	2	2	1	

1300 cu. inch.



**MARINE CABLE DIAGRAM**  
**2400 METER**

(OFF END SPREAD - 48 GROUPS)

GSI Party 909

Ship M/V DUNLAP

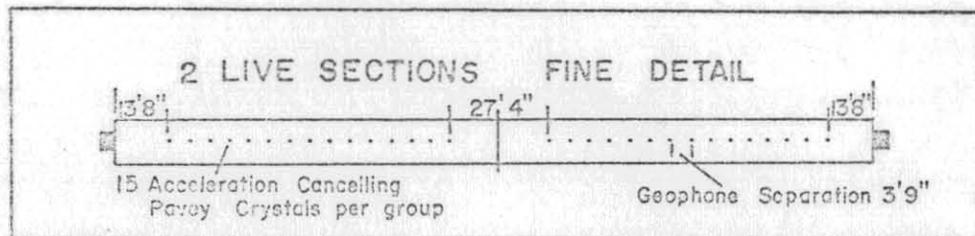
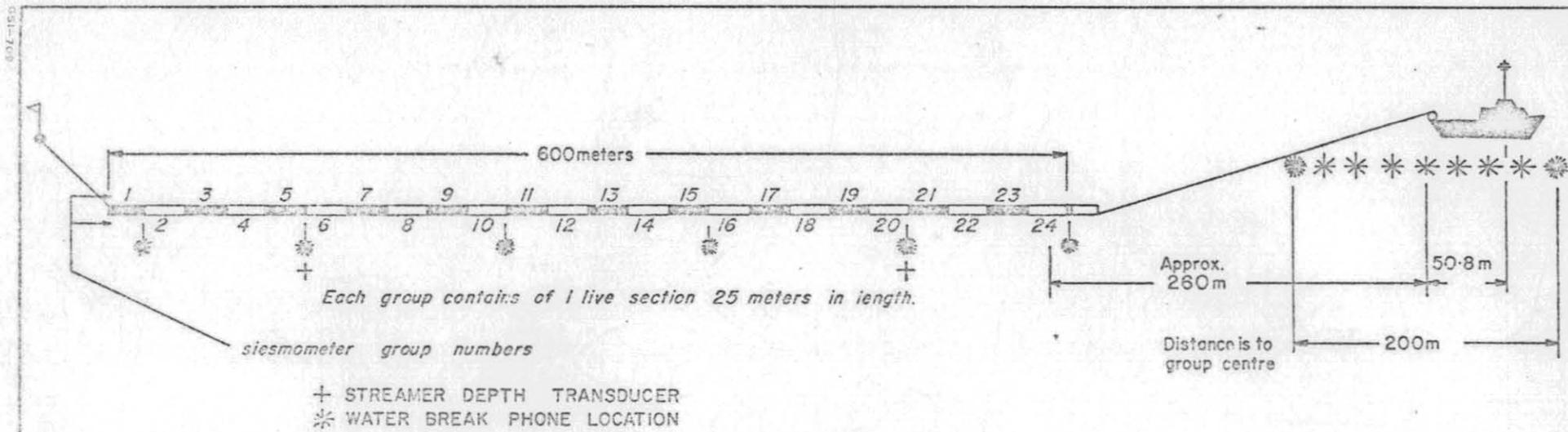
Client ESSO AUSTRALIA LTD.

Area OTWAY BASS, GIPPSLAND

Date NOV. 1971 - JAN. 1972

057070

PLATE 2



FISH STBD	cu. inch.	120	80	40	20	10	= 340 cu. inch.	} 590 cu. inch.
	guns	-	-	5	7	-		
FISH PORT	cu. inch.	400	240	40	20	10	= 250 cu. inch.	
	guns	-	-	4	4	1		

**MARINE CABLE DIAGRAM**  
600 METERS

(OFF END SPREAD - 24 GROUPS)

G.S.I. Party 909

Ship MV DUNLAP

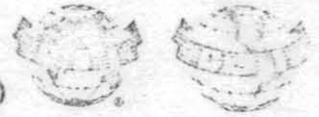
Client ESSO AUSTRALIA LTD.

Area BASS BASIN

Date DEC. 1971 - JAN. 1972

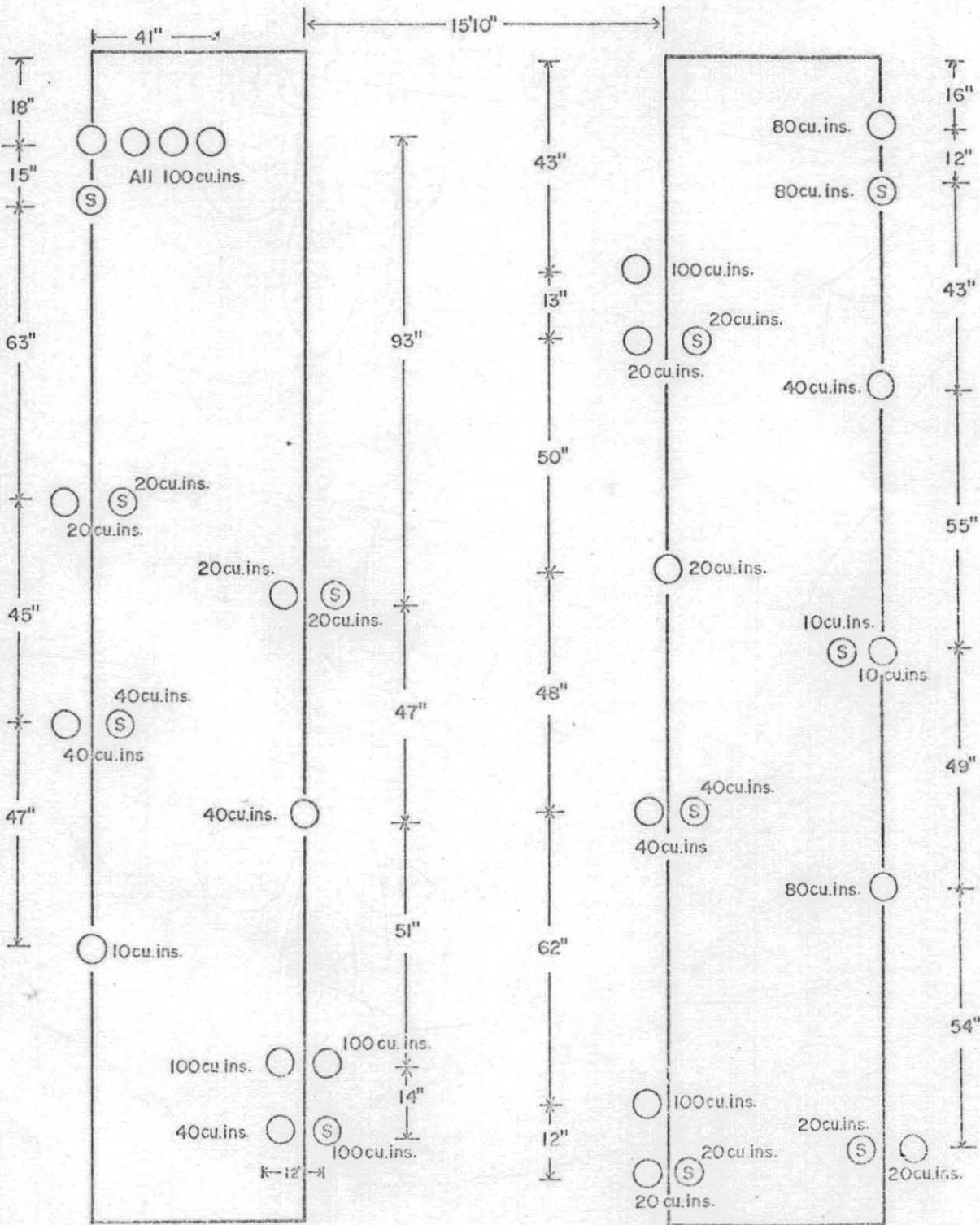
5 cm

057071



PORT

STARBOARD

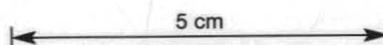


S = Spare Gun

M.V. "R.C. DUNLAP"

Depth 30 ft.  
Pressure 2000 psi.

1300 cubic inch AIR GUN ARRAY

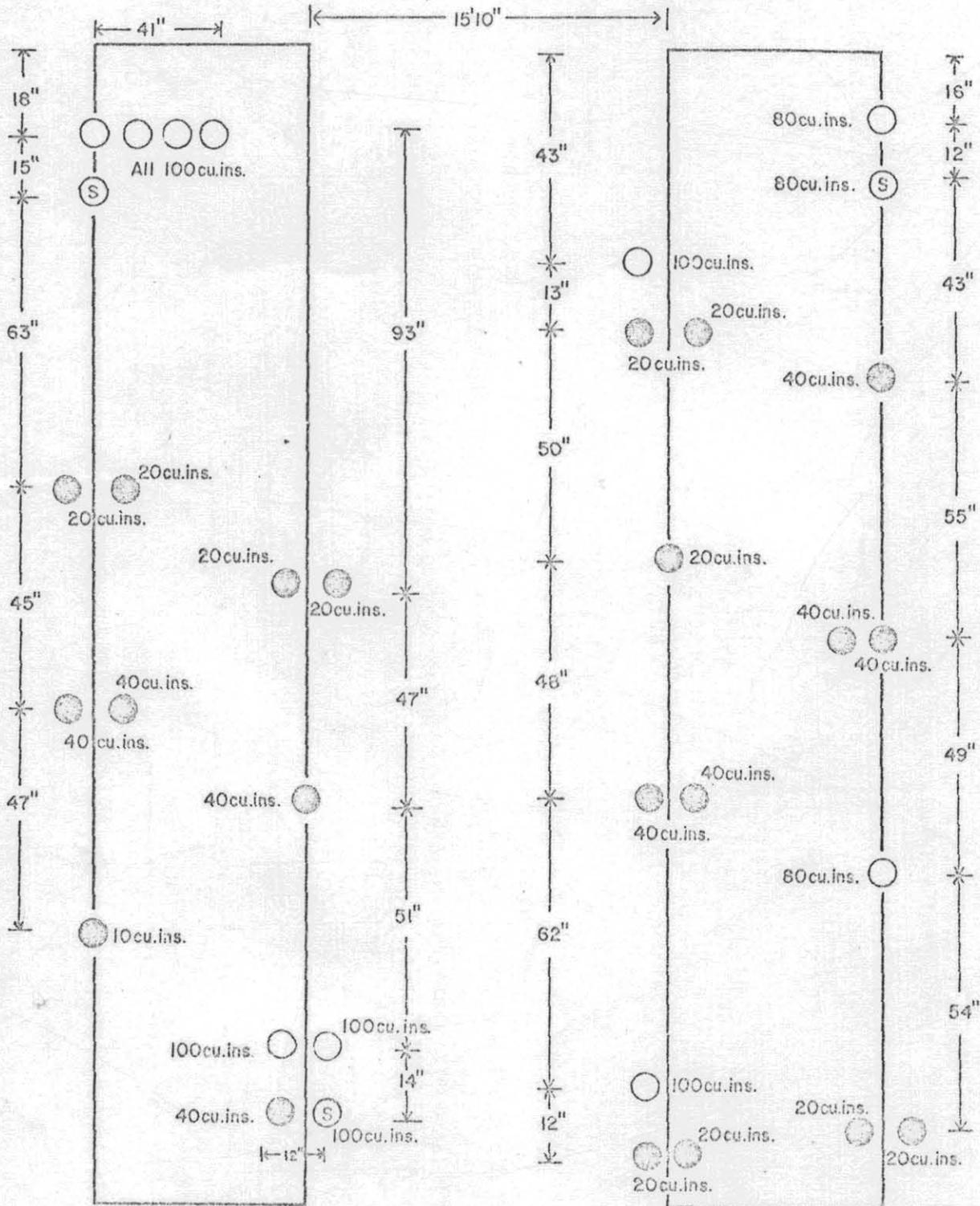


(Not to Scale)



PORT

STARBOARD



S = Spare Gun

M.V. "R.C. DUNLAP"

Depth 30 ft.  
Pressure 1800 psi.

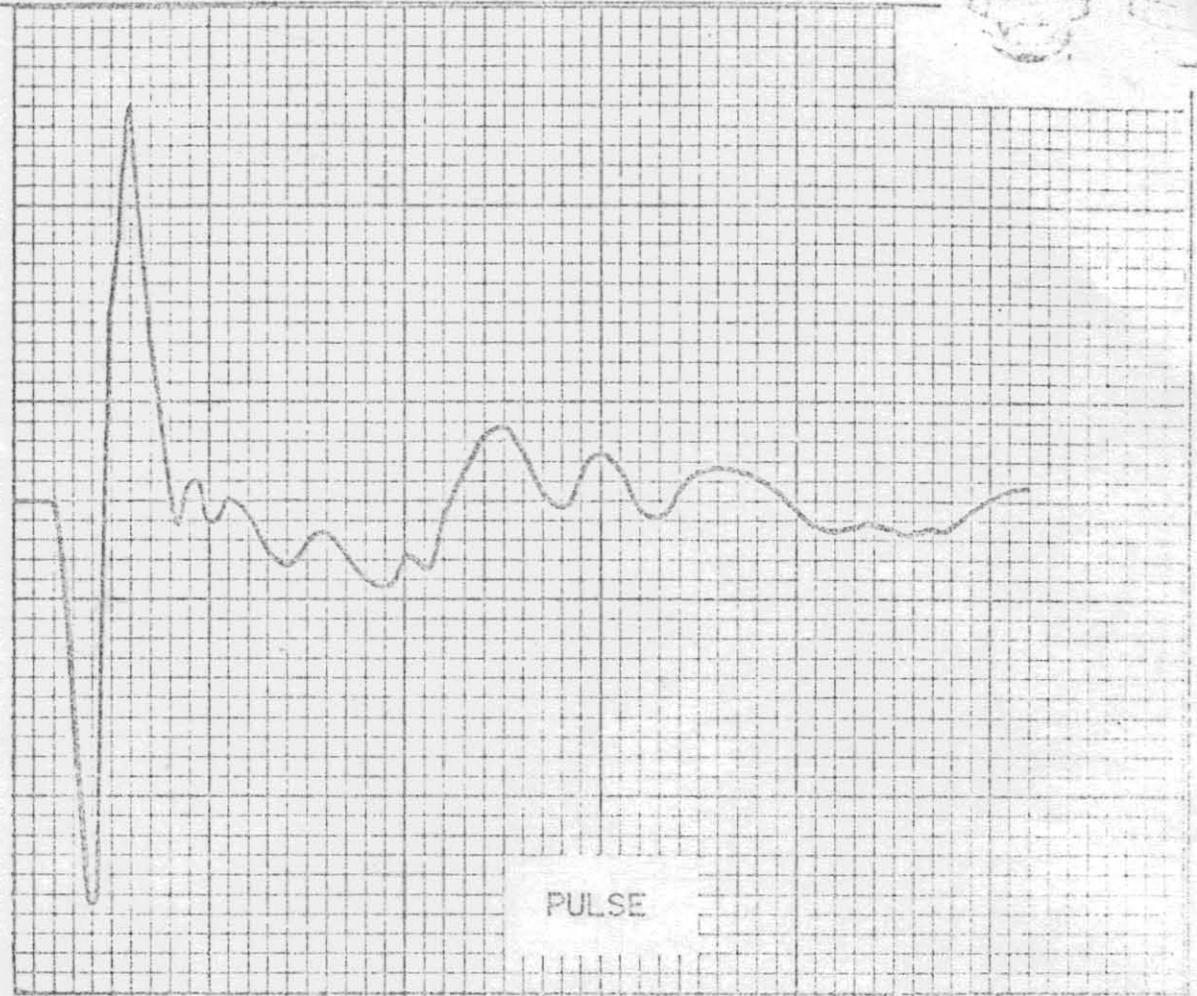
590 cubic inch AIR GUN ARRAY

(Guns operating as opposed to 1300 cubic inch tuned array are blanked)

5 cm

057074

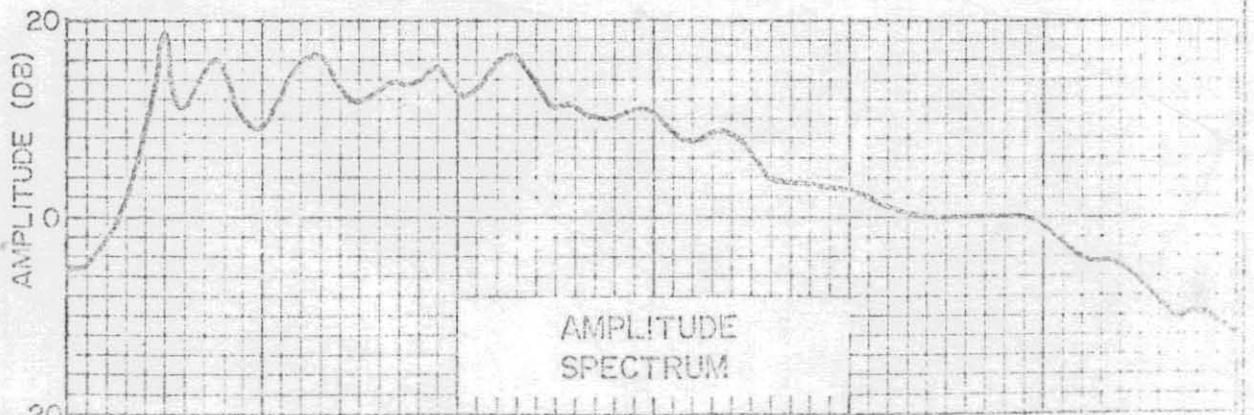
AMPLITUDE



PULSE

0 100 200 MILLISECONDS

RELATIVE AMPLITUDE (DB)



AMPLITUDE SPECTRUM

0 20 40 60 80 100 FREQUENCY (HZ)

GUN	SIZES
1 X 400	cubic inches.
1 X 240	" "
2 X 120	" "
2 X 80	" "
4 X 40	" "
4 X 20	" "
2 X 10	" "

AIRGUN ARRAY PULSE AND SPECTRUM

Vessel M/V R.C. DUNLAP  
 Array Capacity 1300 cubic inches  
 Recording Filter cut-218 Hz  
 Date 29th October 1971

057075

Bass Basin part XIII

DATA PROCESSING

FINAL REPORT

GIPPSLAND BASIN - G71B  
BASS BASIN - B71A  
OTWAY BASIN - O72A

OR - 013 (vol.3)

057076



DATA PROCESSING

FINAL REPORT

GIPPSLAND BASIN - G71B  
BASS BASIN - B71A  
OTWAY BASIN - 072A

For

ESSO AUSTRALIA LIMITED

127 Kent Street,  
SYDNEY. N.S.W. 2000

By

GEOPHYSICAL SERVICE INTERNATIONAL

120 Christie Street,  
ST. LEONARDS. N.S.W. 2065

PARTY 107-ES0-2

John R. Guenther : Party Chief  
Kenneth W. Howard : Data Processing Manager

APRIL, 1972.

TABLE OF CONTENTS

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II	PRODUCTION PROCESSING	2
III	PROCESSING DETAILS	7

APPENDIX A - PURCHASE TAPE LOG INDEX

PLATE 1 - PRODUCTION PROCESSING FLOW



SECTION I

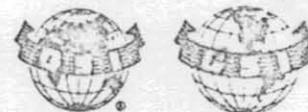
ABSTRACT

A seismic reflection survey was conducted by the M.V. "R.C. Dunlap" in the Gippsland, Bass and Otway Basins between 26th November, 1971 and 20th January, 1972.

Approximately 1850 miles of 24-fold reflection coverage were shot utilizing a 48 trace, 2400 meter streamer under continuous tow. A tuned array of airguns (1300 cubic inches) was used as the acoustic energy source.

A further 260 miles of 12-fold, 24 trace data were recorded in the Bass Basin using a 600 meter streamer and an airgun capacity of 590 cubic inches. Field operations and survey reports are under separate covers.

Data enhancement using Pre and Post 700 Package digital processing was carried out in the Sydney Office of G.S.I. The 700 Package velocity processing was carried out in the Singapore Office of G.S.I.



## SECTION II

### PRODUCTION PROCESSING

#### SEQUENCE A.

(24-fold, 5 second processing performed on the Gippsland Basin data.)

#### Pre-Processing :

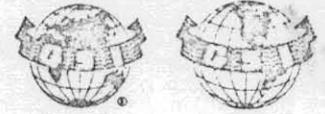
1. True Amplitude Recovery.
2. Even/Odd Vertical Stack.
3. Trace Editing.
4. Static Corrections for field multiplexing errors.
5. Shot and Seismometer Static Correction.
6. Pre-Deconvolution Ramp Scaling.
7. Deconvolution.
8. Time Varying Scaling (TVS).
9. Common Depth Point (CDP) Gather.
10. Annotation.

#### Velocity Analysis :

11. Full 700 Package Velocity Analysis.

#### Post-Processing :

12. Trace Editing.
13. Normal Moveout Correction.



14. Single-Fold Reproduction.
15. Common Depth Point Stack.
16. Time Variant Deconvolution
17. Time Variant Digital Filtering.
18. Plotter Displays.

Other Processing :

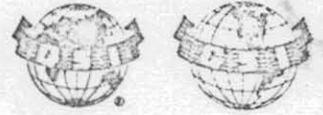
19. Iso-velocity Overlays.

SEQUENCE B.

(24-fold, 5 second processing performed on the Bass Basin,  
2400 meter streamer, data.)

Pre-Processing :

1. True Amplitude Recovery.
2. Even/Odd Vertical Stack.
3. Trace Editing.
4. Static Corrections for field multiplexing errors.
5. Shot and Seismometer Static Correction.
6. Pre-Deconvolution Ramp Scaling.
7. Deconvolution.
8. Time Varying Scaling (TVS).
9. Common Depth Point (CDP) Gather.
10. Annotation.



Velocity Analysis :

11. Full 700 and Mini-700 Package Velocity Analysis.

Post-Processing :

12. Trace Editing.
13. Normal Moveout Correction.
14. Single-Fold Reproduction.
15. Common Depth Point Stack.
16. Time Variant Deconvolution.
17. Time Variant Digital Filtering.
18. Plotter Displays.

Other Processing :

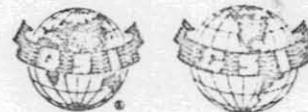
19. Iso-velocity Overlay.

SEQUENCE C.

(12-fold, 3 second processing performed on the Bass Basin,  
600 meter streamer, data.)

Pre-Processing :

1. True Amplitude Recovery.
2. Static Corrections for field multiplexing errors.
3. Shot and Seismometer Static Correction.
4. Pre-Deconvolution Ramp Scaling.
5. Deconvolution.



6. Time Varying Scaling (TVS).
7. Common Depth Point (CDP) Gather.
8. Annotation.

Velocity Analysis :

9. Moveout Scans.

Post-Processing :

10. Trace Editing.
11. Normal Moveout Correction.
12. Single-Fold Reproduction.
13. Common Depth Point Stack.
14. Time Variant Deconvolution.
15. Time Variant Digital Filtering.
16. Plotter Displays.

SEQUENCE D.

(24-fold, 5 second processing performed on the Otway Basin,  
2400 meter, data.)

Pre-Processing :

1. True Amplitude Recovery.
2. Even/Odd Vertical Stack.
3. Trace Editing.
4. Static Corrections for field multiplexing errors.



5. Shot and Seismometer Static Correction.
6. Pre-Deconvolution Ramp Scaling.
7. Deconvolution.
8. Common Depth Point (CDP) Gather.
9. Annotation.

Velocity Analysis :

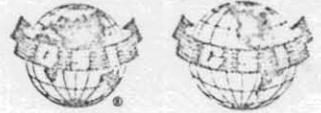
10. Full 700 and Mini-700 Package Velocity Analysis.

Post-Processing :

11. Trace Editing.
12. Normal Moveout Correction.
13. Single-Fold Reproduction.
14. Common Depth Point Stack.
15. Time Variant Deconvolution.
16. Time Variant Digital Filtering.
17. Plotter Displays.

Other Processing :

18. Iso-velocity Overlays.



### SECTION III

#### PROCESSING DETAILS

##### Pre-Processing Module :

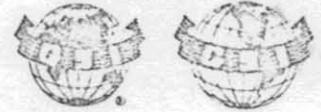
(1) True Amplitude Recovery (TAR).

The TAR process is applied to digital field records in order to produce output records on which relative amplitudes of reflections on each trace are approximately true and traces evenly modulated. This consists of removing the gain imposed on the field record by the DFS III Binary Gain Control system and correcting for inelastic attenuation and spherical divergence losses.

(2) Even/Odd Vertical Stack.

The adjacent even and odd groups of the 48 group streamer utilized in the surveys were vertically stacked to yield a single, 24 trace record for each airgun 'pop'. When it was possible to determine the required editing from the field Q.C. reports, trace editing was performed prior to vertical stack.

Note that the Bass 600 meter data was not vertically stacked.



(3) Trace Editing.

Using field Q.C. reports as a guide, as well as on a random basis, vertically stacked records were displayed and edited.

(4) Static Corrections for Field Multiplexing Errors.

Static corrections of field multiplexing delays, shifts the traces to compensate for the difference in time of recording each individual trace.

(5) Shot and Seismometer Static Correction.

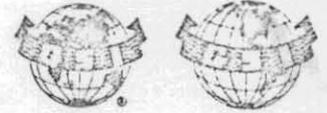
A static correction to compensate for the depth of airgun array and streamer below sea level, generally on the order of 15 milliseconds.

(6) Pre-Deconvolution Ramp Scaling.

A ramp scaling designed to suppress direct arrival energy. This is to prevent the high amplitude direct arrivals from being "blown-up" when the deconvolution operator is applied.

(7) Deconvolution.

The deconvolution parameters employed on a particular line were a function of the water depth and consequent available design gate. Two types of deconvolution were used :



## Bass Basin part XIII

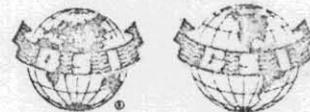
- (a) TVD (Time Variant Deconvolution), a multiple operator, whitening, deconvolution designed from and applied to each trace in a series of overlapping gates.
- (b) DCN (Deconvolution), a single operator, whitening, deconvolution designed from and applied to each trace.  
Except in the Otway Basin, the deconvolution operators were not normalized.

### (8) Time Varying Scaling (TVS).

TVS affects amplitude equalization between traces as a function of record time. The number of time gates for which amplitude scalars are computed can be specified depending upon the geophysical problems and requirements. The scalars computed for each gate are applied to data at the centre of their gate and scale factors for intermediate data are computed by linear interpolation of consecutive scalars.

### (9) Common Depth Point (CDP) Gather.

All data output from the pre-processing stage is in a CDP format. Effectively this means that each of the 24 traces on these output records are common to the same depth point.



(10) Annotation.

The water depth at the depth point and the offset to each trace in the gather is annotated in channel 25 for use in further processing.

Velocity Analysis :

A. Two initial displays were generated for each line as an aid in velocity analysis. These were achieved during the pre-processing stage.

1. Initial Single-Fold.

A deconvolved, moveout corrected, single-fold section with a 10-50 Hz digital filter applied was displayed on paper. The velocity function used for normal moveout correction was supplied by Esso.

2. Near Trace Gather.

A deconvolved near trace gather with a 10-50 Hz digital filter applied was displayed on paper. Effectively the shortest offset trace was gathered to give a continuous single-fold coverage. This section was not moveout corrected.

Over the complete project, the breakdown of the various types of velocity analyses applied are tabulated on the following page.

<u>SURVEY</u>	<u>MOVEOUT SCANS</u>	<u>FULL 700 PACKAGE</u>	<u>PART FULL/MINI 700 PACKAGE</u>	<u>MINI-700 PACKAGE</u>
G71B		All Lines		
B71A	Lines 6S 22S 36S 38S 39S 40S 42S	Lines 49 (SP 7396-7539) 51 52 54 55 59 61 61A 62 63 64 68 73	Lines 44 (SP 919-1461) 50 53 57 65	Lines 17 18 36 40 41 42 43 44 (SP 6411-6700A) 45 46 47 48 49 (SP 5643-5794) 55A 56 58 59A 60 66 67 69 70 71 72



SURVEYMOVEOUT SCANSFULL 700 PACKAGEPART FULL/MINI  
700 PACKAGEMINI-700 PACKAGE

072A

Lines 20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
35  
41  
43  
45  
47

Lines 37  
39

- 12 -

Note that parts of Lines B71A-44 and 49 are expressed separately because they were recorded and processed as such.





B. Of the lines listed above as having had Full 700 Package analysis applied, all were processed alternate depth points except Lines G71B-534 and 551 which were processed using every depth point. A comparison was made on Line G71B-514 between alternate and every depth point processing.

1. Program 04-700-2 reads every other CDP gather and performs the following :

- o Time Variant Filtering.
- o Equalization.
- o Moveout and dip scan building.
- o Interpretation of moveout/dip scans to detect valid events with time, amplitude, moveout and dip information.
- o Output to magnetic tape the Event files for each space/time gate.
- o Extension of the Event files in each time gate to produce the Work file.
- o Output of Work files on magnetic tape.

At this stage the program takes all time gates and outputs Summary and Consolidated Files in the following manner.

- o Hookup of segments between time gates to allow continuous segments across time gates.



- o Output of Summary Files.
  - o Consolidation of Summary Files into continuous segments with time, amplitude and moveout at every depth point.
  - o Output of the Consolidated Segment File on magnetic tape to be submitted for display or analysis routines.
2. Program 04-611 - Velocity Analysis Module - provides statistical displays of velocity as a function of time over the entire space and, also over specified space gates. The RMS velocities are computed from the segment times and moveouts averaged over each space gate and plotted as a coded symbol for each segment. The symbols are coded according to segment length within each space gate or according to the relative length in the entire Consolidated File as follows :

<u>Symbol</u>	<u>Length</u>
+	> 12 depth points
▽	< 12, ≥ 6 depth points
·	< 6, ≥ 3 depth points
N	Nth longest segment in the file (up to 50).

As well, the relative amplitude indication of the largest segment within a 100 ms. gate is shown by circling the rank or grading symbol.



The input to this module is the Consolidated File record and the output is a series of CRT frames plus a listing.

Scattergrams (time vs. velocity plots) are enlarged to a vertical scale of 1 second = 2.5 inches and a horizontal scale of 1,000 ft/sec = 1 inch.

3. Program 04-602 - Segment Sort and Display - displays the Consolidated File in a fashion suitable for section overlay. Various sorting and annotation techniques are available to aid in the interpretation of the File. The following were selected for this project.

- a. Total File.

An initial display of all the segments in the file annotated with segment numbers according to the following schedule of segment lengths.

<u>Basin</u>	<u>Plotted</u>	<u>Annotated</u>
Gippsland	$\geq 6$ $\geq 12$	$\geq 24$ $\geq 24$
Bass	$\geq 24$	$\geq 30$
Otway	$\geq 12$	$\geq 24$

- b. Primary File, Peaks and Troughs, length  $\geq 24$  depth points.

A velocity and length sorted file annotated with segment number.



- c. Primary File, Peaks only, length  $\geq .6$  depth points.  
A velocity, polarity and length sorted File.  
Only segments  $\geq 24$  depth points were annotated with RMS velocity, which was averaged over 24 depth points and annotated every 24 depth points.
  
- d. Primary File, Troughs only, length  $\geq 12$  depth points.  
A velocity, polarity and length sorted file.  
Only segments  $\geq 24$  depth points were annotated with RMS velocity, which was averaged over and annotated every 24 depth points.

Input to program 04-602 was the Consolidated File and output was on CRT frame. These frames were enlarged to a horizontal scale of 24 traces/inch and a vertical scale of 3.75 inches/second.

- C. In the relevant areas, a Mini-700 Analysis was performed approximately every four miles over six consecutive depth points. Thus six consecutive CDP records are input to program 04-700-2 as outlined above under Full 700 Package processing. However, these are only processed as far as output of Work Files on magnetic tape. The subsequent Hookup and Consolidation stages are not attempted.



The Work File is then input into program 04-611 where output is a CRT frame plus a listing. Again this provides a statistical display of velocity as a function of time but in this case the grading is according to amplitude.

<u>Symbol</u>	<u>Amplitude</u>
+	All segments $\geq$ 12 db down from max. amplitude in the file.
▽	All segments with average amplitude $\geq$ 20 and $<$ 12 db down from max. amplitude.
.	Segments with average amplitude $\geq$ 50 and $<$ 20 db down from max. amplitude.

In addition, segments are ranked 1-35 according to amplitude within the File. Annotation on scattergrams was the same for both Bass and Otway Surveys. Scattergrams were enlarged as stated previously.

- D. Moveout Scans were run on the Bass (12-fold) data, a total of 16 being performed. The number and placement of scans was deemed sufficient to give adequate velocity control and was ratified by Esso's Representative. Locations of scans were marked on the final sections. Scans were processed to 3 seconds, with a moveout increment of 4 ms. per trace, deconvolved and filtered with the following TVF.



20-60 Hz	400 ms.
15-55 Hz	600 ms.
10-50 Hz	800 ms.
10-40 Hz	1200 ms.

Input to the scan program were the CDP gather records and two common depth points were analysed. A computer listing was provided.

Post-Processing :

1. Trace Editing.

At this stage of processing those traces edited were from the CDP gather records. The principal sources of this edit were the near trace gather and initial single-fold sections derived during pre-processing.

2. Normal Moveout Correction.

All velocity functions were submitted as 'water surface' functions. A linear interpolation was performed between the velocity functions which were applied at the points indicated on the final sections.

3. Final Single-Fold.

A single-fold section with the final stacking velocities applied was generated from the normal moveout program. This section was displayed on paper with a 10-50 Hz digital filter applied.



4. Common Depth Point Stack.

Common Depth Point Stack was performed with a scaling response equal to the square root of the number of live traces divided by the fold (24). First break suppression ramps were derived from the initial single-fold sections. In addition, the B71A and G71B lines all had some of their near offset traces ramped off. Typically, the near 6-8 traces were deleted from the stack from about 2500 ms. to 5000 ms. The purpose of this was to try and attenuate as much multiple energy as possible. The situation concerning the 072A lines varied somewhat, where in some cases it was deemed unnecessary to ramp any of the near traces at all. On other lines, the inside traces were ramped off and then on again. In all cases, the exact extent of near trace ramping can be seen on the final section at the end of a line.

The stacked records were output on magnetic tapes which were purchased by Esso.

5. Time Variant Deconvolution.

A Time Variant Deconvolution was performed on all data after CDP Stack. The TVD operators were normalized in all cases. These records were output on magnetic tapes purchased by Esso.



6. Time Variant Digital Filtering.

- (a) The standard Gippsland filter was used for all of the G71B lines.

20-60 Hz	400 ms.
15-55 Hz	600 ms.
10-50 Hz	800 ms.

- (b) The filter applied to the B71A (24-fold) data varied.

(i) 20-60 Hz	400 ms.	(ii) 15-60 Hz	200 ms.
15-55 Hz	600 ms.	10-40 Hz	1500 ms.
10-50 Hz	800 ms.	8-32 Hz	3000 ms.
10-40 Hz	1200 ms.		

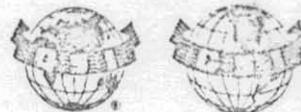
The various filters are represented on each final section. The B71A (12-fold) data was entirely filtered with -

20-60 Hz	400 ms.
15-55 Hz	600 ms.
10-50 Hz	800 ms.
10-40 Hz	1200 ms.

- (c) The 072A lines had different filters applied.

(i) 15-60 Hz	500 ms.	(ii) 15-60 Hz	500 ms.
12.5-50 Hz	1500 ms.	12.5-50 Hz	1500 ms.
10-40 Hz	2000 ms.	10-40 Hz	2500 ms.
8-32 Hz	3000 ms.	8-32 Hz	3500 ms.

All 072A lines except 072A-37, 39  
072A-37, 39. - 20 -



Note that on the 072A Survey, the Time Variant Filter was designed to follow the water bottom. On all other data, the filter times indicated on the section are referenced to zero record time.

7. Plotter Displays.

All Bass and Gippsland displays were in a variable density format with 100% bias. Otway was plotted wiggle trace/variable area with a 10% bias. All plotter displays were at a horizontal scale of 24 traces/inch and a vertical scale of 3.75 inches/second.

In addition to the displays noted above, two final sections were presented to Esso.

- (a) The CDP stacked, Time Variant Deconvolved records were displayed on paper without a filter.
- (b) The Time Variant Filtered records were displayed on film with polarity reversed.

Other Processing :

An iso-velocity overlay was derived from the RMS stacking velocity functions. Both velocity and time were referenced to water top. Starting at an initial contour of 5000 ft/sec, contours of 500 ft/sec intervals were plotted. These contours



were displayed on film in a variable area format at a horizontal scale of 24 traces/inch and a vertical scale of 3.75 inches/second.

The side panel on all final sections gives pertinent field and processing information for ready reference.

Respectfully submitted,  
GEOPHYSICAL SERVICE INTERNATIONAL

*K. Paine*

for John R. Guenther,  
Party Chief.

*Kenneth W. Howard*

Kenneth W. Howard,  
Data Processing Manager.

APPENDIX APURCHASE TAPE LOG INDEX(1) GIPPSLAND G71B

<u>Tape Number</u>	<u>Line Numbers</u>
DPS 3421	503, 506, 508, 514, 515, 516, 521, 529.
DPS 5513	526, 527, 528, 537, 538, 542, 545, 546, 547, 548, 551, 552, 553, 554.
DPS 355	502, 504, 505, 507, 508A, 510, 511, 513, 518, 519, 520, 522, 525, 530, 531, 532, 533, 534, 535.
DPS 6346	509, 512, 516A, 517, 523, 524, 536, 539, 540, 541, 543, 544, 549, 550, 555.
TVD 6721	526, 527, 528, 537, 538, 542, 545, 546, 547, 548, 551, 552, 553, 554.
TVD 6703	503, 506, 508, 514, 515, 516, 521, 529.
TVD 6547	509, 512, 516A, 517, 523, 524, 536, 539, 540, 541, 543, 544, 549, 550, 555.

Tape NumberLine Numbers

TVD 6534

502, 504, 505, 507, 508A, 510,  
511, 513, 518, 519, 520, 522,  
525, 530, 531, 532, 533, 534,  
535.

(2) BASS B71ATape NumberLine Numbers

DPS 6253

49 (SP 5643-5794), 52, 53, 55,  
56, 58, 59, 59A, 61A, 65, 66, 68.

DPS 1212

44 (SP 6411-6700A), 46, 47, 48,  
60, 62, 63, 67, 69, 70, 71, 72.

DPS 4134

6S, 36S, 39S, 40S, 43S, 44S  
(SP 859B-2004).

DPS 5725

44 (SP 919-1461), 50, 51, 54, 57,  
61.

DPS 4294

17, 18, 36, 40, 41, 42, 43, 45,  
55A.

DPS 3136

42S, 44S (SP 858-1001), 49  
(SP 7396-7543), 64, 73.

DPS 1211

22S, 38S.

TVD 4163

6S, 36S, 39S, 40S, 43S, 44S  
(SP 859B-2004).

TVD 6254

49 (SP 5643-5794), 52, 53, 55,  
56, 58, 59, 59A, 61A, 65, 66, 68.



<u>Tape Number</u>	<u>Line Numbers</u>
TVD 4242	44 (SP 6411-6700A), 46, 47, 48, 60, 62, 63, 67, 69, 70, 71, 72.
TVD 4291	22S, 38S.
TVD 4304	17, 18, 36, 40, 41, 42, 43, 45, 55A.
TVD 6478	42S, 44S (SP 858-1001), 49 (SP 7396-7543), 64, 73.
TVD 6193	44 (SP 919-1461), 50, 51, 54, 57, 61.

(3) OTWAY 072A

<u>Tape Number</u>	<u>Line Numbers</u>
DPS 6403	20, 21, 22, 23, 24, 25, 26, 27, 29, 33, 37, 39.
DPS 6420	28, 30, 31, 32, 35, 41, 43, 45, 47.
TVD 6404	20, 21, 22, 23, 24, 25, 26, 27, 29, 33, 37, 39.
TVD 6422	28, 30, 31, 32, 35, 41, 43, 45, 47.

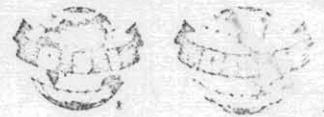


PLATE No. I.  
PRODUCTION PROCESSING FLOW.

