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ESSO EXPLORATION AUSTRALIA, INC. SYDNEY, N.S.W.

Bass Basin part VIII

KING ISLAND EAST MARINE SEISMIC SURVEY

FINAL SUBSIDY REPORT

by

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Sydney, N.S.W., Australia
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OR-008 (PT 1)

ABSTRACT

This report of the King Island East Marine Seismic Survey presents the interpretation of 252 miles of 6-fold C.D.P. detailed seismic coverage. This new control is integrated with the Esso Bass Marine Seismic Survey, Haematite reconnaissance data, and Esso Bass-1 subsurface data. Three structure and one interval maps are presented.

The Bass Basin is a silled Tertiary basin deposited on an extensively eroded upper Cretaceous surface. Marine and non-marine Cretaceous is deposited on a rough basement topography. An en-echelon system of faulting on the northeast and southwest flanks of the basin developed during the pre-Cretaceous period and has had subsequent movement through the close of the Oligocene. Structural movement throughout most of the Tertiary appears to have been in the form of subsidence with the present highs remaining as stable areas.

Three well defined anticlinal features have been mapped and several structural leads are indicated.

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INTRODUCTION

The objective of the King Island East Seismic Survey was to detail structural leads with the aim of locating possible well sites for future Bass Basin drilling. The previous Esso Bass Basin seismic survey mainly delineated build-up anomalies and only one drillable structural prospect was mapped. Esso Bass-1 tested a build-up anomaly and discovered that it was volcanic in origin. As a result of the King Island East survey there are two anticlines in addition to the one mapped by the previous Bass Basin seismic survey from which to choose the next Bass Basin drill site.

Geophysical Services International was the contractor for this survey. Six-fold C.D.P. was used and was designed to provide section multiple attenuation to a depth below the top of the Cretaceous. Water bottom multiples were attenuated by the application of G.S.I's MAE (Multiple Analyser and Eliminator) process. The King Island East Marine Seismic Survey contains 3109 reflection profiles for a total of 252 miles of coverage. Field work began on October 10, 1965 and was completed on October 25, 1965. Appendix II is G.S.I's "Field Operations Report Bass Strait - King Island East Prospect". The data were processed in the G.S.I. playback center in Perth, W.A. Playback of the data was made using filter setting out -47K and medium A.G.C. The data were presented as variable density sections.

INTERPRETATION

Generalized Geologic History

The good quality of the seismic data and excellent correlation between reflections and geologic markers in Esso Bass-1 make possible a reliable interpretation of the Bass Basin geologic history.

Prior to Cretaceous deposition a system of faults developed on the northeast and southwest flanks of the basin. The faults generally are en-echelon and in some instances a system of regional horsts and grabens are found. Cretaceous deposition of marine and non-marine sediments occurred upon this rather rough topography and in many cases deposition and faulting were contemporaneous. The close of the Cretaceous was marked by a period of uplift, fault rejuvenation and extensive erosion.

Basin subsidence, transgressive seas, and marine deposition persisted throughout most of the Tertiary. Local uplift and faulting along the older fault zones continued during the Eocene. Up to 1200 feet of Eocene rocks were deposited. Gentle erosion along the basin flanks is evident at the close of the Eocene. During the Oligocene transgressive marine deposition continued, depositing upwards of 1500 feet of sediment. Local uplift and faulting were less than during the Eocene. The upper Oligocene was marked by extensive volcanic activity. Many volcanic build-ups are recognisable on the seismic sections. A time of major subsidence and marine deposition began with the Miocene. Over 4500 feet of Miocene and younger Cenozoic deposits are preserved in the Bass Basin. The areas coincident with the northwest-southeast trending faults on the flanks of the basin remained relatively stable while the center portion of the basin subsided, forming the basin as we know it today. Some mid-Miocene volcanic activity occurred and one of these build-up anomalies was tested by Esso Bass-1.

A thin veneer of Quaternary sediments cover the predominantly Tertiary Bass Basin.

Refer to "Esso Bass-1 Well Completion Report" by Esso Exploration Australia, Inc., December 1965, for regional geology of the Bass area and generalised stratigraphy of the Bass Basin.

Velocity Control

Three expanded spread velocity profiles, a reversed refraction profile, T-ΔT analysis of selected reflection shots, and a velocity survey in the Esso Bass-1 provide velocity control in the basin. The time-depth curve plotted from the velocity survey in Esso Bass-1, was similar to the curve computed from the X^2-T^2 study. Because of the anomalous nature of the volcanic portion of Esso Bass-1, the X^2-T^2 curve was used for depth calculation. This curve is tabulated in Appendix I.

Reflectors

The Esso Bass-1 velocity survey provides good control for identification of reflections from upper Cretaceous and younger horizons. The middle Miocene, the top of the Oligocene, the top of the Eocene, the top of the Eocene sand in Esso Bass-1 and the unconformity at the base of the Tertiary generally have good reflection character and can be mapped throughout the basin. Basement can also be mapped in most areas where the sedimentary section is relatively thin, 10,000 feet or less.

Horizons Mapped

This report includes maps of the top of the Oligocene, top of the Eocene, unconformity at the base of the Tertiary and the interval between the top of the Eocene and the unconformity at the base of the Tertiary.

The unconformity at the base of the Tertiary is generally characterised by truncation of the upper Cretaceous reflections. The upper Cretaceous reflections are characteristically low frequency, normal amplitude reflections. These reflections represent a sandstone, siltstone, shale and coal section in Esso Bass-1. Structure on the unconformity at the base of the Tertiary is presented by Plate III.

The top of the Eocene is a good continuous reflection. In Esso Bass-1 the Eocene interval contains a predominantly shale unit at the top and a predominantly sandstone unit at its base. The Eocene sand is considered a prime target for future wells on structure. Structure on the top of the Eocene is presented by Plate II.

The Eocene to base of Tertiary interval pinches out towards the flanks of the basin and the zero edge is seismically mappable. The sand represents a greater percentage of the total Eocene in the thinner portions of the interval because the shale thins more rapidly than the sand does. This interval map is presented by Plate IV.

The top of the Oligocene is a high amplitude reflection often characterised by erratic dips. The Oligocene is easily mapped because the overlying lower Miocene is characteristically a low amplitude reflection interval. Many volcanic build-ups are evident at the top of Oligocene and the erratic dips are considered to be evidence of deposition of volcanics. Lower Oligocene reflections originate from a shale section at Esso Bass-1. Plate I is the structure map on top of the Oligocene.

Structural Anomalies

Six anticlinal anomalies have been mapped in the report area. Three of these anticlines have been detailed with seismic control. The anomalies have been labelled numerically on all of the maps. No anomaly quality grading is intended.

Anomaly K-1 is primarily a Cretaceous structure but exhibits some growth during Eocene deposition. There is approximately 300 feet of vertical and 16 square miles of areal closure at the basal Tertiary unconformity. Vertical closure is approximately 200 feet at the top of the Eocene and nil at the top of the Oligocene. This anomaly provides a drillable prospect on the south flank of the basin.

Anomaly K-5 was formed similarly to K-1. A high basement block is responsible for this being a positive area. Anomaly K-5 is along the basin's north flanking fault trend. Faulting occurred from the Mesozoic to the close of the Oligocene. K-5 is a well-defined anticline with 250+ feet of vertical closure and approximately 40 square miles of areal closure at the basal Tertiary unconformity. Basement closure is 1100 feet and vertical closure has decreased to 200 feet at the top of the Eocene and to 100 feet at the top of the Oligocene. A wildcat well on this anomaly would test a closed structure in a more shelfward position than the section penetrated by Esso Bass-1. The basal Eocene sand penetrated by Esso Bass-1 thins regionally towards K-5 but the sand is expected to be present on the structure.

Anomaly K-3 appears to be an Oligocene structure and was possibly formed contemporaneously with the interpreted stock immediately to the north. The thickest Eocene interval is in the K-3 area (see Plate IV). There is approximately 200 feet of vertical closure and 33 square miles of areal closure on the unconformity at the base of the Tertiary. At the top of the Eocene closure increased to 300 feet and 50 square miles. This increase in closure is due to the local thick Eocene deposition and post Eocene growth of the structure. There is 300 feet of closure at the top of the Oligocene. K-3 is considered less prospective than K-1 or K-5 due to its younger age.

Anomaly K-2 is a small anticlinal lead which will require further seismic control to assess its full potential. K-2 is along the same trend with the K-1 anomaly on the south flank of the basin and is interpreted to have experienced the same Cretaceous and Eocene growth as K-1.

Anomaly K-4 is a structural nose associated with a horst block. This feature lies in a favorable position relative to the apparent Eocene pinchout (see Plate IV). Additional seismic control is necessary to check the possible closure at K-4.

Several small closures on the upthrown side of down-to-the-shelf faulting have been detailed in the K-6 area. The largest has 100 feet of vertical and 8 square miles of areal closure. The Tertiary section thins regionally very rapidly to the northeast across the K-6 area making it stratigraphically favorable.

The oval shaped zero limit of the Eocene and Cretaceous on the northern end of line EK-25 (see Plates II, III, and IV) is due to the onlap edge of the Eocene and Cretaceous onto a basement high. This basement high has 300 feet of closure on the basal Tertiary unconformity map with the upper Oligocene resting directly on Basement.

CONCLUSIONS

The CDP technique has produced excellent data. Ties to key horizons at Esso Bass-1 are mappable over all of the report area with a high degree of confidence.

Three drillable structures have been mapped and several additional structural leads are indicated by the seismic control. Anomalies K-1 and K-5 were structurally positive areas during Cretaceous through Oligocene deposition and anomaly K-3 is dated as post-Eocene, probably late Oligocene. It is likely that Esso Bass-2 will be drilled on the K-5 anomaly.

APPENDIX I

BASS BASIN X^2-T^2 TIME vs. DEPTH

Depth	Two-way Time	Depth	Two-way Time	Depth	Two-way Time
100		3100	.910	6100	1.585
200		3200	.930	6200	1.605
300		3300	.955	6300	1.630
400	.125	3400	.975	6400	1.650
500	.160	3500	1.000	6500	1.670
600	.190	3600	1.025	6600	1.690
700	.215	3700	1.050	6700	1.710
800	.250	3800	1.070	6800	1.735
900	.280	3900	1.095	6900	1.750
1000	.310	4000	1.120	7000	1.775
1100	.345	4100	1.140	7100	1.800
1200	.375	4200	1.165	7200	1.820
1300	.405	4300	1.190	7300	1.840
1400	.430	4400	1.210	7400	1.860
1500	.460	4500	1.235	7500	1.880
1600	.490	4600	1.255	8000	1.980
1700	.520	4700	1.280	8500	2.080
1800	.550	4800	1.300	9000	2.170
1900	.575	4900	1.325	9500	2.265
2000	.605	5000	1.345		
2100	.630	5100	1.370		
2200	.660	5200	1.390		
2300	.690	5300	1.410		
2400	.720	5400	1.435		
2500	.745	5500	1.455		
2600	.775	5600	1.480		
2700	.800	5700	1.500		
2800	.830	5800	1.520		
2900	.855	5900	1.540		
3000	.885	6000	1.560		

Bass Basin part VIII

APPENDIX II

FIELD OPERATIONS REPORT

BASS STRAIT - KING ISLAND EAST PROSPECT

For

ESSO EXPLORATION AUSTRALIA, INC.
R.R. Tharp, Client Representative

GEOPHYSICAL SERVICE INTERNATIONAL
A Division of Texas Instruments Australia Limited
Sydney, New South Wales, Australia

GSI Party 921

E.W. Hart, Operations Supervisor
E.O. McCutchen, Quality Control Seismologist

Shooting Dates, October 10 to October 25, 1965

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SECTION I

INTRODUCTION

Geophysical Service International (GSI) Party 921 conducted a marine seismic survey between October 10 and October 25, 1965, in the Bass Strait-King Island East Prospect. Profile numbers were assigned with number 1 as the first shotpoint on each line; numbers increased in the direction shot. Line number 10 was shot in two parts; the northwest part (from "dogleg") was identified as line 10, the southeast part was identified as line 10A.

The entire program was shot for sixfold (off front end) common data point subsurface coverage. Logs were maintained on all instrument settings, streamer depths, water depths, direction shot and ship positions with respect to two fixed points.

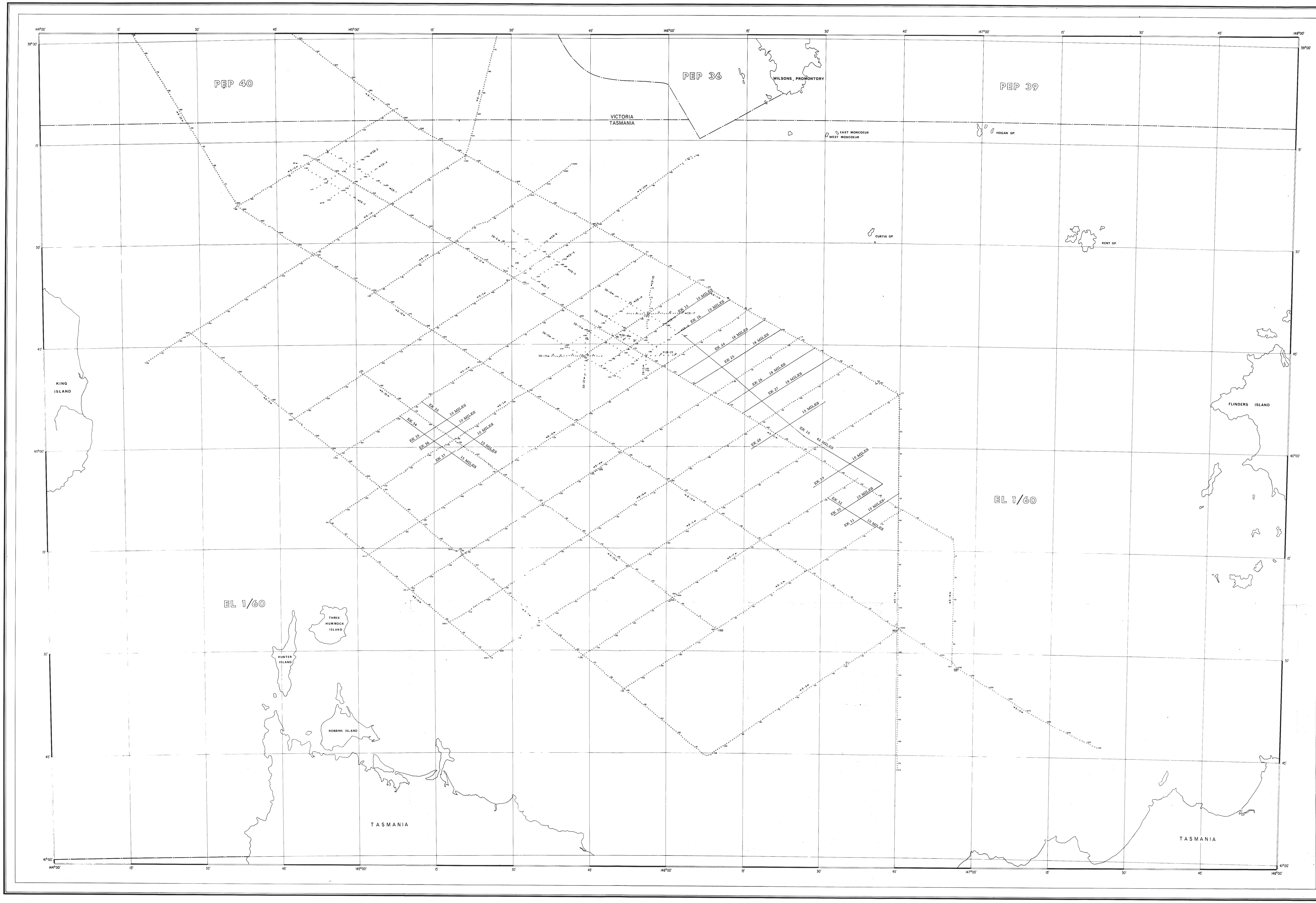
Data on the program, physical conditions of the prospect, operating techniques, and results of the total operation are presented in this report.

SECTION II

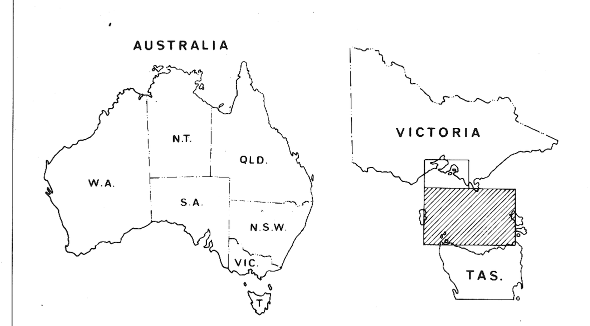
PROGRAM

The program as laid out by the client consisted of two areas east of King Island. The first area contained three lines running from SE to NW and two lines running from SW to NE for a total of 60.97 mi. The second area contained one principle line running from SE to NW, a second shorter line parallel to this line and 10 lines running from SW to NE for a total of 191.66 mi (Plate I).

Shotpoint positions (preplots) relative to the land-based DM Raydist stations were computed by IBM.



MAP INDEX



ESSO EXPLORATION AUSTRALIA INC., SYDNEY, NEW SOUTH WALES

THE BASS BASIN

VICTORIA - TASMANIA

052014

SEISMIC PROGRAM MAP

5 cm

Scale 1:250,000

4 0 4 8 12

MILES

AUTHOR: K.A. RICHARDS. DRAFTED BY: A.F STRAHAN
TO ACCOMPANY REPORT AUST. REVISED
SHEET II PLATE I

OR-008

SECTION III

PHYSICAL CONDITIONS

The two areas of the prospect are in open water of the Bass Strait 30 to 50 fathoms deep. The ocean bottom is generally flat with no major anomalies.

The weather during this operation was generally good. The seas were calm to moderate with moderate to heavy swells and winds of force 3 to 5. On October 15 and 16 some difficulty was experienced in recovering the streamer. Moderate to heavy swells have been a contributing factor to the number of "bubbles."

SECTION IV

OPERATING TECHNIQUES

A. MARINE CABLE (STREAMER)

The marine cable was a neutral buoyant streamer composed of 24 equally spaced live sections 100 ft long and 28 dead sections 114 ft long. Each trace input was the composite of 20 crystal detectors spaced at 5-ft intervals in the live sections. Any two adjacent live sections were separated by a 114-ft dead section, a section without crystal detectors. There were four dead sections in front of the number 1 live section. The second dead section contained nylon stress members which served the purpose of diminishing cable noise originating from the towing vessel or the head buoy. There was one dead section between group number 24 and a floating cable attached to a tail buoy. (See Plate II.)

The neutrally buoyant marine streamer was ballasted to ride horizontally below wave action. A suppressor ("pig") attached to the forward end of the streamer was suspended below a large buoy by a chain whose length determined the streamer depth. A variable length of non-buoyant lead-in cable connected the streamer to the towing vessel.

Pressure-sensitive streamer-depth transducers were located between groups 8-9, 13-14 and 23-24. These transducers were calibrated to give correct streamer depth readings in the range 0 to 50 ft. Streamer depth readings were made from three meters mounted in the Instrument Room.

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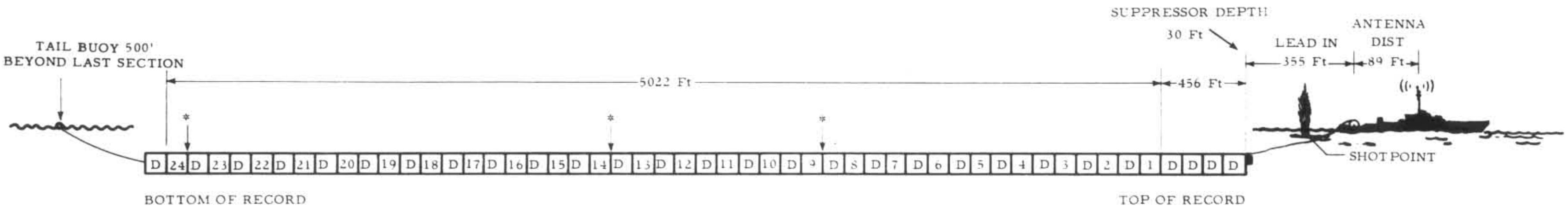


a) Letter "D" Indicates Dead Section 114 Ft Long
b) * Indicates Location of Streamer Depth Transducer
c) Live Sections 100 Ft Long
d) "Lead In" Distance Measured in Roll-Up Position
No Yo-Yo or Reel Free

5 cm

PLATE II

B. RECORDING AND AMPLIFICATION SYSTEM

Output of each of the hydrophone groups (live sections) was amplified with a Texas Instruments series 8000 amplifier system and recorded simultaneously by a SIE PMR-20 frequency-modulated tape recorder and a SIE TR06-A photo-oscillograph. Detailed descriptions of this equipment are available from the respective manufacturers.

In normal recording routine a playback was made of every sixth shotpoint. These were direct playbacks from the tape head to the galvanometer, and all signals were in phase with those on monitor records (first breaks down). High production rates did not allow normal playback routine at all times. Modulation levels were monitored by a meter on the PMR-20 tape recorder system.

Instrument settings were established initially after consultation with the client representative. Automatic Gain Control (AGC) was the only gain mode used in amplification. The rate of AGC attack and release was 30 db/sec. A 92/out filter was used throughout the prospect. No filter test shots were taken at the beginning of the prospect. Cable noise test and straight-gain recordings were made daily to determine signal-to-noise ratios.

C. WATERBREAK AMPLIFIERS

The shot-generated pulse traveling through the water directly to the detector was used to locate the shot relative to the submerged streamer. While this high-frequency transient was received by all crystal detectors, it was sharply filtered by the relative narrow passband used in the seismic recording. Four GSI waterbreak amplifiers amplified the raw signal from groups 3, 10, 17 and 24. The waterbreaks appeared on traces 26 and 27 of each monitor record; they were not recorded on magnetic tape.

D. NAVIGATION - SHIP AND SHOT POSITIONS

Position of the recording ship was controlled by a DM Raydist navigation system supplied and operated by Offshore Raydist International.

In the DM Raydist system, stations transmit and receive radio frequency signals which change phase relations as the ship moves relative to two fixed shore stations. The phase changes are converted to changes in lane counts by instruments on board the ship, thus the lane distances from the ship to the two shore stations may be read continuously if the correct lane distances are calibrated or set into the Raydist instruments at the beginning of the survey.

The DM Raydist system used on this prospect was calibrated from a known position of the wharf at Burnie, Tasmania, and checked by crossing the base line. The initial calibration on October 11 was six lanes off when checked by crossing the base line. The calibration point location was checked by IBM and the original data were found to be in error. A second calibration, using the new data, on October 12 checked within 0.03 lanes of the calculated length of the base line.

Two buoys were laid in the first part of the prospect area and their position determined by Raydist. Raydist calibration was checked before the beginning of each day's shooting and at the end of each day's shooting when possible. Upon completion of the first part of the prospect, the ship returned to the calibration point at Burnie and calibrations checked all right.

Signal was lost while steaming to the second part of the prospect and the ship returned to Burnie for re-calibration. Two buoys were set in the second area on October 19 and the same daily calibration was followed.

Track-plots (distance in lanes from shore stations to planned shotpoint locations) were computed by IBM to provide a shotpoint interval of 428 ft. These locations were occupied as nearly as possible and the shipboard operator read and recorded lane distances for the actual fixes. This data were then plotted to produce a map showing the location of the DM Raydist antenna for each point at which a fix was taken. The final shotpoint location map was prepared by scaling, from the fix position, the DM Raydist antenna-to-shotpoint distance (setback).

Shotpoint-to-Raydist antenna distance was calculated as follows: the measured distances from the Raydist antenna to the first effective hydrophone in group number 3 was 1332 ft. The velocity of sound in sea water, corrected to a measured temperature of 55° F, is 4,920 fps. Setback = 1332 ft - (number 3 waterbreak time) (4,920 fps). The shotpoint was located 10 ft to port or starboard and a variable distance in front of group number 1 as indicated by the calculated setback distances.

Two base stations and one calibration point were used. These positions are described in an appendix.

E. SHOOTING

Charges were fired off the front end of the spread via one of two floating, single-conductor firing lines located on either side of the streamer. Charges were suspended by strings attached to rings on the firing line and fired at an average depth of 6 ft below the water surface. The blaster was activated by the PMR-20 magnetic recorder at the appropriate instant. A timebreak originating from the blaster was recorded trace 25 (channel 27 on tape). Charges were loaded at 428 ft intervals for sixfold coverage. Charges were 50 lb cans or two 25-lb cans of nitro-carbo-nitrate. When two 25-lb cans were used it was difficult to control shot depth and excess bubbles resulted. Moderate to heavy swells also were a contributing factor in this problem.

F. NORMAL RECORDING AND SHOOTING CYCLE

Shooting and recording were controlled to a large degree by the Raydist operator. The time interval between shotpoints was determined by a series of alignment points located at either end of all lines. This time interval was set into a master interval timer which controlled the shooting and recording sequence. As the ship slowed down or speeded up, the time interval on the master timer was varied so that it keyed or zeroed when the ship arrived at the next pre-plotted position. When the master timer reached zero, it set the PMR-20 in motion which fired the shot. The master timer also reset a timer on the shooting platform. This timer was used to vary the loading cycle to conform with the rate at which the charges moved down the firing line. Sequential counters in the instrument room and on the bridge also were controlled by the master timer. These counters were used to indicate shotpoint numbers. A relay controlled by the bridge counter caused a mark to be scribed on the Raydist tape and fathogram. The Raydist mobile operator read the ship position only when the counter advanced.

G. WATER DEPTH RECORDINGS

Two continuous recording fathometers were available on the ship; however, only one instrument was used at any given time. Details of these instruments will be found in an appendix. These fathometers were checked by lead-line soundings at Geelong, Victoria, on October 9.

The shot instant was marked automatically by a vertical line on the fathogram which was numbered for every tenth shotpoint. At the beginning of each line the following information was placed on the fathogram: line number, direction shot, fathometer and transducer in use, scale, and range.

SECTION V

RESULTS

After initial problems in calibration and transmitter malfunction on the 'Red' station, the DM Raydist system provided good horizontal control for the survey.

October 13 was spent ballasting the streamer and taking test shots. Because of the high number of misfires and "bubble" shots, this data were rejected and reshot. Probable causes of this problem were as follows:

- Initial lack of synchronization between the charge-loading and shooting cycles
- Moderate-to-heavy swells causing the charge to "run deep" on crests causing bubble shots or shallow in troughs causing "air blasts"
- Poor hydrodynamic control when two 25-lb charges were tied together

The second two of these problems continued to cause misfires and bubbles throughout the prospect.

Streamer depth was maintained between 25 and 50 ft below the surface throughout the prospect.

Streamer noise tests were made daily. The average streamer noise on any one record was generally less than 10 to 15 μv with occasional bursts of 30 to 40 μv caused by cable jerk originating from the tail buoy. These higher-level bursts were of very low frequency and will be filtered out in processing.

The signal-to-noise ratio, as evidenced by the straight-gain recordings and noise test, was uniformly good over the prospect and generally exceeded 15-to-1 at a time of 2.5 sec. In a few areas the signal decay rate was rapid after 2 sec, possibly indicating a shallower section or faulting.

No waterbreak was recorded for group number 24 on line EK-33 and for the first 81 shotpoints of line EK-34. Minor faults caused by instrument malfunction are noted on "Recording and Playback Logs".

Respectfully submitted,

GEOPHYSICAL SERVICE INTERNATIONAL

E. O. McCutchen
Quality Control Seismologist

052025

SHORAN FINAL REPORT

PROJECT 203

GEOPHYSICAL SERVICE INTERNATIONAL

PARTY 921

OFFSHORE TASMANIA
(BASS STRAITS)

FOR

ESSO EXPLORATION AUSTRALIA, INC.

BY

OFFSHORE NAVIGATION, INC.

NOVEMBER 1965

052026

Bass Basin part VIII

SHORAN FINAL REPORT
PROJECT 203
GEOPHYSICAL SERVICE INTERNATIONAL
OFFSHORE TASMANIA
ESSO EXPLORATION AUSTRALIA, INC.
BY
OFFSHORE NAVIGATION, INC.
NOVEMBER 1965

052027

ABSTRACT

Project 203 was a Shoran and Raydist (DM) positioned and controlled marine siesmic survey for potential mineral deposits in the Bass Straits offshore Tasmania. The principal involved was the Esso Exploration Australia, Incorporated (ESSO). The prime contractor and operator was Geophysical Service International (GSI). Horizontal control was furnished by Offshore Navigation, Inc. (ONI).

The scope of the attached report encompasses:

I. THE SHORAN RADIOPOSITIONING SYSTEM

The Shoran system is a radar transponder type of radiopositioning 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 distances 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.

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 signal 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.

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 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.

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

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

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

where,
d = estimated maximum range, in miles
h_1 = height of mobile station antenna, in feet, above sea level
h_2 = height of base station antenna, in feet, above sea level
k = empirical range factor

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

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

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

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 within the first few thousand feet of the atmosphere. It has the effect of confining the radio waves near the earth's surface, and acts as a duct to bend radio waves around the curvature of the earth. Under these conditions the factor, k, above 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 ± 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, possible by a factor of 2, by correcting the propagation velocity slightly under varying meterological conditions, and by the

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

application of more rigid calibration and operating specifications. For most operations, this 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.

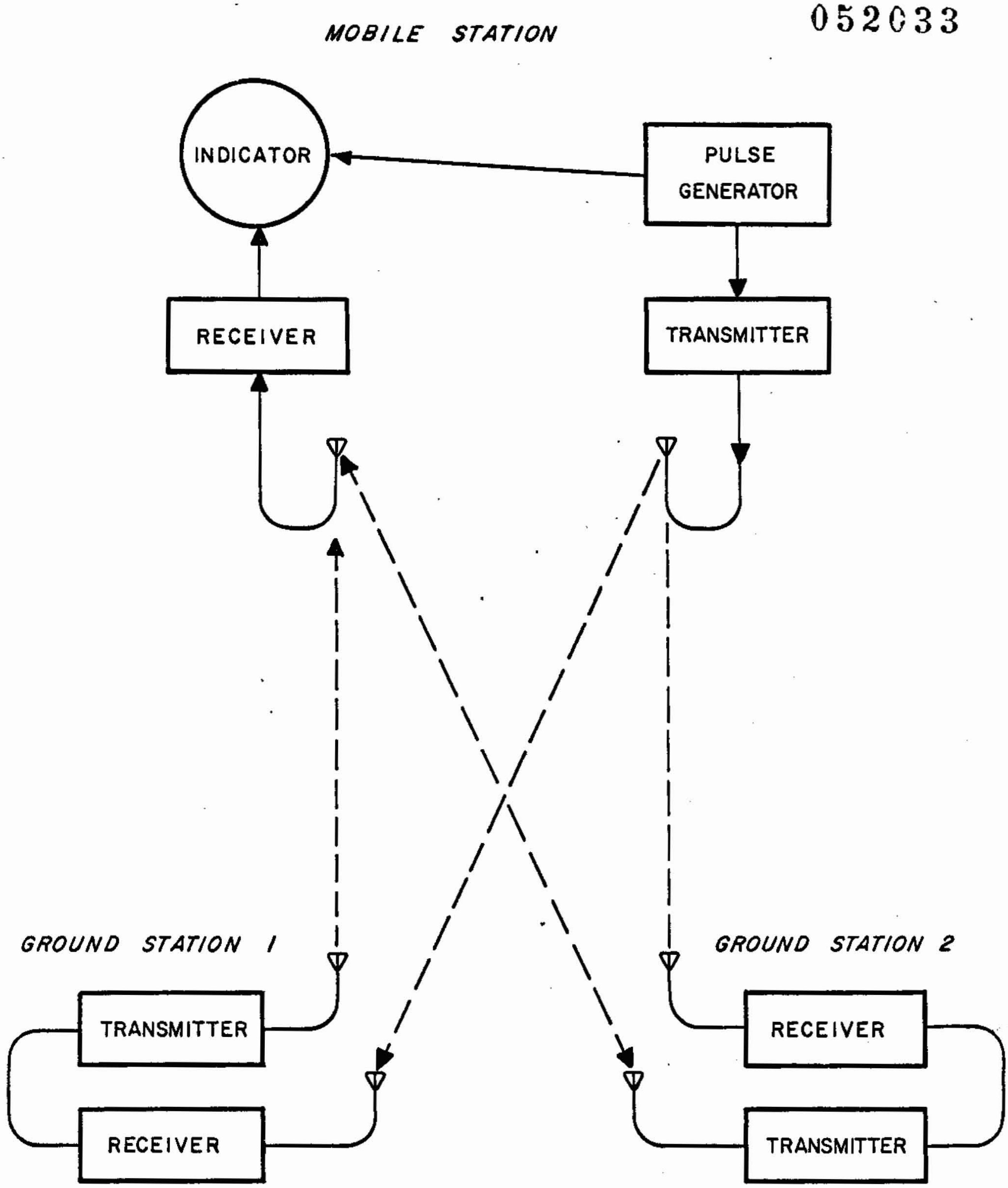
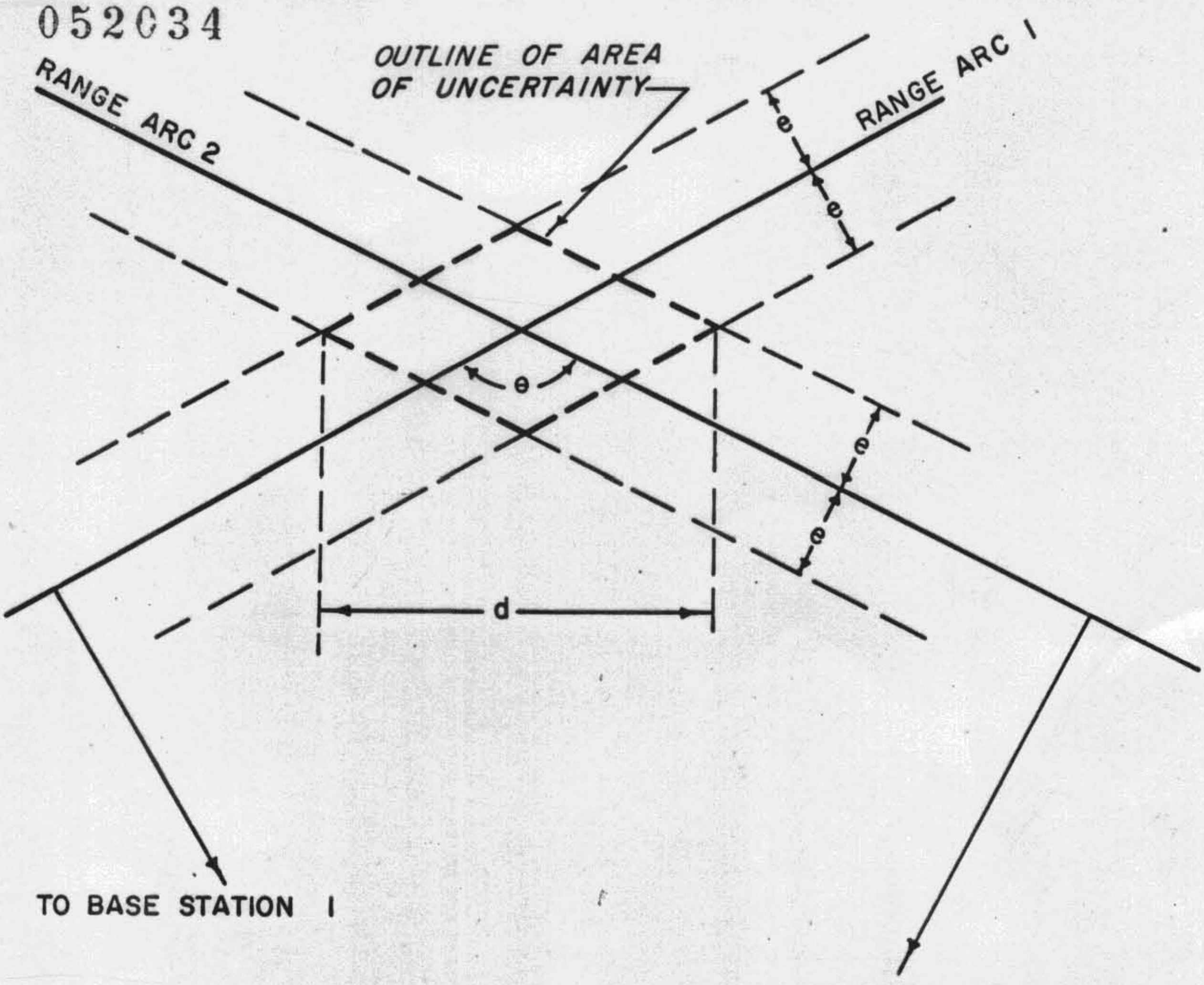


FIGURE 1
SIMPLIFIED BLOCK DIAGRAM OF BASIC RADIO EQUIPMENT OF A SHORAN SYSTEM

052034



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

e = RANGE ERROR

θ = ANGLE OF INTERSECTION OF RANGE CIRCLES

FIGURE 2

AREA OF UNCERTAINTY OF POSITION DUE TO ERROR IN RANGE MEASUREMENT

5 cm

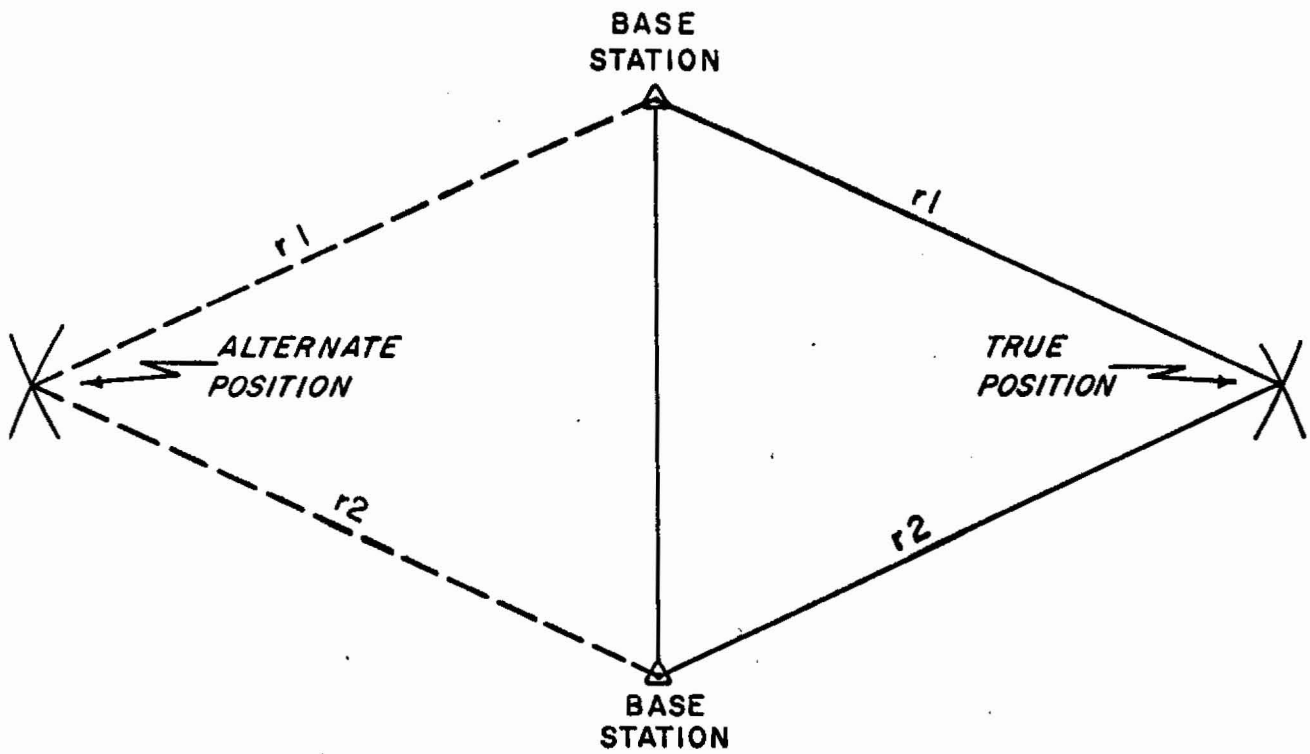
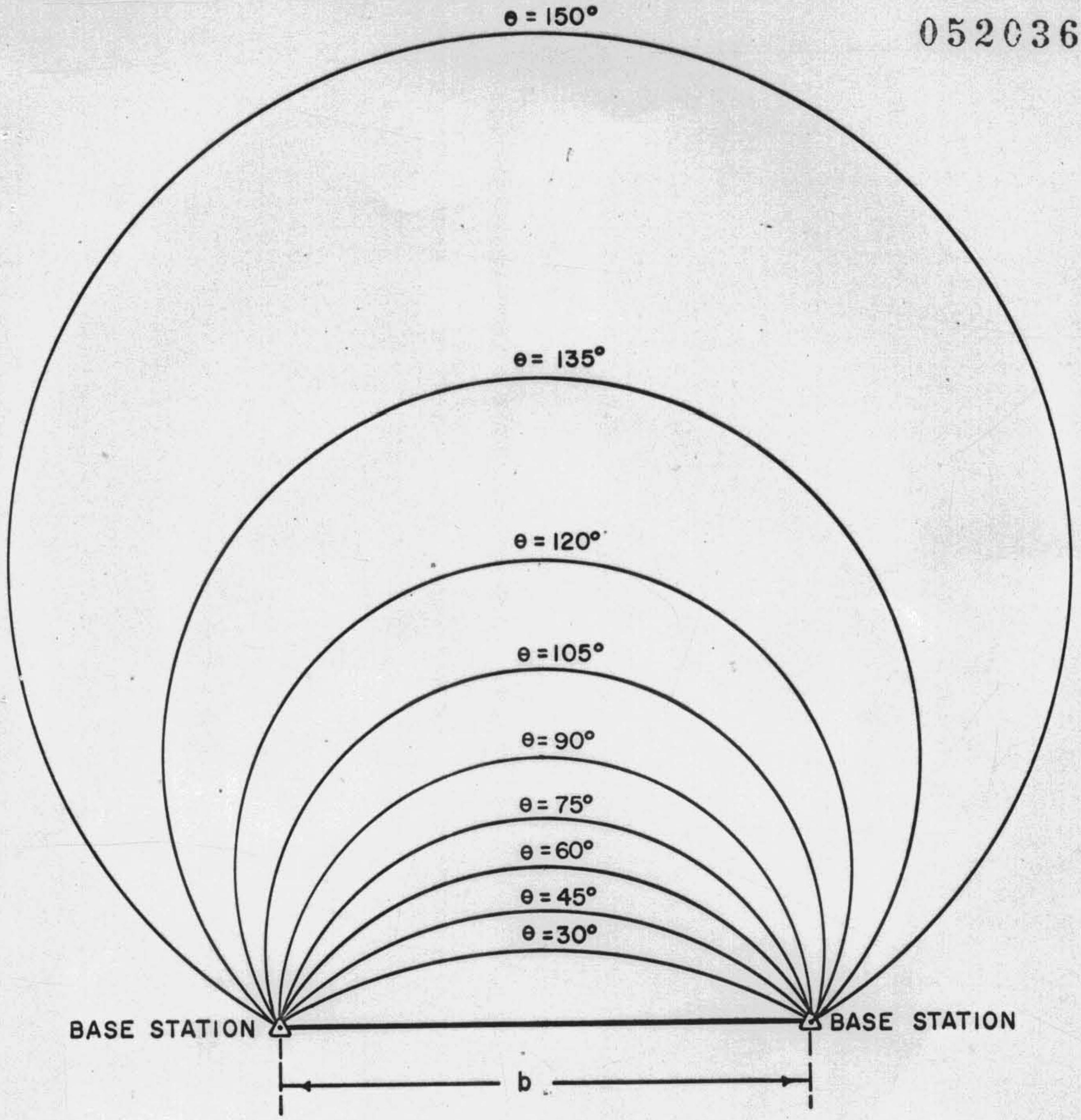


FIGURE 3

POSITION AMBIGUITY IN CIRCULAR RANGE SYSTEM

5 cm

052036



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

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

WHERE θ IS ANGLE OF INTERSECTION BETWEEN RANGE CIRCLES

5 cm

FIGURE 4

RELATIVE AREA OF COVERAGE, CIRCULAR RANGING SYSTEM

DM RAYDIST

DM Raydist is the most precise radiolocation system to be used as an aid to navigation. Following is a brief description of its principles of operation.

The DM Raydist system is a direct ranging system operating on the phase comparison principle. The usual system uses two base stations and a mobile station for a two way fix. If a three way fix is wanted, it is necessary to add another base station. All direct ranging systems are saturable and DM is no exception. We're found two mobile units to be the practical limit. Even then certain limitations still exist that are overcome by operational techniques.

Raydist operates on the relative phase between two continuous wave radio transmitters. There are over 30 different Raydist configurations, and DM is the latest in the Raydist evolution. Raydist phase measurement is accomplished by comparing the phase of the output of two receivers on the mobile unit. One receiver is tuned to pick up the audio beat between two hetrodyning transmitters, and the other receiver picks up a return link from the beach. This return link is a transmitter modulated by the same audio tone; the beat between the two hetrodyning transmitters. Out of one receiver on the boat there is a phase change every wavelength of RF, and out of the link receiver there is the unchanging phase of the modulated wave from the link transmitter.

In DM one of the hetrodyning transmitters is on the boat. To keep from blocking the hetrodyning receiver on the boat, it is necessary to operate on harmonically related frequencies. The transmitters operate on frequencies bearing the relationship of F and 2F plus A, where A is the hetrodyne or audio difference. This is usually 400 Cycles per second. This requires a special receiver, one side to pick up F and multiply by two, the other side to pick the 2F plus A, mix the two and generate the audio tone.

Refer to Figure 1 "Basic Elements of The DM System."

The base stations are set ashore with a 50 to 100 mile separation, one called Red and one called Green.

The Red station has one of the hetrodyning transmitters, a link transmitter, and a receiver. The receiver picks the 2F plus A from the boat, and the F from the local transmitter. The output of the receiver modulates the Red link transmitter.

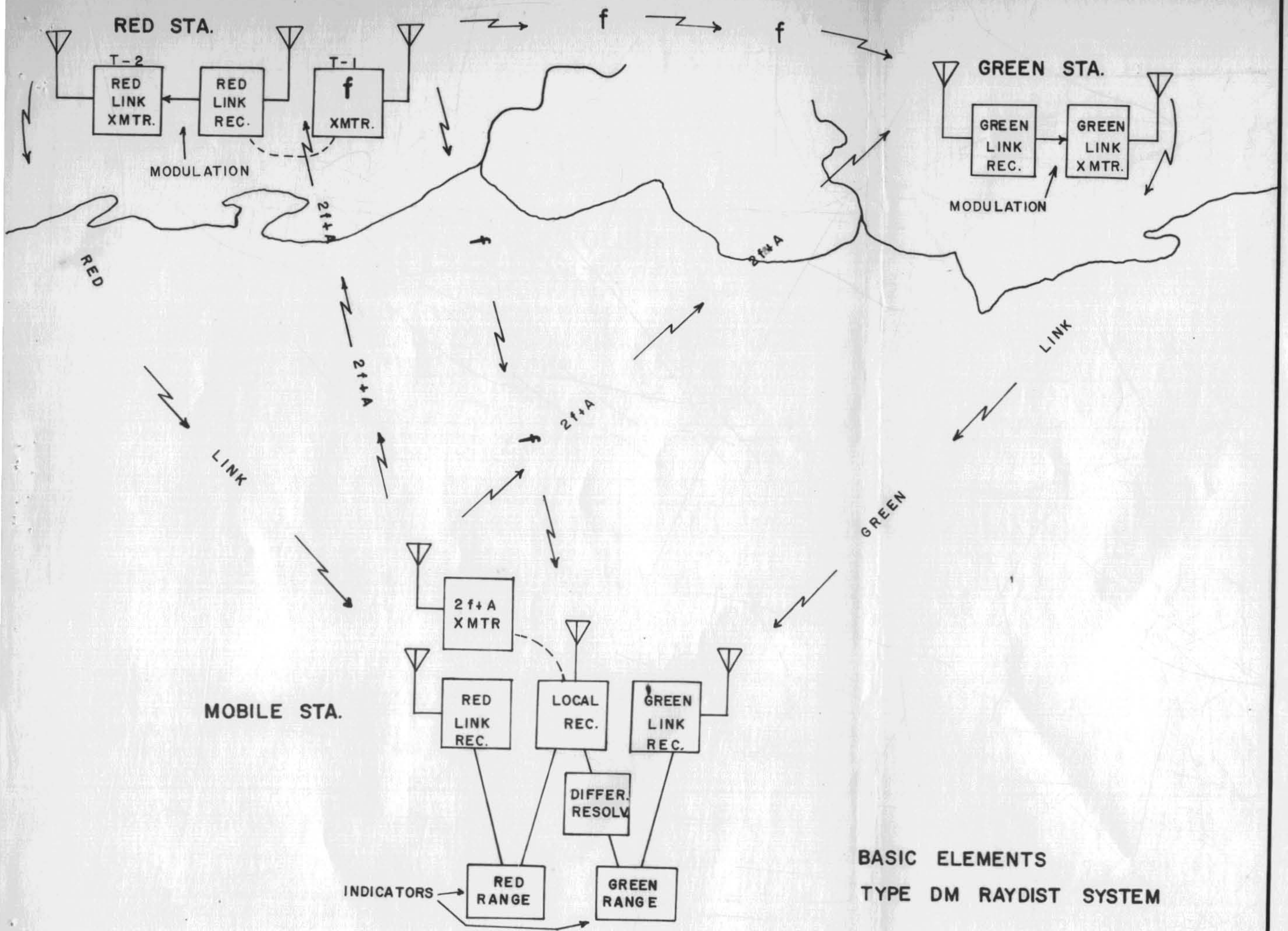
The Green station has one receiver and a link transmitter. The receiver picks up the F from the Red station, and the 2F plus A from the mobile station. The output of this receiver modulates the Green link transmitter.

The mobile unit carries the other hetrodyning transmitter that transmitts 2F plus A. It has a receiver that picks up the F from the Red station, and the 2F plus A from the local transmitter.

The output of this receiver is phase compared to the output of the Red link receiver to give Red range and the output of the receiver is likewise compared to the output of the Green link receiver to give Green range.

Red and Green range are presented as mechanical revolution on a dial. An odeometer counter is attached to keep a total count; a strip chart recorder keeps permanent record of the lanes traversed.

DM operates in the frequency range of 1500 to 3500 Kilocycles. Twenty-four hour operation is common in ranges to 125 miles, and tracking has been done up to 400 miles. The effect of the greater ranges is to shorten the working day because of sky wave effect at the greater distances.



BASIC ELEMENTS
TYPE DM RAYDIST SYSTEM

052040

II. AREA OF OPERATIONS

The area of operations extended approximately 100 miles into the Bass Strait from the northern coast of Tasmania. The area was approximately bounded by North Point on the West and Port Sorell on the East. ONI established its main base of operations at Melbourne, Australia, and an alternate base at Wynyard, Tasmania. (Plat 1)

III. OPERATIONS RECAP

On September 8, 1965, ONI personnel, accompanied by electronic navigation equipment, left Wynyard by chartered aircraft for Melbourne. By September 12, the personnel and equipment were in Melbourne. The ONI main base of operations was established in Melbourne by September 17. At this time GSI's base of operations had already been established in Geelong, Victoria, Australia. Establishment of the base stations commenced on October 3 and was completed by October 4.

The full compliment of ONI's field crew was present in the work area on October 9. ONI's alternate base of operations was established in Wynyard, Tasmania, by October 10.

The M/V MARINO (recording and shooting) arrived in Geelong, Victoria on October 8. The vessel had Shoran mobile equipment installed on board; this equipment had previously been installed in Sydney, N.S.W., Australia. Upon the vessels arrival in Geelong, the Raydist equipment installation was

III. OPERATIONS RECAP (continued)

initiated and was completed at Geelong on October 9, 1965.

The first Shoran and Raydist fixes were recorded on October 12. Actual seismic operations commenced on October 13 and continued through October 24. The dismantling of the base stations started immediately after the completion of the prospect and was completed on October 25. By October 27, the Raydist base station equipment was in Melbourne.

On November 5, the Raydist technician and equipment were released by GSI. The Shoran personnel and equipment were reassigned.

IV. MAPPING AND BASIC CONTROL

There were approximately 2890 shotpoints and 1260 intermediate shotpoints pre-plotted by IBM in Melbourne. Approximately 3034 positions were post-plotted at ONI's base of operations. The ONI field draftsman constructed three field charts, scale 1:50,000. These charts and copies of the field data were turned over to GSI's representative on October 25. For step-back distances used during the course of the operation, refer to Addendum A.

The field charts and the base station coordinates are based upon the Australian Transverse Mercator, Clarke 1858 Spheroid, Belt 7, Central Meridian 146° East.

IV. MAPPING AND BASIC CONTROL (continued)

There were three Raydist base stations used to position and control the prospect. There was one Shoran base station employed. The Shoran network was used to verify the position of key bouys and to reposition them if they had been displaced. Following is a tabulation of the base stations along with their coordinates.

POINT SORELL (Raydist Red Station)

Latitude	41°07'17".044	X	448,778 yards
Longitude	146°31'51".876	Y	935,472 yards
Elevation	Sea Level		

The position of Raydist base station Point Sorell, Tasmania, was determined by transit bearings to triangulation station Asbestos and a distance determination to triangulation station Point Sorell involving an electrotape. The coordinates for the aforementioned triangulation stations are as follows:

Triangulation Station		Coordinates	
Point Sorell			
Latitude	41°07'25".776	X	448,581.30 yards
Longitude	146°31'44".236	Y	935,178.60 yards
Asbestos			
Latitude	41°08'05".083	X	463,823.14 yards
Longitude	146°41'42".080	Y	933,745.30 yards

The antenna location is identified by a rock cairn which covers a marker inscribed "Raydist Survey Point." The Raydist station is located on the property of Mr. D. C. Montcriff and he must be approached prior to siting the station on his

IV. MAPPING AND BASIC CONTROL (continued)

property. He knows the point where the Raydist antenna was located.

STANLEY (Raydist Green Station)

Latitude	40°43'28".716	X	332,319 yards
Longitude	145°16'03".035	Y	983,524 yards
Elevation	Sea level		

The position of Raydist base station Stanley, Tasmania, was determined by transit bearings to triangulation station Rocky Cape (Number 692) and a distance determination to "The Nut" triangulation station involving an electrotape. The coordinates for the aforementioned triangulation stations are as follows:

Triangulation Station		Coordinates	
Rocky Cape (692)			
Latitude	40°52'52".759	X	353,538.35 yards
Longitude	145°29'45".510	Y	964,644.57 yards
The Nut			
Latitude	40°45'51".527	X	335,767.20 yards
Longitude	145°18'15".894	Y	978,734.02 yards

The antenna location is identified by two five-gallon containers, side by side, filled with cement and sunk three quarters of their length down into the sod. The containers are marked "Raydist Survey Points." The Raydist station is on the property of the Van Dieman Land Co. Mr. R. L. Hyland, attorney for the company, must be approached prior to siting the station on the company's property. Mr. Hyland is located

IV. MAPPING AND BASIC CONTROL (continued)

at the Van Dieman Land Co. in Burnie, Tasmania.

BURNIE (Raydist Calibration Point)

Latitude	41°03'11".773	X	392,713 yards
Longitude	145°55'14".677	Y	943,892 yards
Elevation	Sea level		

At this time there is no available information concerning the location or identification of this point. As soon as information is available it will be forwarded so that it can be incorporated in this report.

MOUNT OBERON (Shoran Station 704)

Latitude	39°02'31".72	X	432,697 yards
Longitude	146°20'43".17	Y	188,044 yards
Elevation	1,845 feet		

Mount Oberon triangulation station is approximately two miles east of the Tidal River Victoria Post Office, Wilsons Promontory, Victoria, Australia. A winding mountain road leads from Tidal River to the P.M.G. repeater station. The end of the road is approximately four hundred feet short of the mountain top and the triangulation station location. From the end of the road, due to the steep rocky terrain, all equipment must be hand carried to its final location. The triangulation station marker is a brass plaque embedded in rock. The Shoran antenna was erected on top of this marker.

V. GENERAL INFORMATION

A. Prior to the start of the operation all Shoran equipment was calibrated over a computed range using ONI's standard calibration procedures. Periodically during the course of the operation the Shoran equipment calibration was rechecked to be assured that the Shoran observed ranges were within prescribed limits.

B. During the course of the operation there was one radiotelephone frequency used for communications between the ONI base of operations, the mobile radiolocation station and the base stations. The frequency used was 2816 kilocycles and was satisfactory for radiotelephone communications 24 hours every day.

C. Approval to use the Shoran, Raydist and radiotelephone frequencies required for this operation was obtained from P.M.G. Radio Branch, Melbourne C1, Victoria, Australia.

V. GENERAL INFORMATION (continued)

D. There was a total of 12 hours and 55 minutes Shoran lost time during the course of the operation. The itemized lost time and the reasons therefore are listed below:

DATE	LOST TIME HOURS	MINUTES	REASON
October 14	5	50	Point Sorell Station failed to meet schedule; faulty alarm clock.
October 16	7	05	Radio signals from Point Sorell were too weak to be usable.

VI. PERSONNEL

NAME	POSITION
Sosa, R.	Party Chief
Breckinridge, W.	Draftsman
Diaz, G.	Draftsman
Penton, R.	Mobile Operator
Shirey, J.	Mobile Operator
Bes, R.	Base Operator
Crichton, J.	Base Operator
Hayes, R.	Base Operator
Reyland, S.	Base Operator

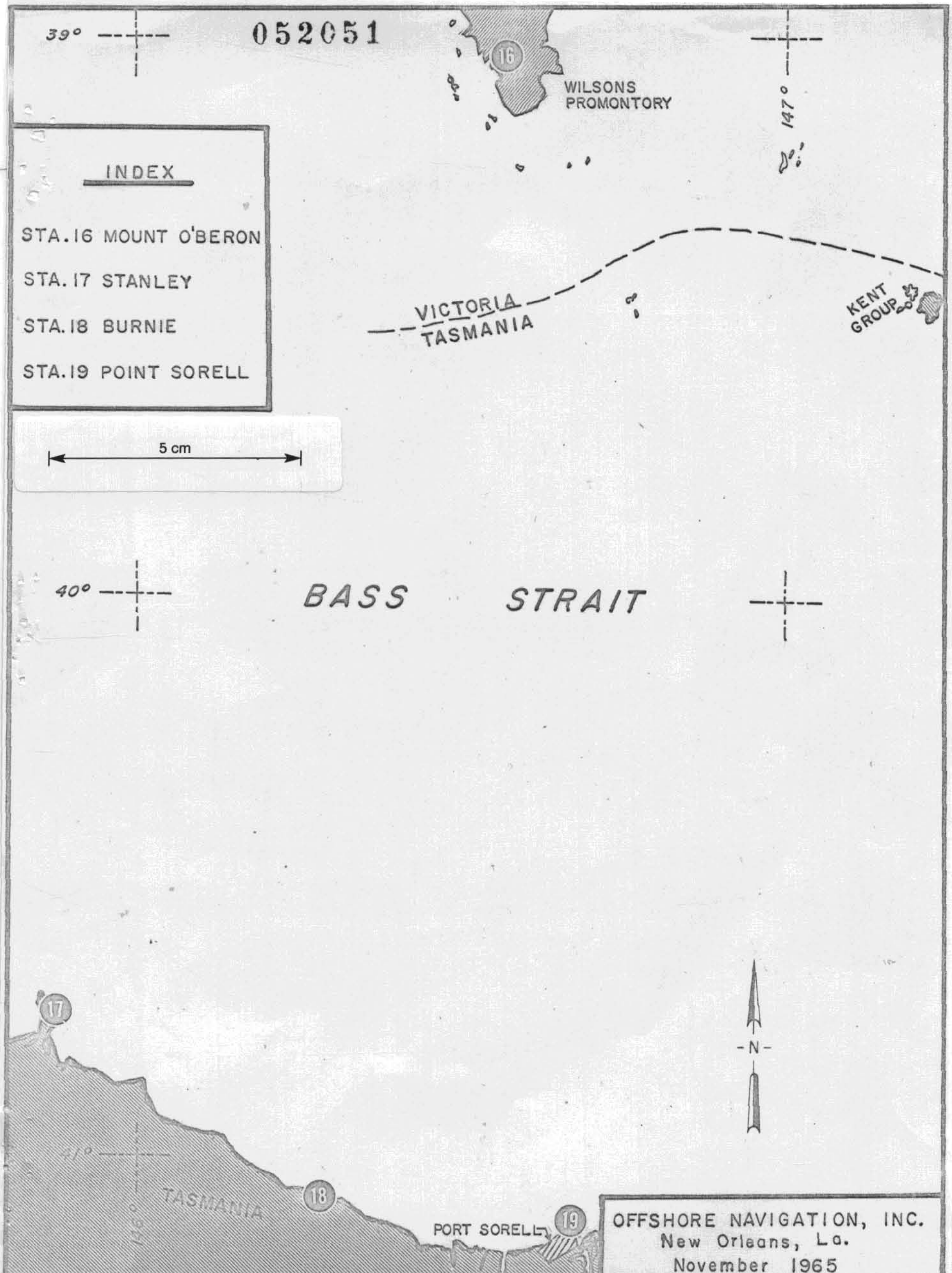
VII. DISTRIBUTION

Four copies to Geophysical Service International, G.P.O. Box 3914, Sydney, N.S.W., Australia.

Two copies to Offshore Navigation, Inc., New Orleans, Louisiana, U.S.A.

ADDENDUM A TO FINAL REPORT P-203 - STEPBACK DATA

LINE	DIRECTION SHOT	SHOTPOINT NUMBERS	STEPBACK
EK 10	NW	1-224	702'
EK 10	NW	225A-227A	742'
EK 10	NW	228-331	742'
EK 10 Reshoot	NW	45A-202A	692'
EK 10A	SW	1-126	742'
EK 15	SW	1-129	732'
EK 16	NE	1-138	742'
EK 24	NE	1-218	742'
EK 25	SW	1-216	742'
EK 26	SW	1-222	732'
EK 27	NE	1-215	747'
EK 28	SW	1-189	771'
EK 29	SW	1-126	742'
EK 30	SE	1-126	706'
EK 31	NE	1-126	737'
EK 32	SE	1-121	737'
EK 33	NW	1-195	737'
EK 34	SE	1-190	737'
EK 35	NE	1-126	781'
EK 36	SW	1-77	692'
EK 36	SW	76A-120	747'
EK 37	NE	1-120	707'



052051
39°
40°
41°
146°
147°
INDEX
STA. 16 MOUNT O'BERON
STA. 17 STANLEY
STA. 18 BURNIE
STA. 19 POINT SORELL
5 cm
WILSONS PROMONTORY
VICTORIA
TASMANIA
KENT GROUP
BASS STRAIT
TASMANIA
PORT SORELL
16
17
18
19
N
OFFSHORE NAVIGATION, INC.
New Orleans, La.
November 1965

PLAT I

APPENDIX B

STATISTICS AND KEY PERSONNEL

Client	Esso Exploration Australia, Inc.
Date commenced	October 10, 1965
Date finished	October 25, 1965
GSI Party Number	921
Headquarters port	Geelong, Victoria, Australia
Area of survey	Bass Strait-King Island East
Name of survey ship	MV MERINO
Type of shooting	Single and sixfold common data point
Total number of profiles	3,109
Total continuous 600 percent subsurface coverage	252.63 mi
Profiles per mile	12.3
Days on prospect	16 days
Lost time	7 days
Travel	
To and from prospect	2 days
Calibrating Raydist and setting buoys	4 days
Test and experimentation	1 day
Production	9 days
Explosives used	222,675 lb
Number of misfires (not reshot)	154

Key personnel

Operations Supervisor	E.W. Hart
Party Manager	T. Moore
Quality Control Seismologist	E.O. McCutchen
Observer	T. Moore
Shooter	K. Nicol
Captain	B. Christie
Raydist Operators	R. Penton
(mobile)	J. Shirer

APPENDIX C

SPREAD DETAILS

Type of cable	Neutral buoyant streamer
Distance from center group 1 to center group 24	4922 ft
Interval between group centers	214 ft
Number of detectors per group	20
Interval between detectors within group	5 ft
Distance from shotpoint to nearest detector in group number 1 (average)	168 ft
Distance from Raydist antenna to nearest detector group number 3	1332 ft
Distance from fathometer to nearest detector group number 3 forward transducer;	1392 ft
Aft transducer	1298 ft
Depth of transducer below mean water line forward transducer;	7 ft
Aft transducer	13 ft
Size of charge	50 lb
Depth of charge	6 ft
Average shot offset	10 ft
Average depth of detector	35 ft

APPENDIX D

INSTRUMENT DETAILS

Type of amplifier	Texas Instruments Model 8000
Type of magnetic recorder	SIE Model PMR-20
Type of photo-oscillograph	SIE TROG-A
Type of fathometer	Marconi Marine "Seamarc" Recording Echometer

Instrument Settings:

Ultimate sensitivity	1µv-31 MV
AGC attack rate	30 db/sec
release rate	30 db/sec
Filter, recording	92/out
Suppression	70-80 db
Average percent modulation on tape	75 percent
Modulation level of 100 c/s timing signal	75 percent

Compression wave at hydrophone gives galvo downswing except as follows: trace number 22 gives galvo upswing on lines EK-25, shotpoints 1-216; line EK-24, shotpoints 1-218; line EK-10, shotpoints 1-331; line EK-16, shotpoints 1-138; line EK-15, shotpoints 1-129; line EK-29, shotpoints 1-126; and EK-32, shotpoints 1-121. Trace number 14 gives galvo upswing on line EK-29, shotpoints 1-126. PMR-20 head allocation (streamer normal)

Heads 1-12	Seismic traces 1-12
Head 13	Noise cancelling trace

Head 14	Timing signal (100 c/s from PMR-20 fork)
Heads 15-26	Seismic traces 13-24
Head 27	Time break
Head 28	Not used

TROG-A Photo-Oscillograph galvo allocations

1-24	Seismic traces 1-24
25	Time break trace (monitor and playback)
26-27	Water break traces on monitor (dead on playback)
28	Records 100 cycles from PMR-20 on monitor (100 cycles from tape on playback)
Timing lines	Separate timing line generator (monitor and playback)

Marconi marine 'Seamarc' Recording Echometer

Ranges

A	0-60 fathoms
B	50-110 fathoms
C	0-240 fathoms
D	200-440 fathoms

Ranges A and C print zero mark along paper's top edge. Depths below transducer are scaled from this mark. Ranges B and D have no zero mark. On range B the top of the paper represents 50 fathoms below the transducer. On range D the top of the paper represents 200 fathoms below the transducer.

Head 14	Timing signal (100 c/s from PMR-20 fork)
Heads 15-26	Seismic traces 13-24
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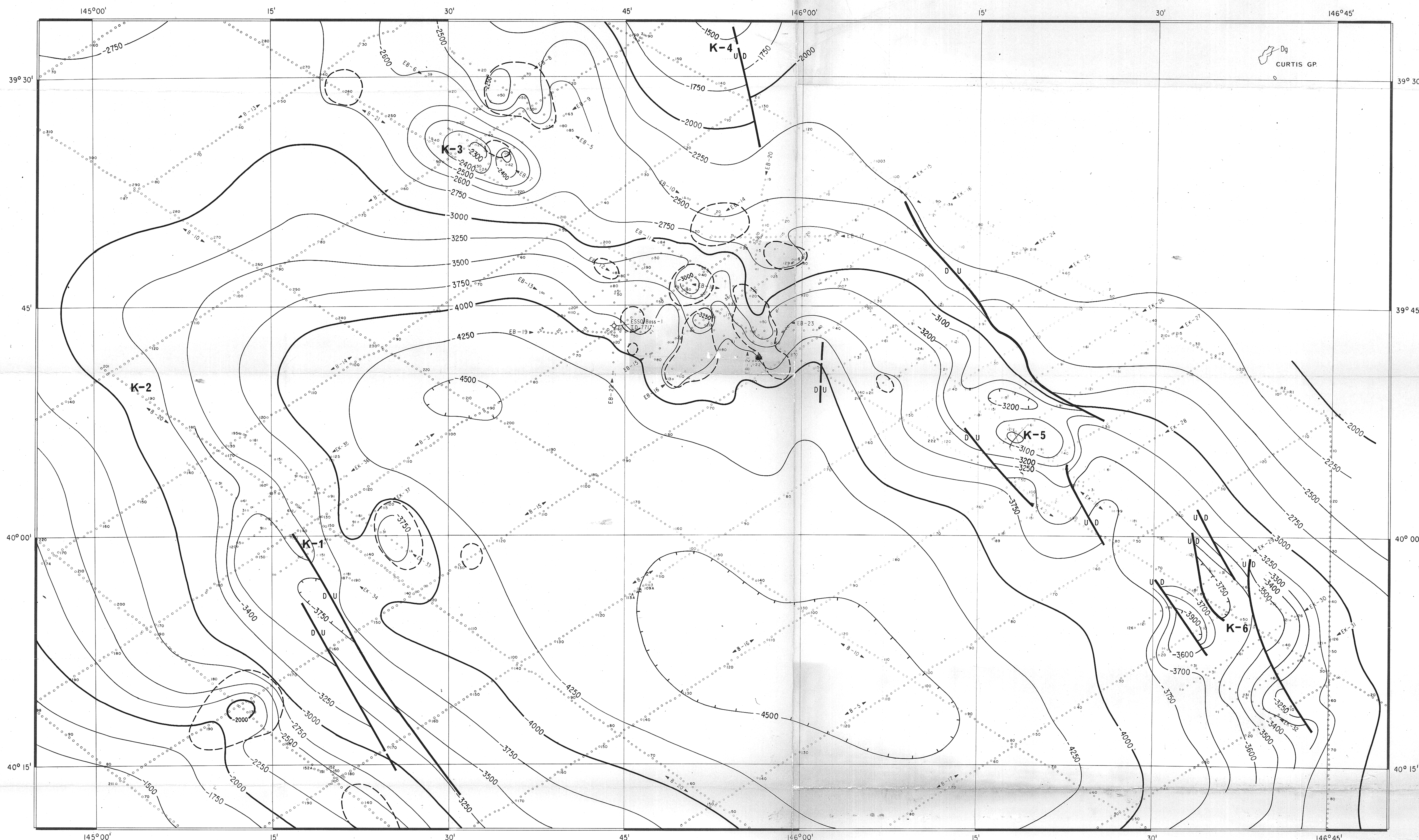
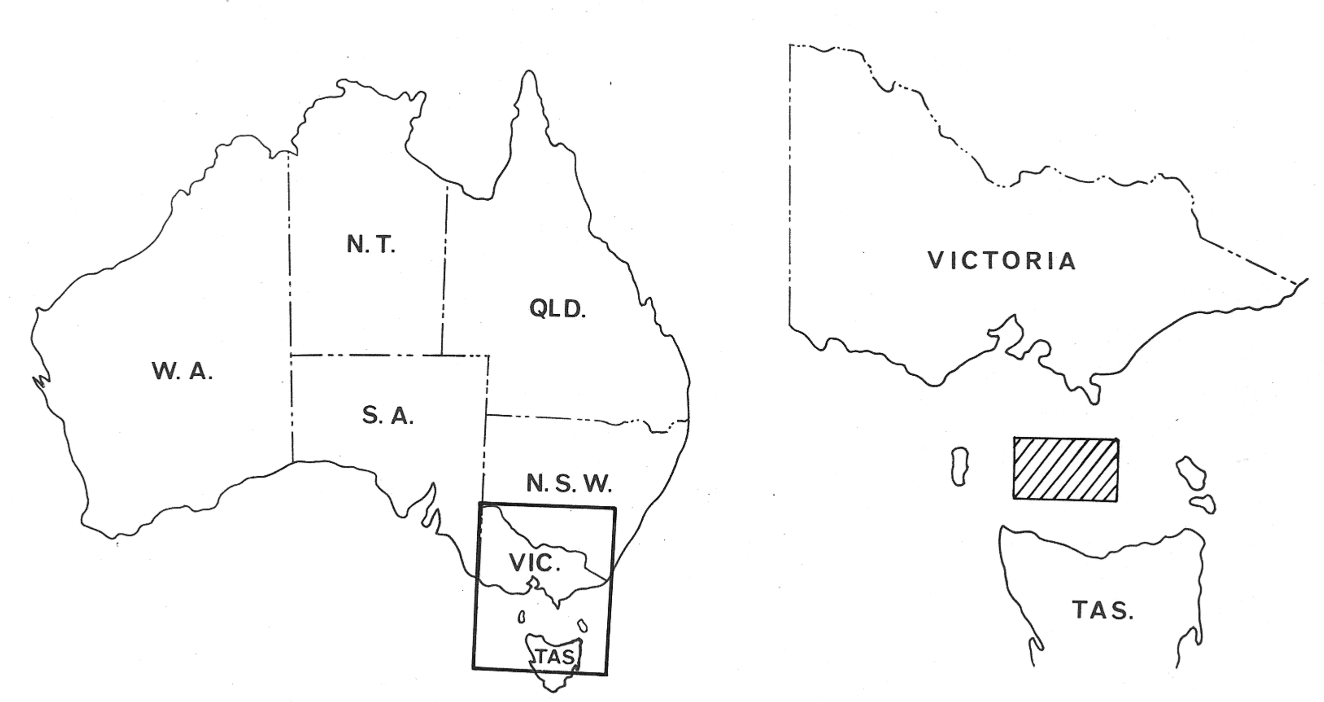


MAP INDEX



LEGEND

- ESSO Bass-I
- --3500-- Structure contour
- U / D Fault, "U" upthrown side, "D" downthrown side
- Area of Oligocene volcanic build-up

Bass Basin part VIII

ESSO EXPLORATION AUSTRALIA INC., SYDNEY, NEW SOUTH WALES.

THE BASS BASIN

TASMANIA

C52058

KING ISLAND EAST MARINE SEISMIC SURVEY

STRUCTURE CONTOUR MAP
ON TOP OF OLIGOCENE

CONTOUR INTERVAL : 250 FEET and 100 FEET

DATUM : SEA LEVEL

Scale 1 : 250,000

4 0 4 8 12

MILES

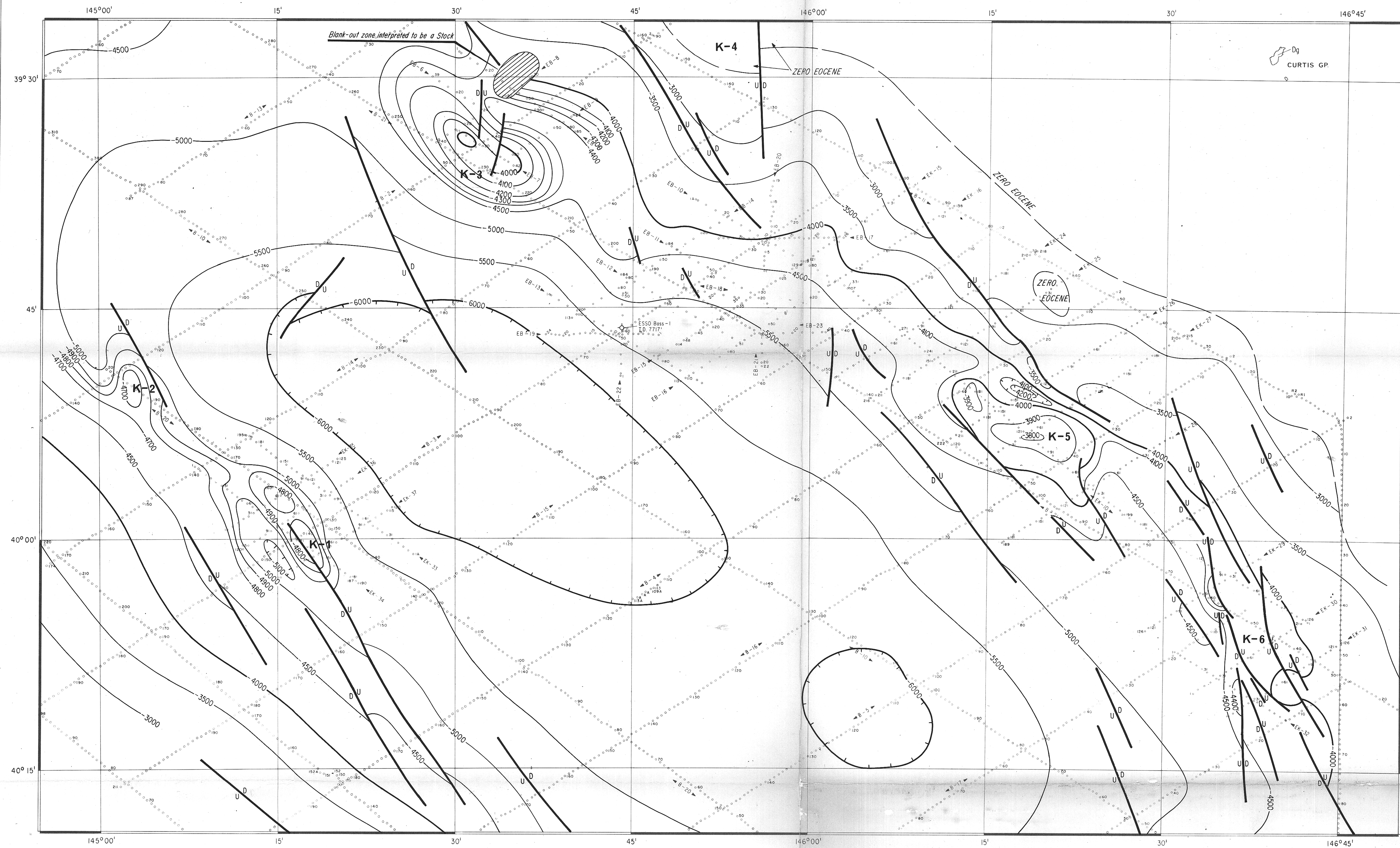
AUTHOR: W. C. PRESLEY

DRAFTED BY: A. F. STRAHAN

PLATE I

5 cm

OR-008



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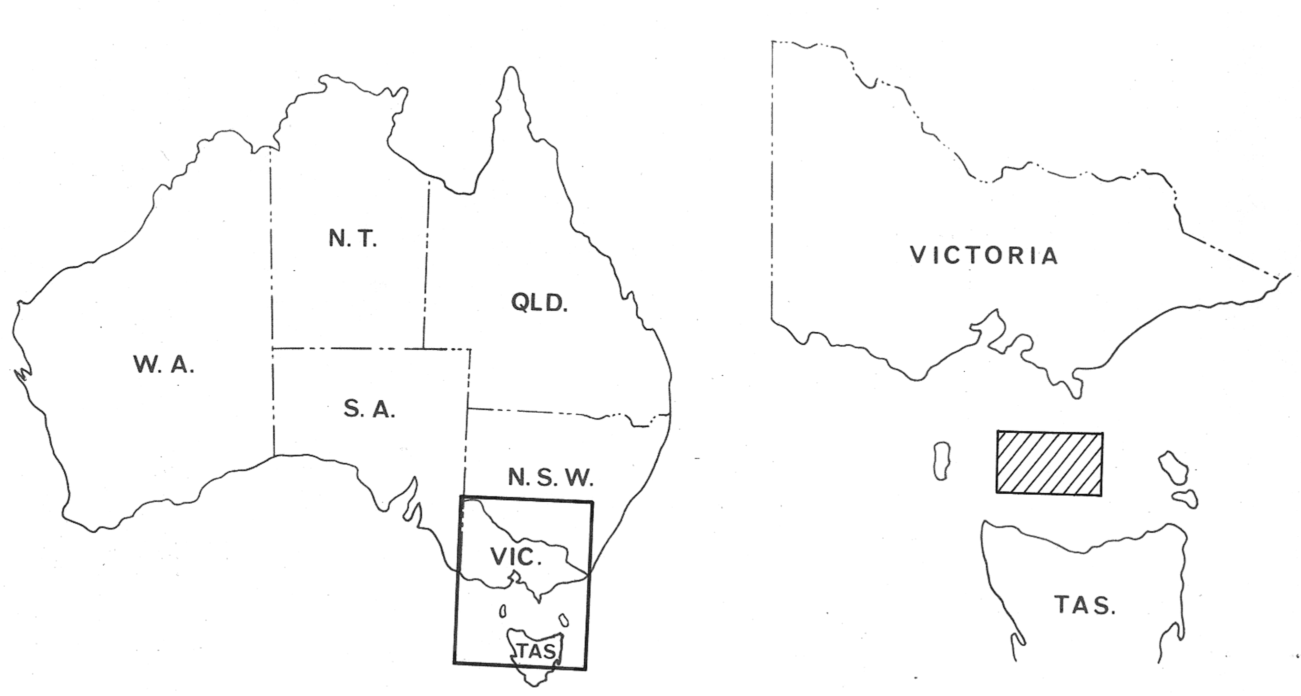


LEGEND

ESSO Bass-1

—3500— Structure contour

Fault, "U" upthrown side, "D" downthrown side

ESSO EXPLORATION AUSTRALIA INC., SYDNEY, NEW SOUTH WALES.

THE BASS BASIN

TASMANIA

KING ISLAND EAST MARINE SEISMIC SURVEY

STRUCTURE CONTOUR MAP ON TOP OF EOCENE

052059

CONTOUR INTERVAL: 500 FEET and 100 FEET

DATUM: SEA LEVEL

Scale 1 : 250,000

4 0 4 8 12

MILES

AUTHOR: W.C. PRESLEY

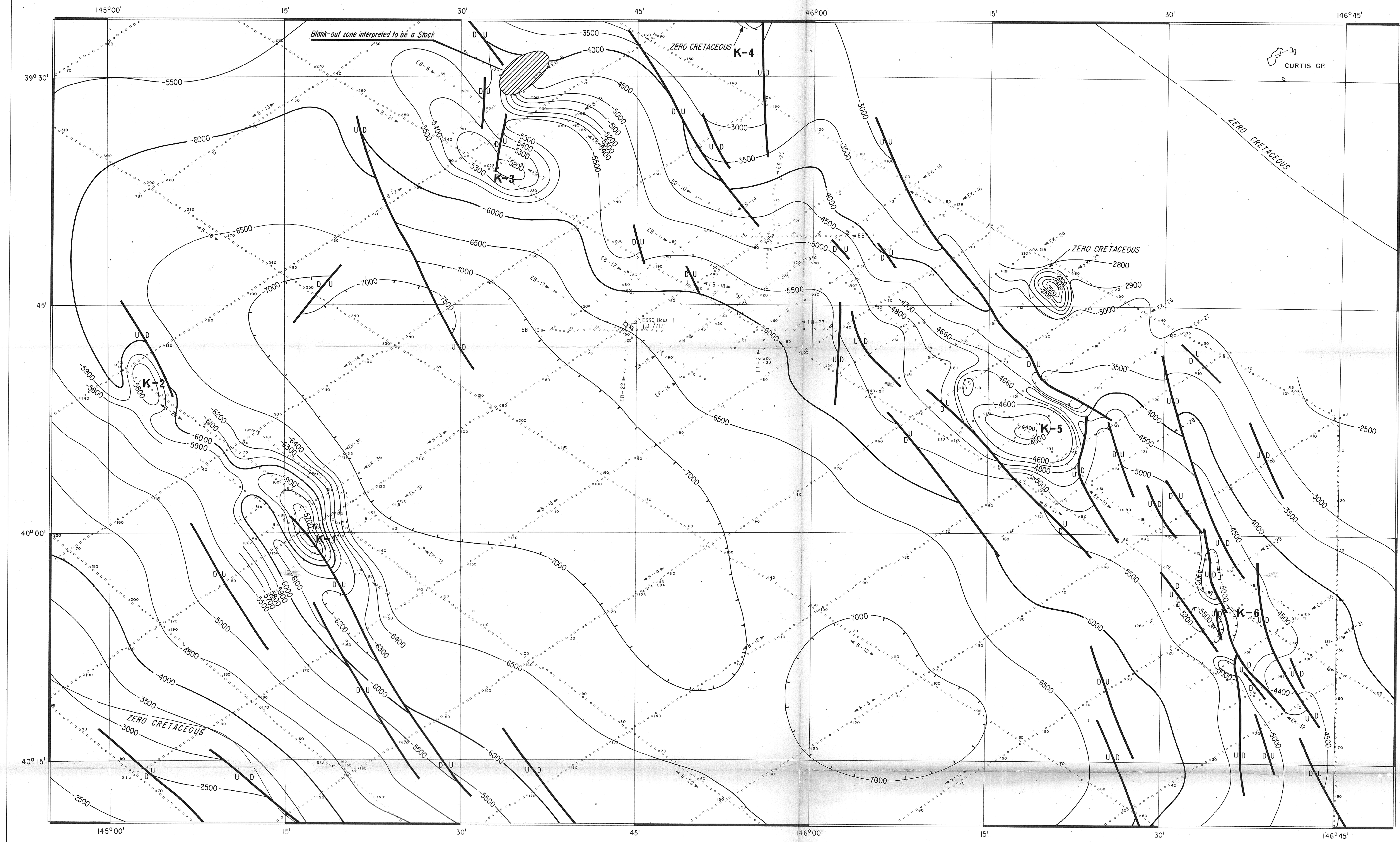
DRAFTED BY: A. F. STRAHAN

PLATE II

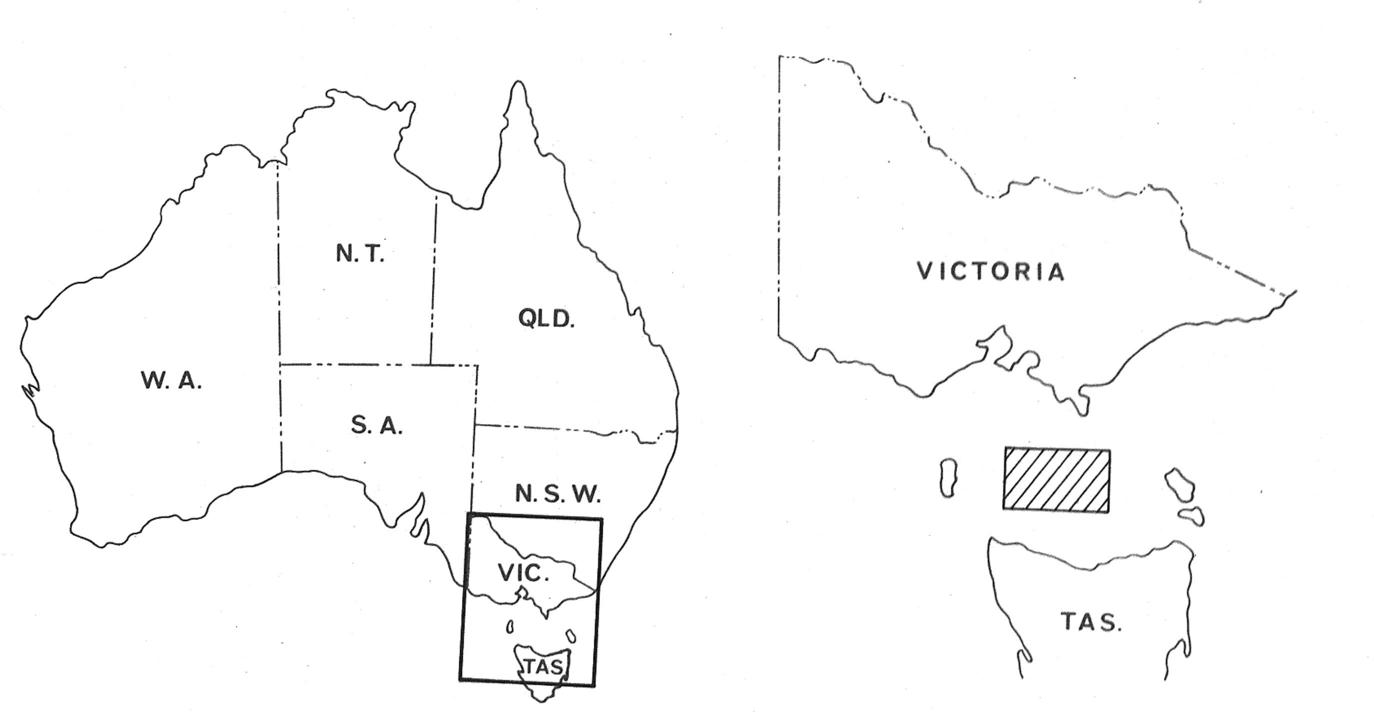
Bass Basin part VIII

5 cm

OR-008



MAP INDEX



LEGEND

ESSO Bass-1

--2500-- Structure contour

Fault, "U" upthrown side, "D" downthrown side

ESSO EXPLORATION AUSTRALIA INC., SYDNEY, NEW SOUTH WALES.

THE BASS BASIN

TASMANIA

KING ISLAND EAST MARINE SEISMIC SURVEY

STRUCTURE CONTOUR MAP ON TOP OF UNCONFORMITY AT BASE OF TERTIARY

052060

CONTOUR INTERVAL : 500 FEET and 100 FEET

DATUM : SEA LEVEL

Scale 1 : 250,000

4 0 4 8 12

MILES

AUTHOR : W. C. PRESLEY

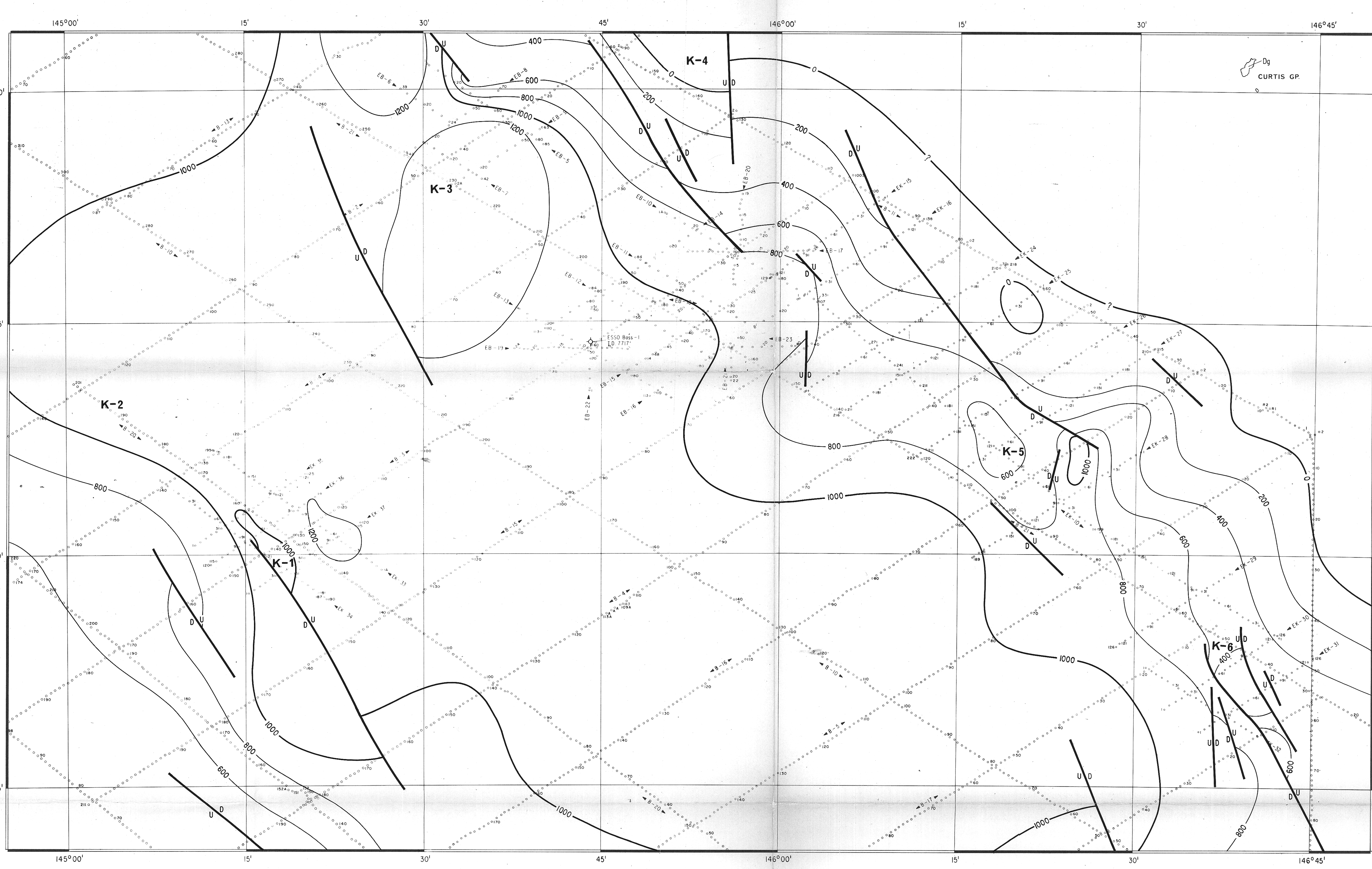
DRAFTED BY : A. F. STRAHAN

PLATE III

Bass Basin part VIII

5 cm

OR-008



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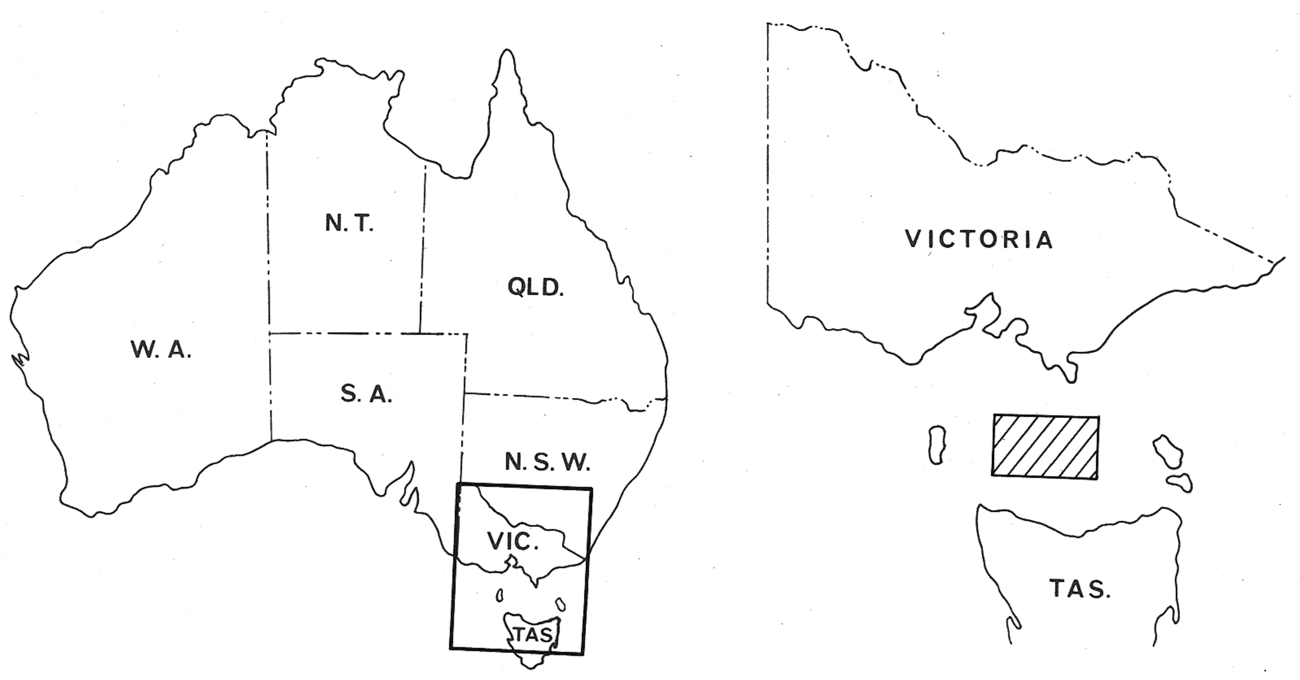


LEGEND

ESSO Bass-1

—600— Thickness contour

U/D Fault, "U" upthrown side, "D" downthrown side

ESSO EXPLORATION AUSTRALIA INC., SYDNEY, NEW SOUTH WALES.

THE BASS BASIN

TASMANIA

KING ISLAND EAST MARINE SEISMIC SURVEY

THICKNESS MAP OF INTERVAL TOP OF EOCENE TO BASE OF TERTIARY

CONTOUR INTERVAL : 200 FEET

Scale 1 : 250,000

052061

4 0 4 8 12

MILES

AUTHOR: W. C. PRESLEY

DRAFTED BY: A. F. STRAHAN

PLATE IV

052062

KING ISLAND EAST MARINE SEISMIC REFLECTION SURVEY

List of Plates:

OR_0008 (PART 2)

OR - 008 (Part 2)

052063

Bass Basin part VIII

November 3, 1965

Esso Exploration Australia, Inc.
280 - 288 George Street
Sydney, N. S. W.

Attention: Mr. Earl Stanford

Gentlemen:

The following statistical information is for the Marine Seismic Reflection Survey conducted October 10th through October 25th, 1965.

GSI Party number	921
Headquarters Port	Geelong, Victoria
Area of survey	Bass Strait - King Island East
Name of Survey ship	M. V. Merino
Type of shooting	single-end, six fold, common data point
Profiles per mile	12. 3
Days shooting	9 days
Profiles Shot	3109
Subsurface traverse	252. 63 miles
Depth of charge (average)	6 feet
Size of charge	50 pounds
Total explosive used: Nitro-carbo-nitrate	167, 925 pounds

....../2

Esso Exploration Australia, Inc.

November 3, 1965

Attention: Mr. Earl Stanford

Days travel:

To and from prospect	2 days
Calibrating Raydist and setting bouys	4 days
Days test and experimentation	1 day

Respectfully submitted,

E. O. McCutchen

E. O. McCutchen
Q. C. Seismologist

Attachment

EOM:la

cc: E. O. McCutchen
E. W. Hart

Bass Basin part VIII

Verification of Mileage

		Shot Point Nos.			
Date	Line No.	From	To	Mileage	Surcharge Miles*
Oct. 14-15	E-K-33	1	195	15.79	4.21
Oct. 15-16	E-K-34	1	190	15.44	4.56
Oct. 17	E-K-35	1	126	10.24	9.76
Oct. 17	E-K-36	1	120	9.75	10.25
Oct. 17	E-K-37	1	120	9.75	10.25
Oct. 20	E-K-26	1	222	18.05	1.95
Oct. 20	E-K-27	1	215	17.47	2.53
Oct. 20	E-K-28	1	189	15.36	4.54
Oct. 21	E-K-24	1	218	17.72	2.28
Oct. 21	E-K-25	1	216	17.56	2.44
Oct. 22	E-K-10	1	331	26.91	
Oct. 22	E-K-16	1	138	11.21	8.79
Oct. 22	E-K-15	1	129	10.49	9.51
Oct. 23	E-K-29	1	126	10.24	9.76
Oct. 23	E-K-32	1	121	9.83	10.17
Oct. 23	E-K-31	1	126	10.24	9.76
Oct. 24	E-K-30	1	126	10.24	9.76
	E-K-10-A	1	201	16.34	3.66
			Totals	252.63	114.18

* Miles of reflection survey traverse less than twenty miles.

ESSO EXPLORATION AUSTRALIA, INC. (INCORPORATED IN U.S.A. WITH LIMITED LIABILITY)

BOX 4249, G.P.O., SYDNEY, N.S.W.
JOHN H. HAMLIN, GENERAL MANAGER

280-288 GEORGE STREET
Telegraph: "EXPLORESSO SYDNEY"
Telephone: 2-0557

EX-1045

March 2, 1965.

450

The Secretary,
Dept. of National Development,
Bureau of Mineral Resources,
Geology & Geophysics,
P.O. Box 378,
CANBERRA CITY, A.C.T.

Application for Commonwealth Subsidy of Bass Marine Seismic Survey
(6134)

Dear Sir,

Under the terms of the Petroleum Search Subsidy Act 1959-1964, Esso Exploration Australia, Inc. hereby respectfully applies for approved grant of subsidy of a marine seismic survey in the Bass Strait, Tasmania offshore area. The specific information required under the Department's "Memorandum of Administrative Procedure" relating to geophysical (seismic) surveys, as revised in September 1964 and in previous Circulars, is given below and in the several attachments listed hereunder.

1. NAME OF THE PROJECT

Bass Marine Seismic Survey

2. NAME OF THE APPLICANT

Esso Exploration Australia, Inc.

3. REGISTERED ADDRESS

18th Floor, A.M.P. Building, Circular Quay, Sydney, N.S.W.
(Box 4047, G.P.O.)

4. NOMINEE AND ADDRESS OF COMMUNICATIONS

A.J. Caan, Exploration Manager,
Esso Exploration Australia, Inc.,
280-288 George Street,
SYDNEY, N.S.W. (Box 4249, G.P.O.)

5. COPY OF LATEST AUDITED BALANCE SHEET AND STATEMENT OF FUNDS AVAILABLE

An audited Balance Sheet for Esso Standard Oil (Australia) Ltd. for the calendar year ended 31st December, 1963 is in the Bureau of Mineral Resources' subsidy files. (See Esso's Application for Commonwealth Subsidy of Gippsland Marine Seismic Survey). When the audited Balance Sheet for Esso Standard Oil (Australia) Ltd. for the calendar year ended 31st December, 1964 is available, a copy will be forwarded to the Bureau of Mineral Resources. A wholly-owned subsidiary of Esso Standard Oil

(Australia) Ltd., Esso Exploration Australia, Inc. was incorporated in December 1963 and has been registered in the States of New South Wales, Queensland, Victoria, and Tasmania. Esso Exploration Australia, Inc. has sufficient funds to carry out the Bass Marine Seismic Survey. A Statutory Declaration relating to availability of funds is enclosed herewith.

6. DETAILS OF PERMIT

The survey will be conducted in the Tasmania Exploration Licence No. 1/60.

Exploration Licence 1/60 of 35,325 sq. miles is held by Haematite Explorations Pty. Ltd. of 500 Bourke Street, Melbourne. The permit expires on 11.10.65. Extensions are available at the discretion of the Tasmanian Minister for Mines.

Esso Exploration Australia, Inc. entered into a farmout agreement with Haematite Explorations Pty. Ltd. for this area. When available, the farmout agreement will be submitted to the B.M.R., but until such a time, we submit a letter in which Esso is granted permission by Haematite to conduct a seismic survey on their tenement. The farmout covers the western 23,150 square miles of E.L. 1/60 and eastern 1850 square miles of P.E.P. 40.

7. LOCATION AND DESCRIPTION OF SURVEY AREA (see Locality Map enclosed herewith)

The shooting program can be divided into 3 local areas, Area A, B, and C. They are found in Bass Strait between King Island and Wilson's Promontory.

Water depth of Area A is 240-250 feet, Area B is approximately 210 feet, and Area C is 230 feet. The seas can be extremely rough in this vicinity, but we anticipate sufficiently moderate sea conditions to complete the survey with a modicum of program continuity.

8. PARTICULARS OF WORK AND TIMING (see Program Map enclosed herewith)

The survey is expected to begin about March 15th, 1965 and should take from two weeks to one month to complete depending upon the weather. Esso's experience in the Gippsland offshore area indicated approximately one half of the time would be spent on weather standby. A total of approximately 200 linear miles, 130 in Area A, 40 in Area B, and 30 in Area C, of subsurface coverage will be obtained. Towards the end of the survey two or three velocity profiles will be shot as an aid in mapping stratigraphy.

Haematite Explorations conducted a reconnaissance seismic survey of the area. Esso's analysis of these data indicated that:

A. Good indications of stratigraphic traps are present. Several reef-like anomalies were crossed by Haematite's profiles.

B. Multiples are present and create a problem throughout much of the section, and any stratigraphic analysis will require their elimination or suppression.

For the above reasons it has been decided to shoot the survey in the following manner. The contractor will use a dual recording cable which utilises both a 600 metre and 1200 metre split spread. The survey will be shot simultaneously as both a six-fold common depth point (C.D.P.) survey using the 1200 metre cable and as a conventional single coverage survey using the 600 metre cable. Both C.D.P. and single coverage will be recorded using slow A.V.C. In this manner it is hoped to achieve considerable cancellation of multiples with the C.D.P. shooting and at the same time use the single coverage data to assist in mapping the very shallow reflections.

The data will be processed and played back at Western's playback centre in Perth. Considerable attention will be paid to the dynamic correction used for the C.D.P. work. A significant velocity variation is anticipated from study of the older data, hence we deem it important to keep a close check on this part of the operation. A $T\Delta T$ analysis of the long spreads from the previous Bass offshore survey will be the first step in this survey. In this analysis, it will be important to avoid using spurious, multiple reflections; it is believed that enough information is available to achieve this goal. The data obtained from this analysis will be used in the initial C.D.P. playback, and a further constant check will be kept on the new data as they become available. Final presentation will be on variable density or variable area record sections, of which three copies will be supplied to the Bureau.

Positioning of the survey points will be by Shoran. The land based Shoran stations will be established at several first order trigonomatrical stations. All stations will be located exactly the same as in the previous Haematite survey. The accuracy of the positioning will be within the limits specified. Water depths will be recorded at all times by a fathometer.

Weekly statistical reports and monthly progress reports will be submitted. A final report will be submitted within three months of the completion of the survey which will contain a statistical report compiled by Western and interpretation by Esso geophysicists.

The whole operation by Western will be closely supervised by Esso geophysicists, both in the field and in the playback office.

9. PERSONNEL

Esso

Supervision of field operations:

Mr. M.J. O'Connor, B.S. in physics, University of Texas, 14 years experience in field operations and in research and development of geophysical instrumentation and techniques, including marine seismic. Mr. O'Connor will also assist in data playback supervision.

Preparation of Final Report:

E.B. Stanford, B.S. in geology, Univ. of Texas; 13 years experience in geophysical interpretation and operations including 2 years experience in Australia. Mr. Stanford will also assist in field and playback supervision.

W.C. Presley, B.S. in geology, Virginia Polytechnical Institute; 7 years experience in geophysics. Mr. Presley will assist in playback supervision.

The field operation will be conducted by a marine seismic crew of Western Geophysical Co. of America. Key personnel on the project will be:

General Field and Operations Supervisor:

V.C. Boyd, Jr., B.S. in Maths and Chemistry, Northwestern State College, Louisiana; 13 years experience in geophysics, primarily in marine seismic.

Operations Manager:

Augusto Brenda, C.E., Institute Technico Superiore, Pescara, Italy; 8 years marine seismic experience, including participation in the earlier survey for Haematite.

Operations Coordinator:

B.V. David, 15 years field experience, including 8 years of marine seismic.

10. SEISMIC CONTRACT

A copy of the Contract, dated 29th May, 1964, between Esso Exploration Australia, Inc. and Western Geophysical Co. is in the Bureau of Mineral Resources subsidy files. (See Esso's application for Commonwealth Subsidy of the Gippsland Marine Seismic Survey). This contract was reactivated for the Bass Survey by the enclosed letter of agreement for reactivation.

11. EQUIPMENT TO BE USED

(a) Two complete sets of 24 trace Western FA-40A seismograph instruments, plus all necessary spare parts and auxiliary equipment.

(b) One dual-purpose floating-type marine cable, capable of recording simultaneously 24 groups of 600-600 metre coverage and 24 groups of 1200-1200 metre coverage, utilising 4 dual seismometers per group.

(c) Three FM receiving and transmitting sets and ship to shore radio telephone.

(d) Two complete Western Techno twenty-six track magnetic tape recording units.

(e) Recording fathometer.

(f) Eight special water break amplifiers.

(g) One all-steel twin screw recording vessel.

(h) One all-steel twin screw shooting vessel.

(i) Complete Shoran electronic positioning system for each vessel.

12. ESTIMATED COST

As indicated in the letter of contract reactivation, the basic field cost will be figured on a \$490/hour price rather than a cost/mile. This adjustment is due to the short length of seismic profiles and the location of these profiles in three separate areas.

(a)	200 miles to be shot. Assuming a 10 hour day and 150 profiles/day, the program will require 10.7 days. 10.7 days x 10 hrs. x \$490	=	\$52,400
(b)	Preparation of single coverage record section at \$14/mile. 200 miles x \$14	=	\$2,800
(c)	Preparation of stacked record section at \$10 per field tape, assuming 1600 field tapes 1600 tapes x \$10	=	\$16,000
(d)	Playback of single fold uncorrected sections on boat at \$10/mile 200 miles x \$10	=	\$2,000
(e)	Cost of Explosives (100 lb/shot) 1600 shots x 100 lb. = 160,000 lbs. x \$.30/lb	=	\$48,000
(f)	Procurement of maps, final reports, prints, photographic work, etc., including freight and postage.		\$500
(g)	Government permits, licences and custom duties applicable to consumer items.		\$250
(h)	Payment of compensation to fishermen and cray-fishermen.		\$250
(i)	Cost of velocity profile		
	(i) 10 hours at \$490/hour		\$4,900
	(ii) Explosives		\$650
	(iii) Playback		\$300

(j)	Esso Technical Supervision in the field and in the playback office, including transportation and living expenses. Esso's field supervisor will spend approximately 2 weeks checking Western's equipment and operational procedures in both the field and Perth playback centre. Esso will have a technical representative on the recording boat for most of the survey, approximately 2 weeks, for purpose of field record monitoring. Playback of the C.D.P. data is expected to take 1½ months and will be closely supervised. The final interpretation will take at least one month. This is a total of 3½ man-months.	$10,000
(k)	Days lost due to bad weather, assuming an average of 16 days lost/calendar month. 10 days x $2500/day	$25,000
(l)	TΔT analysis prior to survey commencement.	$400
	TOTAL	$163,450
	Approximately	£73,573

13. GEOLOGY

Regional and Historical Geology

The Bass Basin lies at the southern end of the Paleozoic Tasman Geosyncline whose rocks probably exceed 25,000 feet thickness on the Mornington Peninsula, north of the basin (Keble, 1950). The strata range from Cambrian through Carboniferous in a complexity of folded, faulted and intruded marine to non-marine sedimentary, metamorphic, and extrusive igneous rock. In Tasmania, similar complex rocks, tens of thousands of feet thick, occur along with more than 25,000 feet of pre-Cambrian sedimentary and metamorphic rocks. It is quite logical then to expect Bass to be underlain by some of these rocks. They would extend from shallow depths at the basin edge, and downward from 12,000 feet in its deepest part.

Bass is considered to be essentially a Tertiary basin, although it may contain Permian, Triassic, Jurassic, and Cretaceous rocks between the undisturbed Tertiary above and complexly folded and intruded pre-Permian rocks below. Permian "tillites" are known from small outcrops along the northern Tasmanian coastline. These may extend northward for some distance into the Bass Basin. Triassic sandstone and shale with minor conglomerate and coal occurs in Tasmania, and minor glacial beds in Victoria. Regional outcrop pattern negates these being in the Bass Basin. The Jurassic-Lower Cretaceous, generally non-marine, Otway Group occurs in the Gippsland and Otway Basins. It may be present in the Bass Basin, particularly in the northernmost part where it ought to extend beneath the Tertiary from the large outcrop which lies southeast of Melbourne to the large outcrop area in the Anglesea region southwest of Melbourne. Considerable pre-Tertiary uplift and deformation, accompanied by long erosion, occurred over a widespread region.

During Paleocene and Eocene time gentle regional downwarping occurred in the Gippsland and Otway Basins. It is assumed similar downwarp occurred in the Bass Basin. Tasmania remained a positive area. Volcanism and lava flows were abundant from the western part of Gippsland westward to the eastern part of Otway. Similarly, a few small flows occurred in Tasmania. There were widespread swamp conditions under which peat, clay, sand, silt, and gravel were deposited. Occasional thin marine sediments were intercalated with these non-marine rocks. Seismic interpretation suggests similar coal measure deposits in Bass.

Uplift and slight deformation took place in Gippsland after deposition of the Eocene coal measures. Deposition apparently was continuous during this time in the Otway Basin. In the Bass Basin there is definite seismic evidence, however, of an unconformity at the top of the presumed coal measures.

During Oligocene and Miocene time transgressive marine sedimentation occurred in both Gippsland and Otway. Fossiliferous limestone, calcareous shale, marl, and minor siltstone beds are the result. At and near the present edges of the Bass Basin in Tasmania and Victoria are similar outcrops of mainly Miocene skeletal limestones and some marine, fossiliferous siltstones.

During Pliocene time, the marine transgression reached the end of its full cycle in Gippsland and Otway. During middle Pliocene time, those areas and also the entire Bass Straits region, were subjected to uplift, probably accompanied by some gentle deformation and faulting. Volcanism and outpouring of lava was widespread in Tasmania and west-central Victoria.

The sea, in general, regressed to its present limits during late Pliocene and Pleistocene time.

14. <u>EXISTING GEOPHYSICAL INFORMATION</u> (See Structure Map enclosed)

An aeromagnetic survey was flown over the entire basin area by Aero Service for Haematite Explorations in 1961-62. The interpreted basement contours indicated good approximate basin limits and shape.

Haematite then, through the services of Western Geophysical, shot a reconnaissance grid over most of the basin area. The seismic quality was generally fair, but multiple interference was a major problem.

15. <u>REASONS FOR UNDERTAKING THE PROJECT</u> (see Structure Contour Map enclosed)

Esso conducted a basin study of the Bass Basin which interpreted and integrated all available surface geologic and geophysical data. This report included a stratigraphic interpretation of the seismic sections. Several very interesting postulations were made; i.e. several reef-like anomalies were mapped, but nothing is definitely known about the basin's stratigraphy. No wells have been drilled in the basin, and only very scanty outcrops are present around the basin margin. The absence of subsurface data has led to the following seismic program. Approximately 200 miles of seismic profiles will be shot in 3 areas, Area A, B, and C.

Area A was chosen for the greatest concentration of effort, approximately 130 miles, because Haematite's seismic lines crossed 4 reef-line anomalies in this fairly restricted area. This density of control will -

(a) find the highest structural point on the reef-like build-ups,

(b) answer the question of whether the anomalies are individual or interconnected, and

(c) better delineate seismic stratigraphic chracteristics.

Area B was chosen because -

(a) it is separated from Area A by 50 miles,

(b) the area contains a good reef-like anomaly, and

(c) a good wedge-out of section occurs immediately below the build-up.

The density of shotpoints in this location is designed to locate the highest structural point on the reef-like anomaly.

Area C was chosen because a good structural nose was mapped in this area by the original Haematite survey. The new seismic control is designed to find the highest structural point on this anomaly if closure does exist.

Widely separated well sites can be positioned with this seismic program. While testing the highest structural locations, each well will also yield vital stratigraphic information both above and below the build-ups.

Yours faithfully,

John H. Hamlin

By Earl B. Stanford

For A.J. Caan
Exploration Manager

EBS:FM

List of Attachments

1. Locality Map
2. Program Map
3. Structure Contour Map
4. Letter Reactivating Seismic Contract - Western/Esso
5. Statutory Declaration
6. Haematite Letter of Permission

ESSO EXPLORATION AUSTRALIA, INC.

052074 COPY

CC | S & A | CG | CC&M | ACM
RECEIVED 8 MAR 1965
ANSWERED
DEPT. OF MINES
REF. NO. 1105/65

Bass Basin part VIII

EX-1047

March 3, 1965.

Mr. J.M. Rayner,
Director,
Bureau of Mineral Resources,
P.O. Box 378,
CANBERRA, A.C.T. (6134)

Dear Sir,

Attached are the completed forms concerning Esso Exploration Australia, Inc.'s programme for oil exploration for the 1965 calendar year. One copy is being sent to the appropriate State Mines Department.

We trust this is the information you requested. If there is additional data that we might be able to furnish, please let us know.

Yours very truly,

John H. Hamlin
GENERAL MANAGER

AAP:FM

Encs.

c.c. State Mines Dept.,
Victoria, N.S.W. & Tasmania.

TASMANIA

PETROLEUM SEARCH SUBSIDY ACT 1959-1964

EXPLORATION PROGRAMME, 1965

052075

COMPANY: ....Esso Exploration Australia Inc...

AEROMAGNETIC

Tenement(s) & State	Line-miles	Est Cost (£)	Subsidy (£)
Nil			

GRAVITY

Tenements(s) & State	Stations or Party-months	Est Cost (£)	Subsidy (£)
Nil			

SEISMIC

Tenement(s) & State	Crew-months (Reflection, Refraction, Marine)	Est Cost (£)	Subsidy (£)
EL 1/60 Tasmania Offshore Bass Basin	2 months	165,000	49,500

DRILLING*

Tenement & Location & State	Depth	Est Cost (£)	Subsidy (£)
EL 1/60 Tasmania Offshore Bass Basin (S)	8,000	540,540	100,000

* Indicate type: S - Stratigraphic; T - Test;
Est. Cost not required for footage basis projects.

(signed) John W Hamlin..........
(Responsible Officer)

Date ..March 5/65..........

Bass Basin part VIII

E.B Stanford & P V Day, pls note.
file 6382-2

052076

Bass ... part VIII

ESSO EXPLORATION AUSTRALIA, INC. (INCORPORATED IN U.S.A. WITH LIMITED LIABILITY)

BOX 4249, G.P.O., SYDNEY, N.S.W.
JOHN H. HAMLIN, GENERAL MANAGER

280-288 GEORGE STREET
Telegraph: "EXPLORESSO SYDNEY"
Telephone: 2-0557

RECEIVED 5 MAR 1965
ANSWERED
DEPT. OF
REG. NO.

EX-1030

February 19, 1965

Western Geophysical Co. of America,
Box 70, P.O.,
APPLECROSS, W.A.

Attention : Mr. V.C. Boyd

Reactivation of Contract
for Geophysical Services
(6382-2)

Kindly refer to our letter of proposed Contract Reactivation, EX-1018 of February 10, 1965. After further clarifying discussions with Mr. V.C. Boyd, we wish to revise certain terms and conditions proposed in said letter in respect to the reinstitution of the lapsed former contract for geophysical services. Consequently, the proposals in letter EX-1018 are to be deemed superseded by this letter, as follows.

The Agreement of May 29, 1964, havingterminated upon the conclusion of the Gippsland Shelf Marine Seismic Survey by Western for Esso, whereupon Esso's liability in respect to any subsequent operations of Western's crew had ceased, will again be reinstituted and in effect for the purpose of performing the new survey, namely the Bass Basin Marine Seismic Survey.

Esso hereby requests Western to commence marine seismic operations in the Bass Basin on or about March 1, 1965. These operations shall be conducted under the general terms and conditions of the contract of May 29, 1964, under which the former Gippsland Shelf Survey was conducted. However, it is specifically pointed out in respect to this reactivation of the Agreement that Section 13 of that Agreement, which made reference to "temporary suspension of operations", is not applicable in any sense to this request for reactivation. No cost nor liability nor responsibility applies to Esso for the period intervening between the concluded Gippsland Survey and the forthcoming Bass Survey.

The Bass program will consist of about 170 miles of detailed CDP profiling. Esso agrees that the Bass CDP shooting program will be on an hourly rate basis, similar to that rate stated under the May 29th Agreement, Section 12, subsection VI, even though it does not constitute "widely scattered detailing". The hourly rate will be U.S. dollars four hundred and ninety (U.S.$490). Esso further agrees that all justifiable standby time caused by unfavourable operating weather conditions will be for Esso's account; however Esso stipulates that such rate for unfavourable weather standby will be U.S. dollars two thousand five hundred (U.S.$2500) per day, or proportionately less for any partial days (normal work days to be considered as 10 hours). In all other respects, the general terms and conditions set forth in the former Agreement of May 29, 1964 shall again be deemed to be effective and applicable.

Boyd / ape

Having indicated below, on copy of this letter, your acceptance of this new work assignment and the reinstitution of the Agreement of May 29, 1964, kindly return said copy to us.

Yours faithfully,

John H. Hamlin

By A. J. Caan
A.J. Caan
Exploration Manager

AJC:FM

The above work assignment, terms, and conditions are accepted on behalf of Western Geophysical Co. of America by

N C Boyd Jr .... 2/22/65.

March 1, 1965.

The Secretary,
Department of National Development,
Bureau of Mineral Resources,
Geology and Geophysics,
P.O. Box 378,
CANBERRA CITY, A.C.T.

Bass [illegible]

Statutory Declaration
6134

I, Victor Keith Kidman Young, of 75 Spofforth Street, Cremorne Junction, in the State of New South Wales, hereby solemnly and sincerely declare that:-

1. I am the Secretary of Esso Standard Oil (Australia) Limited.

2. Esso Exploration Australia, Inc. is a wholly-owned subsidiary of Esso Standard Oil (Australia) Limited.

3. For the purpose of obtaining Commonwealth Government Subsidies from the Department of National Development as set out in the Petroleum Search Subsidy Act 1959-1964, Esso Standard Oil (Australia) Ltd. will make available to Esso Exploration Australia, Inc. sufficient funds to cover the full performance of the Bass marine seismic survey in the Bass Basin, Victoria and Tasmania, to be undertaken by that Company.

4. As at the 1st day of March, 1965, Esso Standard Oil (Australia) Ltd. held on twenty-four hour call a deposit of £A1,475,000.0.0 which sum is available to Esso Exploration Australia, Inc. for the purpose of oil search in Australia and is sufficient to finance the aforementioned Bass marine seismic survey.

And I make this solemn declaration conscientiously believing the same to be true and by virtue of the provisions of the Oaths Act, 1900, as amended.

Declared at Sydney this
1st Day of March 1965
Before me:

....
A Justice of the Peace for N.S.W.

....
V.K.K. Young.

Confirmed on behalf of Esso Exploration
Australia, Inc. by

....
Albert J.Z. Caan, Director

on 1/3/65.

HAEMATITE EXPLORATIONS PTY. LTD. 052079

REGISTERED OFFICE:
ESSINGTON LEWIS HOUSE
500 BOURKE STREET
MELBOURNE, C.1

TELEPHONES
67 8001
67 8521

25th February, 1965.

YOUR REF.

OUR REF. BMH:jmc

The Exploration Manager,
Esso Exploration Australia Inc.,
Box 4249, G. P. O.,
SYDNEY. N. S. W.

Dear Sir,

J.14/1-17 - OIL EXPLORATION - BASS BASIN
ESSO MARINE SEISMIC SURVEY

Pending completion of the Operating Agreement between Haematite Explorations Proprietary Limited and Esso Exploration Australia Inc., this Company grants permission to Esso, as the Operator under the Agreement, to carry out marine seismic surveys in the area of the Bass Basin within parts of Petroleum Exploration Permit No. 40 (Victoria) and Exploration Licence 1/60 (Tasmania).

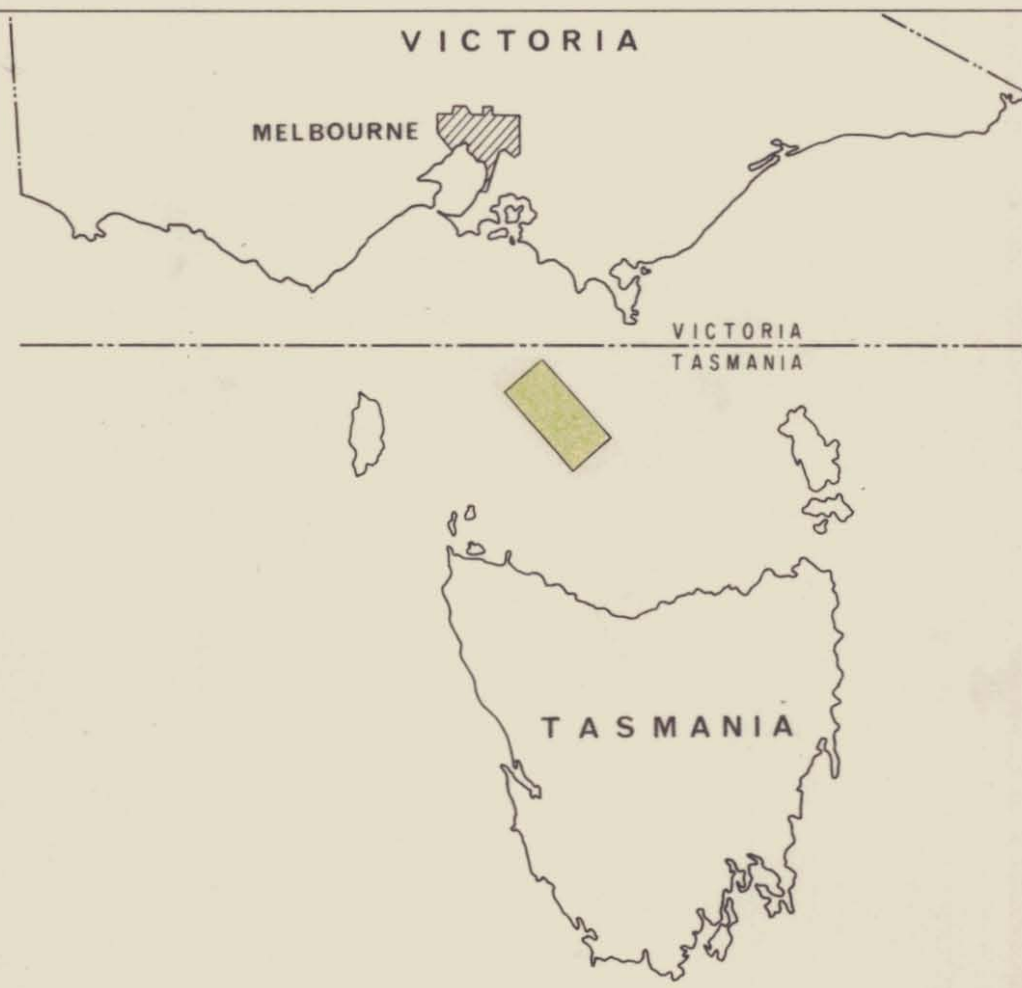
Yours faithfully,

K. A. Rowell

K. A. Rowell, General Manager

052080

AUSTRALIA



Proposed seismic survey area

ESSO EXPLORATION AUSTRALIA INC.

LOCALITY MAP OF BASS MARINE SEISMIC SURVEY

5 cm

MARCH, 1965.

OR-008

Bass Basin part VIII

052081

5 cm

Proposed seismic survey

Previous seismic survey

ESSO EXPLORATION AUSTRALIA INC.

PROPOSED PROGRAM FOR BASS MARINE SEISMIC SURVEY

20 15 10 5 0 20

SCALE IN MILES

Bass Basin part VIII

OR-008

MARCH, 1965


PEP 40
PEP 36
PEP 39
WILSONS PROMONTORY
VICTORIA
TASMANIA
EAST MONCOEUR
WEST MONCOEUR
HOGAN GP
CURTIS GP
KENT GP
KING ISLAND
FLINDERS ISLAND
EL 1/60
EL 1/60
THREE HUMMOCK ISLAND
HUNTER ISLAND
ROBBINS ISLAND
TASMANIA
MAP INDEX
AUSTRALIA
W.A.
N.T.
QLD.
S.A.
N.S.W.
VIC.
VICTORIA
TAS.
ESSO EXPLORATION AUSTRALIA INC., SYDNEY, NEW SOUTH WALES
THE BASS BASIN
VICTORIA - TASMANIA
STRUCTURE CONTOUR MAP AT HORIZON "B"
Datum : Sea level
Contour interval: 250 feet
Scale 1: 250,000
MILES
AUTHOR: K.A. RICHARDS.
DRAFTED BY: A.F STRAHAN
5 cm
TASMANIA
PLATE V
BASS BASIN PART VIII
OR-008
052082

PEP 40
PEP 36
PEP 39
WILSONS PROMONTORY
VICTORIA
TASMANIA
EAST MONCOEUR
WEST MONCOEUR
HOGAN GP
CURTIS GP
KENT GP
KING ISLAND
FLINDERS ISLAND
EL 1/60
EL 1/60
THREE HUMMOCK ISLAND
HUNTER ISLAND
ROBBINS ISLAND
TASMANIA
TASMANIA
144°00'
145°00'
146°00'
147°00'
148°00'
39°00'
40°00'
41°00'
EK-10
East King Island seismic survey
MAP INDEX
AUSTRALIA
W.A.
N.T.
QLD.
S.A.
N.S.W.
VIC.
T
VICTORIA
TAS.
ESSO EXPLORATION AUSTRALIA INC., SYDNEY, NEW SOUTH WALES
THE BASS BASIN
VICTORIA - TASMANIA
5 cm
052083
Scale 1:250,000
MILES
AUTHOR: K.A. RICHARDS.
TO ACCOMPANY REPORT AUST.
SHEET II
DRAFTED BY: A.F STRAHAN
REVISED
PLATE V1
Bass Basin part VIII
OR-008

PEP 40
PEP 36
PEP 39
WILSONS PROMONTORY
VICTORIA
TASMANIA
EAST MONCOEUR
WEST MONCOEUR
HOGAN GP
AREA B
AREA C
AREA A
CURTIS GP
KENT GP
KING ISLAND
FLINDERS ISLAND
EL 1/60
EL 1/60
THREE HUMMOCK ISLAND
HUNTER ISLAND
ROBBINS ISLAND
TASMANIA
TASMANIA
Proposed seismic traverses
MAP INDEX
AUSTRALIA
W.A.
N.T.
QLD.
S.A.
N.S.W.
VIC.
T.
VICTORIA
TAS.
ESSO EXPLORATION AUSTRALIA INC., SYDNEY, NEW SOUTH WALES
THE BASS BASIN
VICTORIA - TASMANIA
SEISMIC PROGRAM MAP
052084
5 cm
Scale 1:250,000
4 0 4 8 12
MILES
AUTHOR: K. A. RICHARDS.
TO ACCOMPANY REPORT AUST.
SHEET II
DRAFTED BY: A.F STRAHAN
REVISED
PLATE VII
BASS BASIN PART VIII
OR-008
Bass Basin part VIII