EAST BASS. BASIN
part 5/1

068001

FINAL SUBSIDY REPORT
OF
THE OFFSHORE GIPPSLAND BASIN
MARINE SEISMIC & MAGNETIC SURVEY G69A

Prepared for:
The Bureau of Mineral Resources, Canberra, A.C.T.

Submitted by:
Esso Exploration & Production Australia Inc.

Author
P.M. Cooney

Contributors
D.B. Depew
J.W. Milliken

June 1969.

068002

TABLE OF CONTENTS

	Page #
List of Illustrations	
Abstract	1
Introduction	2
Gippsland Basin General	3
Source & Quality of Data	4
Objectives of Survey	5
Results of Seismic Survey	6
Magnetometer Survey	7
Conclusions & Recommendations	8
Appendix	
1. Field Operations Report - Western Geophysical	Part 2
2. Final Report Offshore Navigation Inc. Project 305	Part 3.

LIST OF ILLUSTRATIONS

Figure 1	Location Map	With text.
Figure 2	Schematic of Contoured Horizon	"
Figure 3	Stratigraphic Column	"
Figure 4	Time-Depth Conversion	"
Figure 5	List of Seismic Sections	"

Plate I	Water Depth Contour Map.
Plate II	Structure Contour Map on Top of Economic Basement.
Plate III	Structure Contour Map on Latrobe Delta Topographic Surface.
Plate IV	Structure Contour Map on Lakes Entrance Formation.
Plate V	Isopach Map of Interval Latrobe Delta Topographic Surface to Top of Basement.
Plate VI	Isopach Map of Interval Lakes Entrance Formation to Latrobe Delta Topographic Surface.
Plate VII	Shot Point Base Map.

068004

ABSTRACT

The Gippsland G69A Marine Seismic and Magnetic Survey was conducted between December 24, 1968 and March 21, 1969. It was programmed to detail the structural aspects of the large stratigraphic play area in the southwestern part of the Gippsland Basin. Within the subsidized area approximately 272 miles of twelve-fold C.D.P. Aquapulse data was recorded and processed digitally. The new data was integrated with interpretations of previous seismic surveys.

The results of earlier surveys indicated that Latrobe sediments onlapped shallow basement. The G69A survey substantiated this play and more clearly outlined the zero edge of the Latrobe.

Included in the report are a water depth map and structure maps on top of (1) Lakes Entrance Formation, (2) Latrobe Delta Topographic Surface, and (3) Basement. Isopach maps between (1) Lakes Entrance and Latrobe and (2) Latrobe and Basement are also included.

068005

INTRODUCTION

The offshore Gippsland Marine Seismic and Magnetic Survey G69A was conducted in the Bass Strait and Tasman Sea between December 24, 1968 and March 21, 1969. Approximately 1598 miles of twelve-fold C.D.P. reflection seismic data was recorded and processed digitally. The remaining area in Gippsland Basin qualifying for subsidy is defined by 40 mile radii drawn from Barracouta A-1 and B-1 gas wells and 50 mile radii from the Kingfish oil wells. Approximately 272 miles of the G69A survey falls within the remaining subsidy area. The exploration program covered in the report was carried out by Esso Exploration and Production Australia Inc. in connection with a farm-in agreement with Hematite Petroleum Pty. Ltd. The farm-in agreement covers the following exploration licences; PEP-38 in Victoria; PEP-39 in Victoria and EL-1/60 in Tasmania.

Field work was conducted by Western Geophysical Co. and processing was done by Geophysical Services International. Supervision and interpretation was done by Esso. Field operations are covered in a comprehensive report by Western Geophysical Co. that is included in the appendix of this report.

068006

GIPPSLAND BASIN GENERAL

The Gippsland Basin is in southeastern Victoria, Australia with approximately two-thirds of the Basin located offshore in the Tasman sea. Water depths vary from 0 to greater than 600', however, most of the area covered in this report falls inside the 300' water depth contour.

In general, the term Gippsland Basin refers to those rocks of Upper Cretaceous and Tertiary age. These sediments are underlain by some 20,000' + of Lower Cretaceous and several thousand feet of Paleozoic rocks. During the Paleozoic Era the present Gippsland Basin area was part of the broad north-south trending Tasman Geosyncline which extended along the entire east coast of Austraila. In Lower Cretaceous time a thick section of sub-greywacke, siltstones and shales was deposited in an east-west trending regional graben or half-graben in contrast to the older depositional trend. The Gippsland Basin began to assume its present configuration at the beginning of Upper Cretaceous time.

The Gippsland Basin is wedge-shaped, with the apex to the west and opening to the east. It is bounded on the north by a broad north-south trending mountain system where sedimentary, fine and coarse grained igneous and some metamorphic Paleozoic rocks outcrop. The southern boundary of the Upper Cretaceous-Tertiary basin is marked by the large normal down-to-the-north east-west trending Foster Fault System, giving the basin a half graben configuration. The Lower Cretaceous, Upper Cretaceous, Paleocene and most of the Eocene sediments are confined to the north of this fault system. In late Eocene the fault system stabilized and sediments began to onlap the low-lying granitic area to the south. Older units are progressively overstepped by the younger units. The stable area south of the fault system, the granitic Bassian Rise, extending from Wilsons Promontory to the northeastern corner of Tasmania, separated the Gippsland and Bass Basins. The northern boundary of the basin is a shelfal area with all sediments of the Gippsland Basin thinning by onlap and convergance.

068007

SOURCE AND QUALITY OF DATA

The G69A marine seismic reflection survey was conducted by Western Geophysical Co., under contract to Esso Exploration and Production Australia Inc. Field operations commenced on December 24, 1968 and were concluded on March 21, 1969. In the area covered by this subsidy report twelve-fold CDP data were recorded digitally. The energy source for the data was the sleeve exploder developed by Esso Production Research Co., of Houston, Texas and licensed to Western Geophysical Co. Western calls the source 'Aquapulse'. Four aquapulse guns are towed at a depth of 30' subsea, two from each side of the recording vessel. A mixture of oxygen and propane is injected into the guns, which are then fired simultaneously.

To obtain optimum shallow data, a 1600 meter streamer (geophone group center to center 69.5 meters) was used in the subsidized area. The firing rate was 3 pops per 69.5 meters, or 70 pops per mile. Esso supervisory personnel were on board the recording boat throughout the field operations.

The data was digitally processed at the GSI Digital Processing Center in Sydney, N.S.W., Australia with time varying deconvolution (TVD) applied Velocity control, derived from delta-T analysis and the final sections were presented by variable density using a time variant filter. Esso maintained supervision over all facets of data processing operations. The data quality ranged from good to very good.

068008

OBJECTIVES OF SURVEY

The G69A seismic and magnetic survey was conducted, in the area covered by this report, to delineate the structural features of a stratigraphic play on the southwestern flank of the Gippsland Basin. Previous surveys conducted for Hematite Exploration Pty. Ltd., and Esso had uncovered the possibility of a stratigraphic onlap of Latrobe sediments in this area. The G69A survey was programmed to define the structural attitude of stratigraphic traps for the purpose of locating exploratory wells.

068009

RESULTS OF SEISMIC SURVEY

Three structure maps and two isopach maps were constructed as well as a water depth map. The interpretation parameters were the same as those used in the EC-67 and EH-68 seismic subsidy reports. Structural horizons mapped were (1) Top of Lakes Entrance Formation (Oligocene); (2) Top of Latrobe Delta Topographic Surface (Eocene-Paleocene-Upper Cretaceous); (3) Top of Basement. Isopach maps were made between (1) Top of Lakes Entrance and Top of Latrobe Delta Topographic Surface and (2) Top of Latrobe and Basement.

The scale of all maps enclosed is 1:100,000. A composite base covering the subsidized area to the south, with an inset covering the area to the north was used to keep the number of plates to a minimum. Structure maps are contoured in depth with datum being sea level and static corrections applied for variations in water depth. The time versus depth table used for depth conversions on structure maps is a composite of all velocity data available at this time. The following is a discussion of the significant features of each of the mapped horizons:

(1) Lakes Entrance Formation (Oligocene)

The structure at the top of the Lakes Entrance (Plate IV) is monoclinal and dips approximately one to two degrees northeast toward the center of the basin. The Lakes Entrance appears to have been deposited in a transgressive onlap sequence under shallow marine conditions. There is no expression at the top of the Lakes Entrance of underlying basement structural features except in the area covered by the inset map. This structural feature is related to a positive basement feature associated with up-to-the-basin faulting.

The total thickness of the Lakes Entrance as shown on the isopach map (Plate VI) exhibits a general thickening into the basin. The thinning in the area of the Miocene channel cut is due to channel erosion.

(2) The structure on top of the Latrobe Delta Topographic Surface (Plate III) is also monoclinal and dips one to two degrees per mile to the northeast. The Latrobe was also deposited in an onlapping sequence filling the depressions of an irregular basement complex with the older sediments truncating against basement highs.

(3) The Basement structure picture in this area is of primary importance because the basement anomalies form the geometric attitude necessary to set up possible traps in Latrobe sediments. The structural features shown on the Basement map (Plate II) are probably topographic remnants left from the erosion of the Bassian Rise ridge. The Bassian Rise was very likely peneplained early in Cretaceous time with most of the sediments being carried into the central parts of the Bass and Gippsland Basins. Thereafter very few sediments were deposited until the close of the Eocene when the Latrobe Delta Complex had filled most of the Gippsland Basin and had begun to onlap the Bassian Rise. Succeeding sediments continued to onlap the rise until Middle Miocene time, when deposition was continuous with that in the Bass Basin.

068010

MAGNETOMETER SURVEY

Marine magnetometer survey was carried out concurrently with marine seismic survey during the G69A survey in the Gippsland Basin.

The instrument used was a Varian direct readout magnetometer and marine towing system. The Varian V-4937 Proton Magnetometer uses phase lock circuitry to multiply the proton precession frequency received from the sensor. Selection of a unique time base to solve the proton constant allows field values to be presented on an analog strip-chart recorder. System response exceeds by two orders of magnitude the steepest field gradients encountered in marine surveys. The V-4937 is intended for shipboard or station use, but it is well suited for all general purpose survey work in which fast, accurate counts must be taken in high noise conditions.

This instrument measures the total magnetic field intensity, has a sensitivity of $\pm$ 1 gamma and sampled the field every 6 seconds.

The orientation free magnetometer consists of a completely encapsulated sensor and 750' of two cable. The tow cable consists of 2 conductors, shielding and a Type 310 stainless steel strain member with enoprene jacketing. The sensor housing will withstand pressures up to 500 psi. This instrument proved satisfactory. The instrument is not liable to drift other than the normal durnal variation - in the surveyed area this was quite irregular and of the order of $\pm$ ten gammas.

The results of the marine magnetometer survey are shown as profiles at the base of the seismic sections. The area is very nearly undisturbed magnetically. The only large anomaly occurred over the large intrusive body at the intersection of lines G69A - 318 and G69A - 75.

068011

CONCLUSIONS AND RECOMMENDATIONS

Earlier seismic surveys have suggested a possible stratigraphic play along the southwestern edge of the Gippsland Basin. The G69A Marine Seismic Survey further substantiated the concept of this play and more clearly outlined the actual zero edge of the Latrobe.

068012

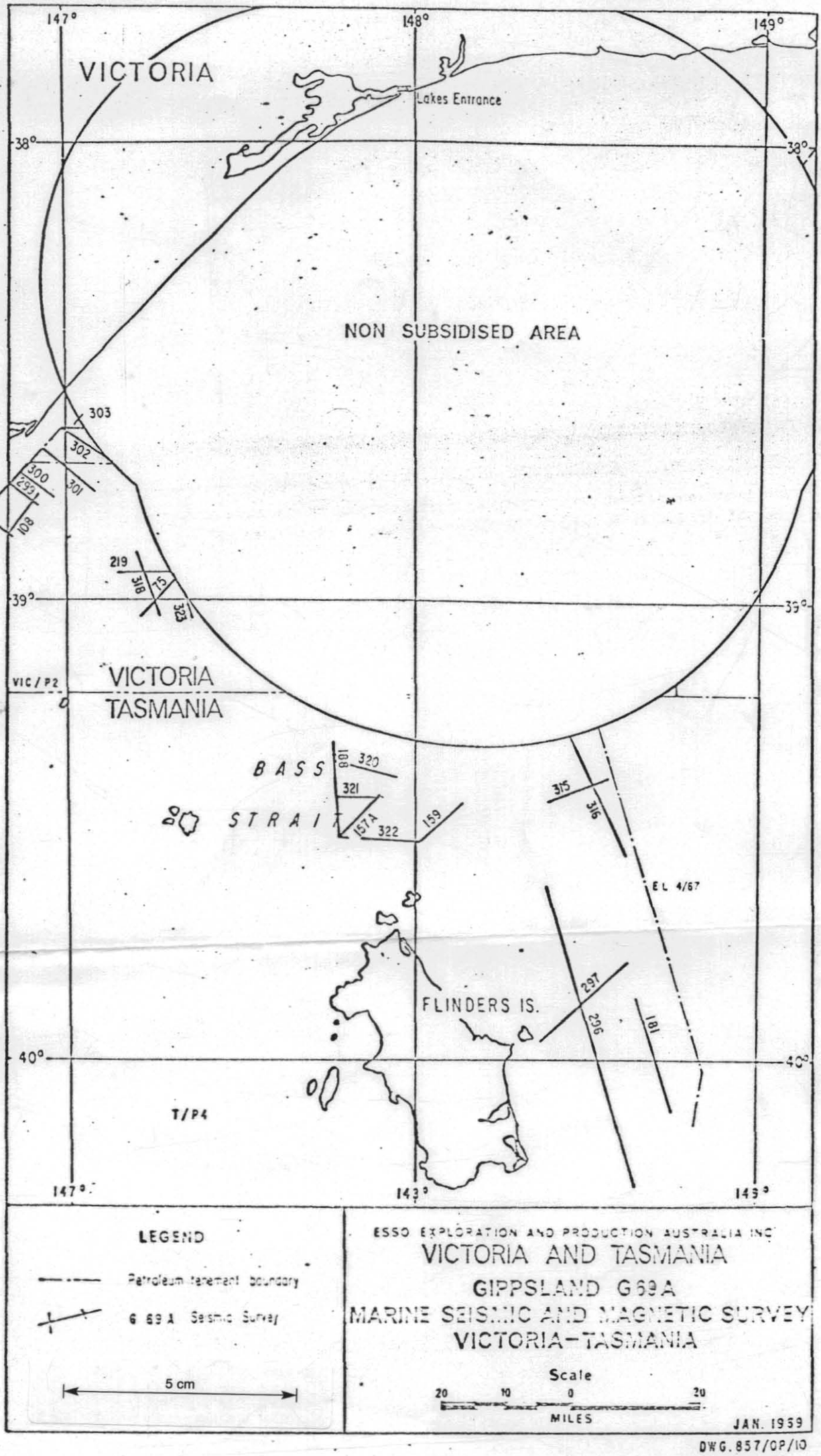


FIGURE 1

068013

5 cm

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

DWG. 1062/G/2

GIPPSLAND BASIN

VICTORIA – TASMANIA

SCHEMATIC OF CONTOURED HORIZONS

A. FULL LINES REPRESENT CONTOURED HORIZONS AND THE GENERAL BASINWARD EXTENT TO WHICH THEY CAN BE RELIABLY FOLLOWED.

B. DASHED LINES REPRESENT INTERPRETATION OF GENERALIZED REGIONAL TRENDS WHICH ARE NOT CAPABLE OF SPECIFIC SEISMIC MAPPING.

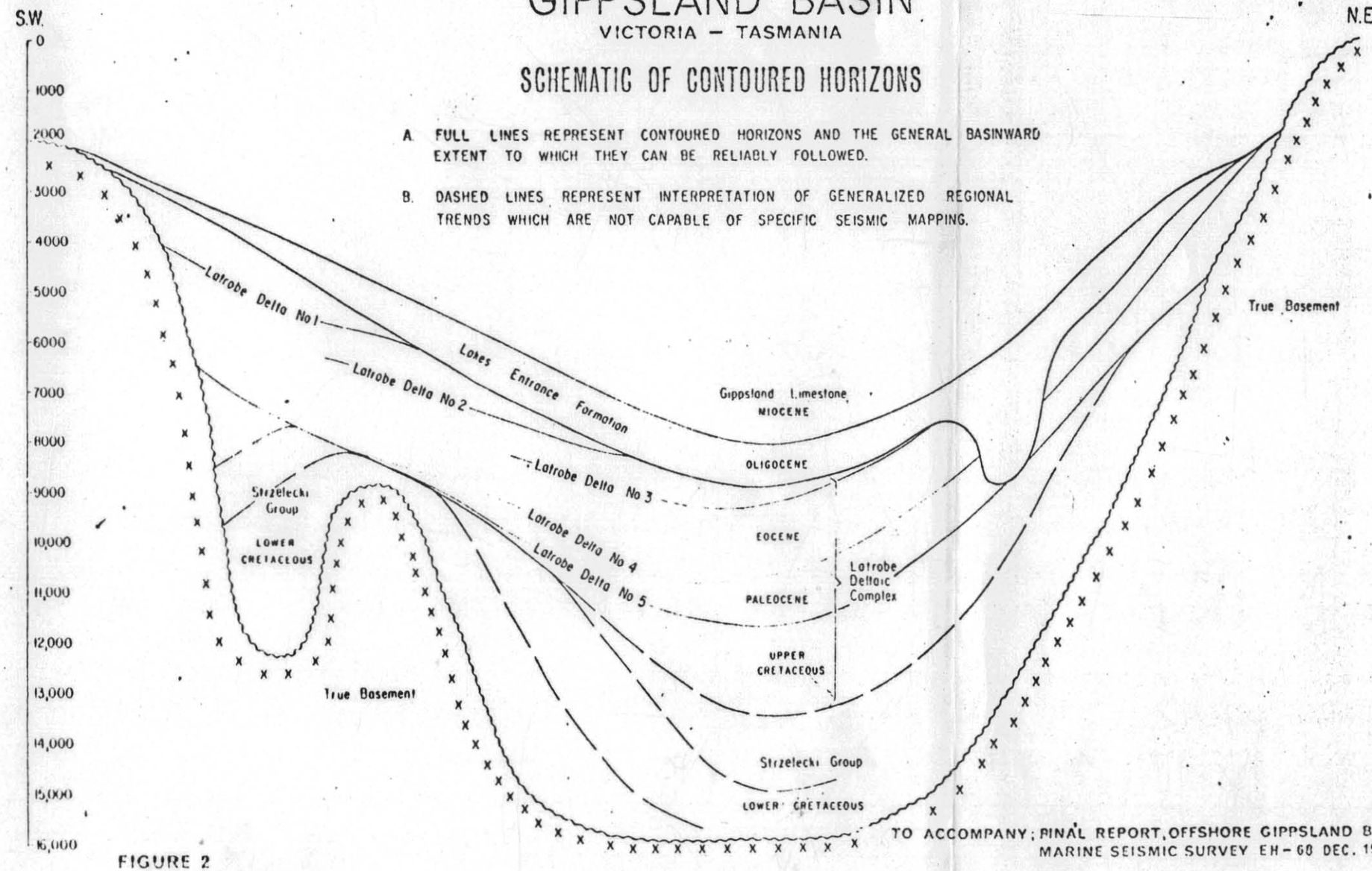


FIGURE 2

TO ACCOMPANY; FINAL REPORT, OFFSHORE GIPPSLAND BASIN MARINE SEISMIC SURVEY EH – 68 DEC. 1968

068014 Fig. 3

AGE	FORMATION	GRAPHIC	FLUIDS	LITHOLOGIC DESCRIPTION	
Quaternary				Sand - Silt and Clay	Non-marine
U.Pliocene	Haunted Hill Gravels		Fresh water	Gravel - Sand and Clay	Non-marine
L.Pliocene	Jemmy Point Fm.		Fresh water (Artesian)	Friable fossiliferous sandstone, sandy marl with bryozoa	Marine
U. Miocene	Tambo River Fm.			Interbeds marl and limestone, fossiliferous	Marine
Miocene	Gippsland Fm.		Rarely porous Local ss Dev. in EGS I & II - Saltwater	Soft, calcareous marl, and shale - with occ. streaks lt. grey, micritic, foss. ls. SS. White, fine-medium grained, with good porosity and permeability	Marine
Oligocene	Lakes Entrance Fm. Glauconitic member- Colquhoun Gravel member		✧Fresh water	Soft, calcareous shale and marl Glauconitic member-very shaly, very glauconitic sandstone with local pockets of Colquhoun Gravel-present along northeast rim of basin, conglomerate and sandstone with good porosity & perm. Changes facies to southeast to calcareous marl and shale	Marine Perm
Eocene	Latrobe Valley Fm.		✲ Fresh water 500 ppm to salt water (48,000 ppm)	Interbedded sandstone, coal and shale Sandstone, quartzose, very fine to medium to coarse, poorly sorted to well sorted, sub-rounded to sub-angular, friable, carbonaceous. Coal - brown to black Shale - brown to grey, micaceous and carbonaceous	Non-marine
Paleocene-Upper Cretaceous Undiff.	Unnamed		✲ Salt water 50,000 ppm	Interbedded sandstone, shale, coal and siltstone Sandstones, quartzose, fn. to medium to coarse, sub-rounded to sub-angular, well sorted to poorly sorted, carbonaceous, micaceous, cemented with white clay material Siltstones - are argillaceous, carbonaceous, and micaceous Shale - medium to brown, carbonaceous, micaceous Coal - black with conchoidal to sub-conchoidal fracture	Non-marine
Lower Cret. & Jurassic	Strzelecki Group		✲ Salt water 18,000 ppm	Over 8,400' greywacke, feldspathic sandstone, siltstone, carbonaceous shales, black coal and fossil plants, dips to 30° common	Non-marine
Permian				Sandstone very fine to fine, friable to poorly indurated with white clay cement. Shale - dark brown to medium grey. Basaltic volcanics. - Present in Duck Bay-1 only	Non-marine ?
Lower Carbon. to Upper Dev.	Avon River Group			Redbeds, sandstone, conglomerate, siltstone & shale (present in one well) (S.W. Bairnsdale)	Non-marine
Basement					

5 cm

DWG. 1062/G/3

FIGURE 3
TO ACCOMPANY FINAL REPORT, OFFSHORE GIPPSLAND BASIN
MARINE SEISMIC SURVEY, EC 7 DEC. 1968

068015

TIME-DEPTH TABLE

Gippsland G69A Marine Seismic & Magnetic Survey Composite of Gippsland Groper, Mullet & Perch well surveys.

Depth	Time	Depth	Time
1400	0.420	3000	0.800
1500	0.450	3100	0.820
1600	0.478	3200	0.838
1700	0.508	3300	0.860
1800	0.535	3400	0.884
1900	0.562	3500	0.907
2000	0.590	3600	0.934
2100	0.615	3700	0.957
2200	0.637	3800	0.983
2300	0.658	3900	1.003
2400	0.680	4000	1.024
2500	0.700	4100	1.042
2600	0.720	4200	1.062
2700	0.740	4300	1.080
2800	0.760	4400	1.102
2900	0.780	4500	1.125

FIGURE 4.

Subsidized Area

(a) Victoria.

Line	SP - SP	Mileage
302	2759 - 2874	10. 06
304	2875 - 2880	0.38
303	2996 - 3050	4.92
301	3051 - 3158	9.36
300	3159 - 3231	6.31
153	3232 - 3361	11.28
298	3362 - 3440	6.84
108	3441 - 3546	9.19
299	3547 - 3623	6.66
319	3624 - 3723	8.68
323	3804 - 3845	3.50
75	3887 - 3973	7.52
318	3974 - 4107	11.63
		96.33

FIGURE 5

(b) Tasmania

Line	SP - SP	Mileage
296	742 - 1268	45.86
181	1269 - 1481	18.51
297	1482 - 1686	17.81
316	1687 - 1895	18.31
315	2074 - 2201	11.11
188	2385 - 2561	15.37
157A	2647 - 2758	9.71
320	4108 - 4225	10.23
322	4226 - 4382	13.63
159	4383 - 4481	8.58
321	4482 - 4563	7.10
		176.22

Total subsidized mileage: 272.55.

068018

APPENDIX 1.
Part 2.

FINAL OPERATIONS REPORT

AUSTRALIAN MARINE SEISMIC SURVEY

G69A

GIPPSLAND

FOR

ESSO STANDARD OIL (AUSTRALIA) LIMITED

BY

WESTERN GEOPHYSICAL COMPANY OF AMERICA

PARTY 64

DECEMBER 1968 - MARCH 1969

TABLE OF CONTENTS

		Page
I.	SUMMARY	1
II.	GENERAL INFORMATION	1
	A. Contractors	1
	B. Base of Operations	1
	C. Weather	2
	D. Surveying Technique	2
	E. Chronology	2
III.	RECORDING OPERATIONS	3
	A. Major Boat Equipment	3
	B. Instrumentation	4
	C. Detector Cable	4
	D. Recording Technique	5
IV.	DATA PRESENTATION	6
	A. Field	6
	B. Processing	6
	C. Final Interpretation	6
V.	KEY FIELD PARTY PERSONNEL	6
	A. Esso Standard Oil (Australia) Limited	6
	B. Western Geophysical Company of America	7
	C. Offshore Navigation, Incorporated	7
VI.	STATISTICAL SUMMARY	7, 8, 9, 10

PLATES

I. Location Map
II. 7590 foot Cable Diagram
III. 5290 foot Cable Diagram

APPENDIX

General Description and Specifications DFR-300 Binary Gain Seismic System

I. SUMMARY

A continuous reflection seismic survey using the AQUAPULSE system was conducted in the Gippsland area offshore Victoria. Operations were carried on for an eight day period in December commencing on the 24th but the majority of the prospect was completed in the period January - March of 1969.

II. GENERAL INFORMATION

A. Contractors

The survey was conducted by Western Geophysical Company of America, 933 North La Brea Avenue, Los Angeles, California, and 69 Berry Street, North Sydney, New South Wales, Australia. Positioning control was provided by Offshore Navigation, Incorporated, 5728 Jefferson Highway, New Orleans, Louisiana and 143-147 New South Head Road, Double Bay, New South Wales, Australia.

B. Base of Operations

Two towns, namely Devonport, Tasmania and Yarram, Victoria were used as headquarter location for the prospect. Running time of the survey vessel from the shooting area determined which town was used as headquarters. Devonport provided a good source of supplies plus daily air services.

Port Welshpool was used as a harbour when using Yarram as a headquarter. Nearby Sale, Victoria provided daily air service, plus daily train service from Melbourne, Victoria. Good docks were available at both of the ports.

C. Weather

Extremely rough weather was encountered in the first days of shooting during December. Some bad weather during the period January - March was experienced but not to a degree to seriously hinder operations.

D. Surveying Technique

Four base station locations were utilized.

E. Chronology

December 23, 1968: Diverted from Bass Basin project area to shoot high priority shooting in Gippsland. 2400 meter.

December 24, 1968: Fired first shot on Line 9A264 to begin project.

December 30, 1968: After bad weather and Shoran signal problems high priority work completed and proceeding to return to Bass Basin project.

January 16, 1969: Bass Basin project completed returning to Gippsland project.

January 20, 1969: Fired first shot on Gippsland Line 9A296.

January 23, 1969: Discontinued shooting Gippsland at Client request and headed for West Coast Tasmania project.

February 4, 1969: West Coast Tasmania completed.

February 7, 1969: Shooting East Coast Tasmania project.

February 11, 1969: East Coast project completed.

February 14, 1969: Returned to Gippsland project 1600 meter shooting.

February 22, 1969: 1600 meter shooting completed.

February 23, 1969: Changing cable in Devonport to 2400 meter cable.

March 2, 1969: Commenced shooting on 2400 meter work.

March 22, 1969: "Western Spruce" destroyed by fire at Port Welshpool.

III. RECORDING OPERATIONS

A. Survey Vessel: M/V "Western Spruce" - 119 foot steel hull twin-screw vessel of American registry, powered by two General Motors V-16 Marine Diesel engines, capable of 11 knots cruising speed, and fitted with two Decca 202 Radar, Raytheon fathometer,

and Apelco ship-to-shore radio.

B. Instrumentation

Digital Recorder - SDS 1010, 30-channel, 9-track, IBM compatible, EPRCO preferred, ½ inch gapless tape format, binary gain controlled amplifiers.
On-board Display - Raytheon Precision Depth Recorder, driven by output of trace 22, through a TFA-1 amplifier.
Magnetometer - Varian Proton Marine.
Magnetometer - Model V-4937.

C. Detector Cable

A neutrally-buoyant oil-filled streamer cable equipped with four depth detectors, three special water break detectors, and 24 seismic detector groups was used. Each seismic detector group was 230 feet in length and initially, consisted of 32 crystal geophones in tapered noise cancelling array. The 7590 foot cable consisted of dead sections 100 feet in length separating each "live" group, giving a group centre spacing of 330 feet. While recording with the 7590 foot cable, the buoyancy was adjusted so that it ran at an average depth of 45 feet, and depth was maintained by eight CONDEP pressure cable depth controllers, to plus or minus 7 feet. The 5290 foot cable length for 1600 meter shooting was accomplished by removing the 100 foot dead sections.

D. Recording Technique

With the AQUAPULSE system, four "guns" in a rectangular array were trailed at a depth of about 20 feet. The gun pulse monitoring system was used in conjunction with MP-8 Geospace 'phones and 300 Hz galvos. Tests were made to ascertain the optimum gas pressure and fill time in order to obtain as near as possible a 3:1 gun pulse ratio of the first positive peak to the second. The pressures decided on were Oxygen 50lbs. per sq. in., Propane 22lbs. per sq. in. with a fill time of 1.5 seconds. Under continuous-tow operations, the metered oxygen/propane mixture was fired electrically at intervals such that when recording with the 7590 foot cable, four pulses per 330 feet, or approximately 64 pulses per mile were produced. When recording with the 5290 foot cable, 3 pulses per 230 feet, or approximately 69 pulses per mile were produced. These pulse densities allow certain options in so-called vertical summing and horizontal stacking, such as 4-sum 12-stack or 8-sum 6-stack, and 3-sum 12-stack or 6-sum 6-stack. Refer to Plates II and III for a detailed diagram of the streamer cable, AQUAPULSE gun array, and navigation antenna-gun array-cable relationship.

IV. DATA PRESENTATION

A. Field

A variable density section was made by recording the output of group 22 on the Raytheon Precision Depth Recorder. It was found that the vertical to horizontal exaggeration was about 5 to 1 when recording single pops. Wiggly trace, read-after-write monitors were produced by a Dri-Write camera every 8 pulses, or 660 feet. This monitor displayed data from the 24 seismic data channels, time break, individual gun pulse signatures, and direct water arrivals to the three water break detectors. A separate Dir-Write camera displayed, in graphic form, cable depth measured by the four depth detectors.

B. Processing

The digital tapes were air-shipped to Geophysical Service International in Sydney for processing.

C. Final Interpretation of the data was performed by Esso, Sydney.

V. KEY FIELD PARTY PERSONNEL

A. Esso Standard Oil (Australia) Limited

Name	Position
A. Martens	Client Representative

Name	Position
I. Criss	Client Representative
R. Stone	Client Representative

B. Western Geophysical Company of America

Name	Position
V. Hearon	Operations Manager
H. Hearn	Asst. Operations Manager
H. Mawdesley	Co-ordinator
A. Shirley	Instrument Supervisor
K. Dunwoody	Observer-Digital Operator
R. Adams	Gun Captain
V. Smith	Supervisor

C. Offshore Navigation, Incorporated

Name	Position
E. Benson	Party Chief
D. Hackenbruck	Mobile Operator
H. Adams	Mobile Operator

VI. STATISTICAL SUMMARY

A. Cable Length - 5290 feet

Line length measured from first to last Shoran position.

Constants:

1 interval - .0871 miles

Line	SP - SP	Profiles	Statute Miles
9A296	742 - 1268	527	45.86
9A181	1269 - 1481	213	18.51
9A297	1482 - 1686	205	17.81
9A316	1687 - 1925	239	20.77
9A317	1926 - 2073	148	12.85
9A315	2074 - 2201	128	11.11
GA188	2385 - 2561	177	15.37
GA157A	2647 - 2758	112	9.71
9A302	2759 - 2874	116	10.06
9A304	2875 - 2969	95	8.23
9A303	2970 - 3050	81	7.01
9A301	3051 - 3158	108	9.36
9A300	3159 - 3231	73	6.31
9A153	3232 - 3361	130	11.28
9A298	3362 - 3440	79	6.84
9A108	3441 - 3546	106	9.19
9A299	3547 - 3623	77	6.66
9A319	3624 - 3803	180	15.63
9A323	3804 - 3880	77	6.66
9A75	3881 - 3973	93	8.06
9A318	3974 - 4107	133	11.63
9A320	4108 - 4225	118	10.23
9A322	4226 - 4382	157	13.63
9A159	4383 - 4481	99	8.58
9A321	4482 - 4563	82	7.10
9A290	4564 - 4812	249	21.64
9A276	4813 - 4997	185	16.07
9A295	4998 - 5111	114	9.89
9A294	5112 - 5222	111	9.62
9A293	5223 - 5408	186	16.16
9A292	5409 - 5522	114	9.89
9A291	5523 - 5684	161	14.07
9A289	5685 - 5806	122	10.58
9A73	5807 - 5948	142	12.32
9A235	5949 - 6448	500	43.51
9A234	6449 - 6845	397	34.54
9A233	6846 - 7020	175	15.20
9A244	7021 - 7181	161	13.98
9A243	7182 - 7397	216	18.77
9A236	7398 - 7564	166	14.50
9A60	7565 - 7738	174	15.02
	Total 1600 Meter	6726	584.21

WESTERN GEOPHYSICAL

B. Cable length - 7590 feet

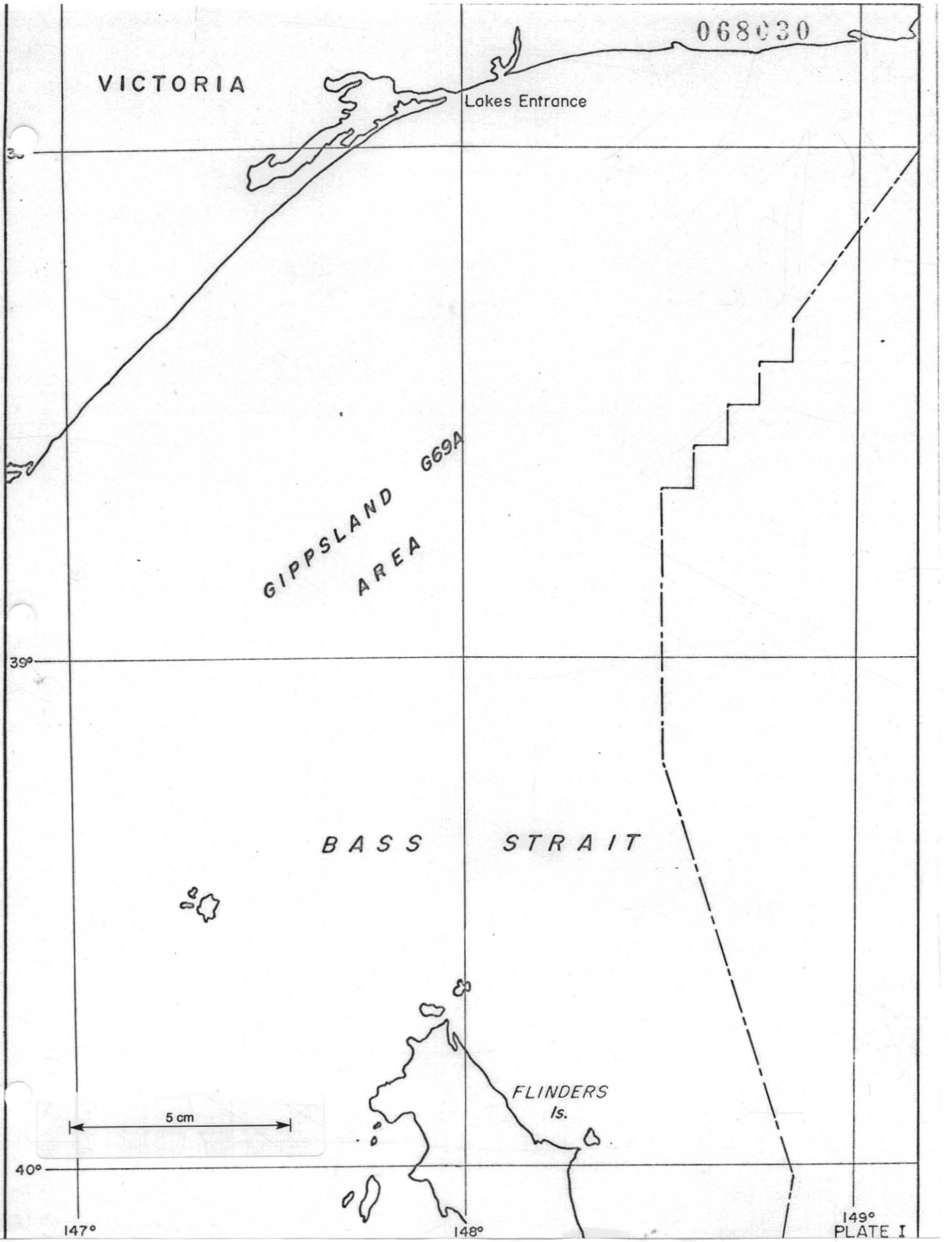
Line length measured from first to last Shoran position.

Constants:

1 interval - .1250 miles

Line	SP - SP	Profiles	Statute Miles
9A264	1 - 60	60	7.44
9A263	61 - 114	54	6.69
9A262	115 - 169	55	6.81
9A261	170 - 226	57	7.06
9A260	227 - 283	57	7.06
9A256	284 - 337	54	6.69
9A257	338 - 409	72	8.94
9A258	410 - 466	57	7.06
9A259	467 - 525	59	7.31
9A250	526 - 688 (Shooting E.)	163	
	689 - 741 (Shooting W.)	53	26.94
9A324	7738 - 7802	65	8.06
9A94	7803 - 7862	60	7.44
9A326	7863 - 7919	57	7.06
9A325	7920 - 7977	58	7.19
9A274	7978 - 8074	97	12.06
9A281	8075 - 8450	376	46.94
9A283	8451 - 8684	234	29.19
9A43	8685 - 8905	221	27.56
9A280	8906 - 9185	280	34.94
9A175	9186 - 9357	172	21.44
9A44	9358 - 9506	149	18.56
9A282	9507 - 9645	139	17.31
9A45	9646 - 9747	102	12.69
9A73B	9748 - 9845	98	12.19
9A273	9846 - 9990	145	18.06
9A279	9991 - 10078	88	10.94
9A278	10079 - 10186	108	13.44
9A277	10187 - 10349	163	20.31
9A276	10350 - 10567	218	27.19
9A156	10568 - 10787	220	27.44
9A288	10788 - 10990	203	25.31
9A284	10991 - 11190	200	24.94
9A285	11191 - 11368	178	22.19
9A157B	11369 - 11475	107	13.31
9A286	11476 - 11635	160	19.94
9A287	11636 - 11758	123	15.31
9A158	11759 - 11863	105	13.06
9A96	11864 - 11989	126	15.69

Line	SP - SP	Profiles	Statute Miles
9A93	11990 - 12044	55	6.81
9A69	12045 - 12140	96	11.94
9A65	12141 - 12250	110	13.69
9A265	12252 - 12331	80	9.94
9A266	12332 - 12526	195	24.31
9A267	12527 - 12662	136	16.94
9A268	12663 - 12718	56	6.94
9A251	12719 - 12778	60	7.44
9A252	12779 - 12869	91	11.31
9A253	12870 - 12935	66	8.19
9A248	12936 - 13285	350	43.69
9A254	13286 - 13369	84	10.44
9A255	13370 - 13439	70	8.69
9A150	13440 - 13517	78	9.69
9A249	13518 - 13628	111	13.81
9A241	13629 - 13972	344	42.94
9A242	13973 - 14044	72	8.94
9A240	14045 - 14110	66	8.19
9A239	14111 - 14163	53	6.56
9A238	14164 - 14220	57	7.06
9A237	14221 - 14277	57	7.06
9A245	14278 - 14413	136	16.94
9A247	14414 - 14475	62	7.69
9A246	14476 - 14550	75	9.31
9A269	14551 - 14630	80	9.94
9A270	14631 - 14709	79	9.81
9A271	14710 - 14780	71	8.81
9A272	14781 - 14836	56	6.94
9A91	14837 - 14918	82	10.19
9A207	14919 - 15141	223	27.81
	Total 2400 Meter	7441	1013.78

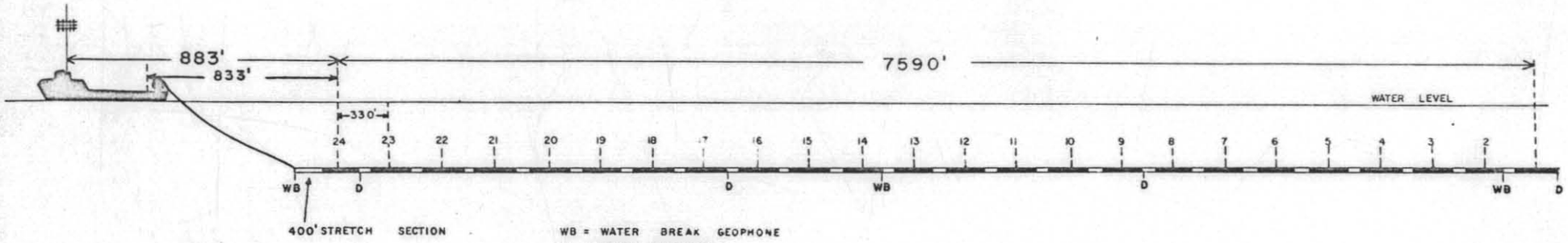

068030
VICTORIA
Lakes Entrance
GIPPSLAND AREA
G69A
BASS STRAIT
FLINDERS Is.
5 cm
38°
39°
40°
147°
148°
149°
PLATE I

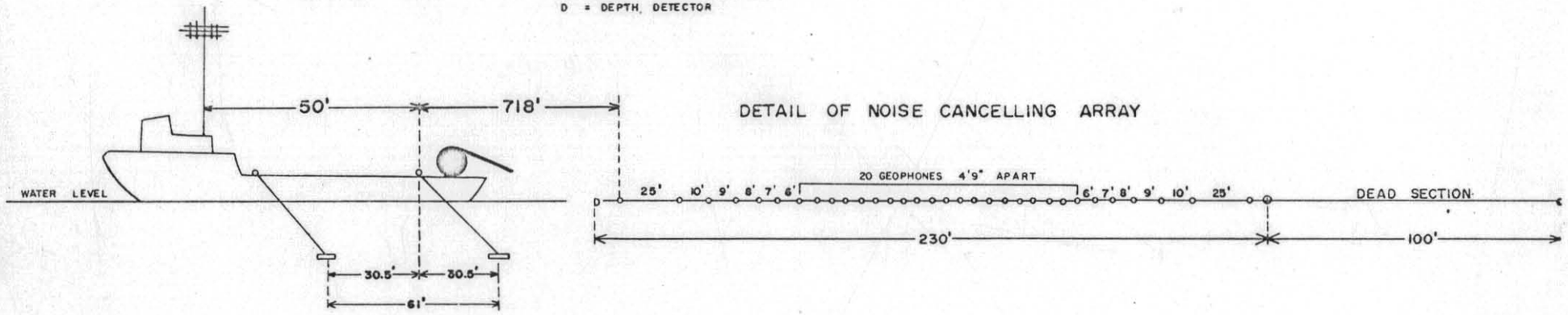
0680031

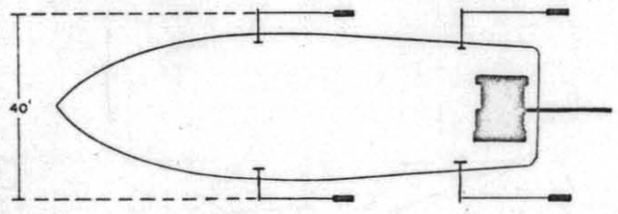
5 cm

ESSO
SEISMIC SURVEY
1969

DIAGRAM OF 7590 Ft. STREAMER CABLE







THE AQUAPULSE SYSTEM

WESTERN GEOPHYSICAL
DIVISION OF LITTON INDUSTRIES

PLATE II

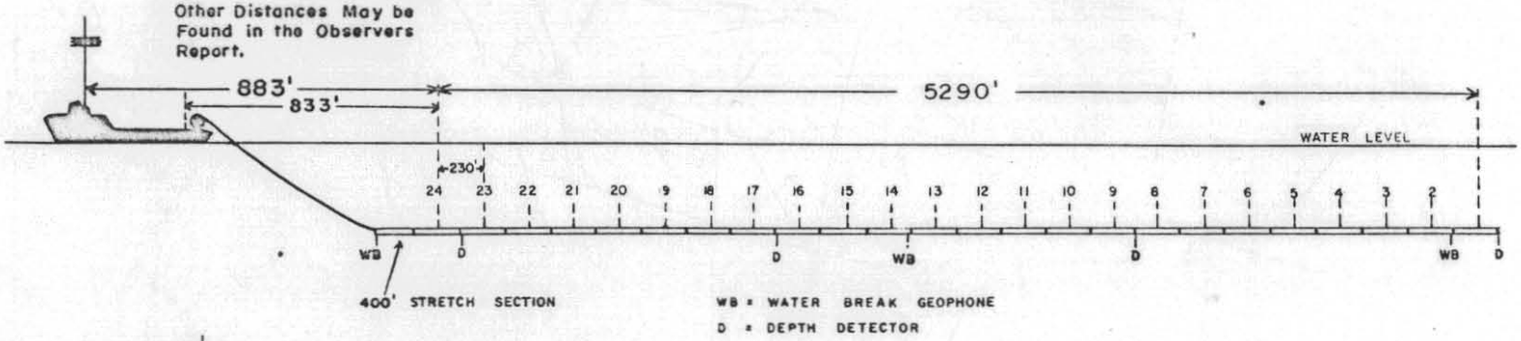
068032

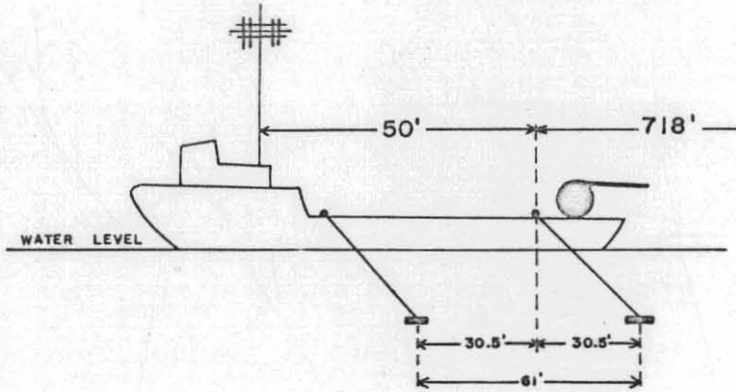
5 cm

ESSO
SEISMIC SURVEY
1969

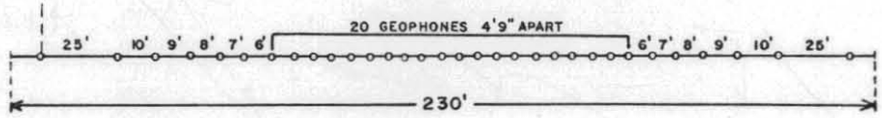
NOTE: Distance from Centre of Guns to Centre Grp. 24 = 833' for Majority of Survey but Varied for Certain Lines. These Other Distances May be Found in the Observers Report.

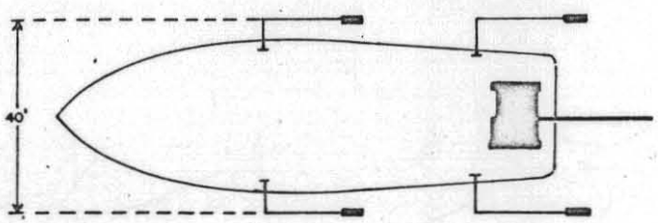
DIAGRAM OF 5290 Ft. STREAMER CABLE





DETAIL OF NOISE CANCELLING ARRAY





THE AQUAPULSE SYSTEM

WESTERN GEOPHYSICAL
DIVISION OF LITTON INDUSTRIES

PLATE III

APPENDIX

GENERAL DESCRIPTION and SPECIFICATIONS

DFR-300 BINARY GAIN SEISMIC SYSTEM (HIGH GAIN)

1. General Information

1.0 Function

1.0.0 The DFR-300 Binary Gain Seismic System accepts data directly from the seismic sensors, conditions the data, and causes the conditioned data to be recorded on digital tape. At the option of the operator, either an analog oscillograph monitor record can be recorded in the read-after-write mode concurrently with the digital recording, output from the amplifiers can be monitored directly, or else selected files can be played back at some later time.

1.0.1 The basic 9-track format is described in Savit, "A proposed standard format for nine-track digital tape", published in Geophysics, v 31, n 4, 1966.

1.1 Physical Description

1.1.1 The recording system consists of seven sections as follows:

1. Input and Test Panel
2. Binary-Gain Input Amplifiers
3. Master Control Panel
4. Magnetic Tape Unit
5. Playback Amplifiers
6. Camera
7. Power Converter

1.2 Input and Test Panel

1.2.1 Included with the input and test panels are bridling switches, cable leakage and continuity tester, precision oscillator and attenuator, group selector switch, and voltage test meter. Test panels include means to terminate the amplifier inputs with a 500 ohm load, a feature used in certain test procedures.

1.3 Binary-Gain Amplifiers

1.3.1 For each amplifier there is provided a hum balance circuit, adjustable high-cut, low-cut, and alias filters, and preamplifier-gain and D.C. offset trim pots.

1.3.2 Amplifier gain is adjusted automatically in 6 db steps; the system always attempts to maintain the signal level between one-fourth and one-half of full scale. To prevent signal clipping and distortion, it is urgent to reduce gain if the signal bursts out above half scale so downward gain-ranging may take place on every alternate scan. At a 1 ms sample rate, the attack rate is 3000 db/sec. On the other hand, in the case of a varying data signal which is crossing zero many times per second, it is apparent that some of the sample values of the signal would fall below the one-quarter scale set-point which triggers the gain increase, yet the signal peaks would be above the trigger level and the existing gain level should be continued. A means is provided to delay the gain increase until all samples fall below the trigger level. This operation is accomplished by examining all samples of a given channel for a time period which is set by a 3-position release-rate switch, having the positions, fast, medium, and slow (30, 40, 60 ms, nominal or 200, 150, 100 db/second). The release rate is an expression of the speed, in decibels per second, at which an amplifier is capable of increasing gain to follow a declining seismic signal. As soon as all samples are below the lower set point for an examination period, the gain is increased by 6 db at the next scan. Thus, with a 30 ms examination period, the gain could be increased 6 db every 30 ms or at a rate of 200 db/sec. Provision of three release rates permits the operator to select the one best suited to the data being received.

1.3.3 Each amplifier unit includes one preamplifier and two paralleled post-amplifiers. The preamplifier has a gain of 40 for systems 105 and all systems with serial number 108 and later. The output of the post-amplifiers is applied to the system multiplexer and also to the analog camera when switched to the noise monitor mode. Of the two post-amplifiers, post-amplifier 1 has selectable gains of 1 and 256; post-amplifier 2 has selectable gains of 16 and 4096. The choice of one of the two gains and one of the two post-amplifiers is a function of the gain-control unit selecting the particular amplifier. In the noise monitor mode, the amplifier gain is forced to X163,840.

1.4 Logic Control Chassis

1.4.1 The Logic Control chassis contains the master control panel multiplexer, buffer amplifier, gain control unit, A/D and D/A converters, and control logic. Early gain controls for the amplifiers are mounted on the master control panel. The tape drive is included in this chassis unless a 10" tape drive is specified, in which case the tape is mounted in a third rack. An optional dual drive is available for continuous operations.

1.4.2 The analog outputs of the amplifier units are time-multiplexed by the amplifier multiplexer, whence each analog signal is fed to the buffer amplifier. The buffer amplifier serves both as

an impedance matcher between the multiplexer and the A/D converter and as an element of the binary gain amplification scheme. Binary signals from the control unit select any one of four buffer-amplifier gains of 1, 2, 4, or 8. The selected buffer-amplifier gain, combined with one of the four gains in the post-amplifiers, result in 15 binary gain steps from 1 to 32,768.

1.4.3 The Gain Control Unit originates a 4-bit gain code to select the gain of one of the two post amplifiers and to control the gain of the buffer amplifier. In general, when the analog value being digitized falls below one-quarter scale, the gain control unit increases the gain code by 1. When the value exceeds one-half scale, the gain control unit decrements the gain code by 1. These values are acquired by decoding the digital outputs of the A/D converter.

1.4.4 The Input Control Unit controls flow of data from the A/D converter, gain control unit, file counter, time counter and other sources to the input bus. This unit sequences and formats the data words into two 8-bit bytes, generates the parity bit, and writes the data on tape via the tape write unit.

1.4.5 The A/D converter is a 14-bit-plus-sign binary converter with complement output for negative numbers. It is controlled by a single start line originating in the input control unit. A trigger pulse on this line for each seismic channel starts the entire conversion sequence. The bit circuits continuously track the analog signal; then, after a particular analog signal has settled, the start signal initiates the sequential clamping of the bit circuits. In this way the precise digital value is achieved very rapidly by successive approximation. The digital output levels are applied to the input bus and are also used to control the gain control units.

1.4.6 The D/A converter accepts the magnitude bits furnished by the A/D converter as well as the 4-bit gain code from the gain control unit. It uses both of these--as mantissa and exponent--in a floating point representation to generate an analog signal with three significant features: (1) The analog output contains the full dynamic range of the system in a form capable of representation on a recording oscillograph. (2) The gain steps that would ordinarily be visible when the system moves from one gain code to another are removed. (3) The average value of the analog signal is normalized by digital and analog AGC, around a manually set playback level, so that rapid changes such as burst-outs are readily visible. The final result is a camera record on which both the average signal value and the reflections are clearly visible for the entire length of the file. On high-gain models, the gain change blips can be displayed at the operator's option.

1.5 Magnetic Tape Unit

1.5.1 The Magnetic Tape Unit is a field tape transport accommodating 9-track tape, ½-inch wide, on 8-½ or 10 inch reels. Direction of tape motion, startup and shutdown are controlled by the system control unit on the basis of the mode selected; tape speed depends upon the sampling rate selected.

1.5.2 A beginning-of-tape sensor determines when first recording may commence, and the end-of-tape sensor warns of the approach of the tape end. If the EOT marker is sensed while a file is being recorded, recording will continue past the EOT mark until the file is completed but no further recording can be done on that reel. It should be noted that this capability is possible because the EOT marker is located 65 feet from the actual end of tape. The tape transport is interlocked with a number of system and transport conditions so that it can operate only when all conditions are ready.

1.5.3 Use of the seismic recording system may involve interlaced recording or playback operations; therefore, a special type of file protection system is provided. This over-write protection uses the electronic detection of data on the tape to inhibit writing. An advance-to-end-of-data control allows the system operator to automatically reposition the tape at the end of the previously recorded data. As a result, it is possible to record a file, replay it or another file, and go ahead with more recording with no chance of inadvertently over-writing data.

1.5.4 In addition to the electronic data-detector-write-inhibitor, conventional write-ring protection is provided. This feature assures the operator that previously recorded data cannot possibly be damaged. If desired, the erase head and electronic file protector can be disabled when recording in the continuous forward mode and, in this case, file protection is available only via the write-ring file protect.

1.5.5 The write logic generates IBM-compatible odd vertical parity which is recorded on tape along with the data. Parity errors are displayed by means of indicator-lights; whenever an excess of parity errors occurs, an audible and visible alarm is activated. The usual EOF characters are generated automatically after the recording has been completed; a manual EOF switch is also available.

1.5.6 A special switch is provided to write a block of all 1's. This block, of indefinite length, is used to check skew.

1.6 Playback Amplifiers

1.6.1 Camera displays can be made in playback mode, either read-after-write during a recording or read only at a later time, or in noise monitor mode.

1.6.2 When the noise-monitor mode is entered, signals are taken from the output of post-amplifier 2 and are fed to the camera. In this mode, the gain is forced to X163,840.

1.6.3 In the direct playback mode only the mantissa is displayed with no reference to the gain code. In this mode the transients due to gain changes are readily visible.

1.6.4 Playback AGC capability is partly analog and partly digital. The digital part removes the transients due to gain changes by bit-shifting and applies gain control to all channels so that the maximum average signal is at a preset level. Differences of amplitude level between channels are then removed by analog AGC applied to individual channels. Burstouts are preserved in their true relationship to the signal envelope level at the point where they occurred. The rate at which the average envelope level is followed in the reconstruction of the signal is adjusted by a three-position AGC rate switch. In addition to the AGC rate, the level at which the average envelope is controlled can also be adjusted. If, for example, the level is reduced, a relatively large burstout capability is provided. To prevent the AGC action from forcing the amplifier to maximum gain when no data signal is present, the AGC preset control is provided to limit the amount of gain control before trip.

1.6.5 Fixed-gain playbacks can be made by locking out the AGC action so that the effective gain is set by the preset switch. It should be noted that if the Preset gain, as set for playback, is greater than the Early gain, as set for record, all signals will be automatically bit-shifted by the amount of the difference, but if the settings are the same, no bit-shifting will occur. For certain test purposes it is desirable to make specified bit-shifts without regard to the early gain setting used at recording time. To accomplish this end, Unit 105, 108 and later models have been equipped with a special function switch providing the option of normal AGC preset, or the capability of shifting the data bits, on playback, by specified fixed amounts regardless of the Early gain setting used during recording.

1.6.6 On playback, the data can be filtered at the option of the operator. Three-position, high- and low-cut filters are provided, with provision to switch the filters out if desired.

1.6.7 Many units have a time accumulator. To monitor its functioning, the least significant bits of the time word are selected and displayed on trace 25 of the camera recording. The signal will appear as a saw-tooth wave with a period of 2048 ms. The time-word display appears on an auxiliary trace.

1.6.8 In addition to the time accumulator display, the time break event is shown as follows. At the beginning of the recording, a DC offset is applied to trace 25. At the moment that the time

break is sensed, the offset is removed and the trace returns to normal in the form of a step function. The amplitude of the time-break signal must exceed 1/4 scale for this feature to function.

1.7 Camera

1.7.1 A multi-trace, direct-writing camera is a permanent part of the system. Ordinarily, camera input is fed from the read-after-write heads on the magnetic tape recorder unless the system is in the noise monitor or tape bypass mode. Camera start may be set to coincide with either the recording or playback cycles. For test purposes, the tape can be bypassed so that incoming signals can be played directly into the camera.

1.8 Power Converter Unit

1.8.1 The Power Converter Unit converts 12-volt battery power to thirteen, DC output voltages to operate the units of the 1010 system. Five shielded outputs are used where the maintenance of analog accuracy is critically important. Seven regulated voltages are used principally for digital purposes. An unregulated voltage is used for indicators and relays, and the battery voltage is used directly for motors and heaters.

1.9 Block Diagram

1.9.1 A simplified block diagram is illustrated in Figure 1.

2. Specifications

2.1 System

Number of inputs	24 data channels plus 6 auxiliary channels
Sample rate	1, 2, or 4 ms per scan, switch-selectable
Sample rate accuracy	0.01%
System resolution (A-D)	15 bits including sign
System resolution (D-A)	10 bits including sign manually left shiftable to 84 db
Data code	15 bits in 2 bytes, 1's complement
Redundancy check	Odd vertical parity
Search capability	Forward and reverse for three-digit file identification
Playback AGC control	3 positions: fast, medium, slow
Voltage required	12 v DC

2.2 Amplifier

Maximum input signal	250 mv zero to peak
Input impedance	500 ohms nominal
Minimum gain	32 db
Noise	Less than 0.2 μvp RTI r.m.s.
Cross talk	Greater than 66 db down from full scale
Harmonic distortion	0.1% from 10 Hz to 250 Hz
Automatic gain range, binary gain amplifiers	90 db
Attack rate (@ 1 ms sample rate)	3000 db/sec.
Release rate	200, 150, 100 db/sec. (30, 40, 60 ms delay, nominal)

2.3 Multiplexer, A/D converter

Input	±10 v from seismic amplifier
Number of inputs	30
Noise	±0.6 mv peak referred to ±10 v peak at input to A-D
Coding error	±½ least significant bit
Nagative numbers	1's complement
Linearity	Better than 0.01%
Slope error	Better than 0.01%
Zero error	Better than 0.01%
Conversion time	12 μs

2.4 D/A Converter

Code input	Binary, 1's complement
Number of bits	10 bits, including sign
Accuracy	±0.2%

2.5 Magnetic Tape Unit

Speeds	20, 40, 80 ips
Speed tolerance	±2% long term
Direction	bi-directional
Tape width	½" (0.498 ±0.002)
Recording	IBM compatible
Packing density	800 bpi
Tracks	9
Track spacing	ASI standard
Tape sensing	Photo-reflective IBM compatible; both BOT and EOT

Read direction	3 speeds forward, 1 speed reverse
File protection	Electronic and/or write-ring file protection
Erase head	
Reels	8½" or 10" compatible with IBM hubs and snap-off locks

2.6 Filter Amplitude Response Curves

2.6.1 Refer to Figures 2 and 3.

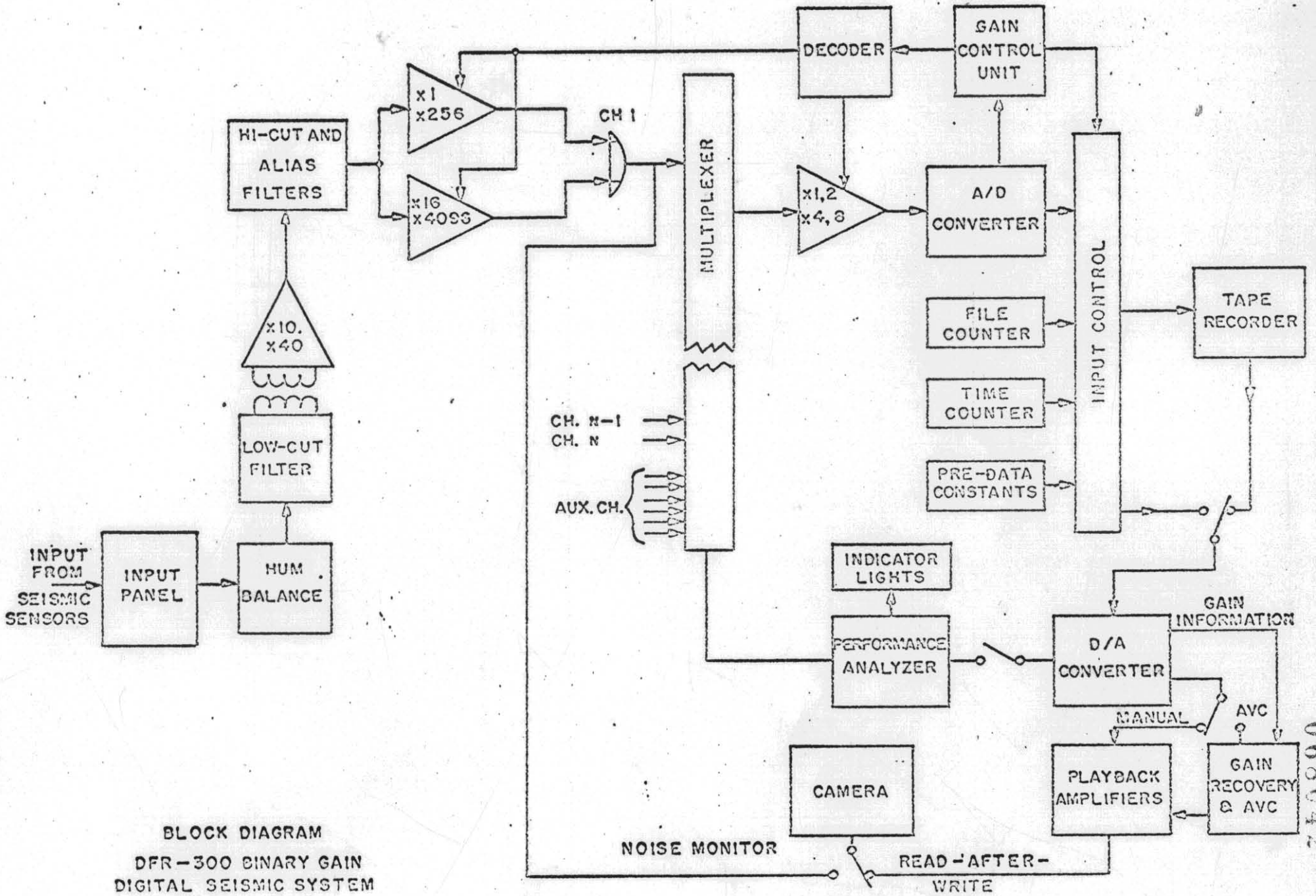


Figure 1

BLOCK DIAGRAM
DFR-300 BINARY GAIN
DIGITAL SEISMIC SYSTEM

WESTERN GEOPHYSICAL

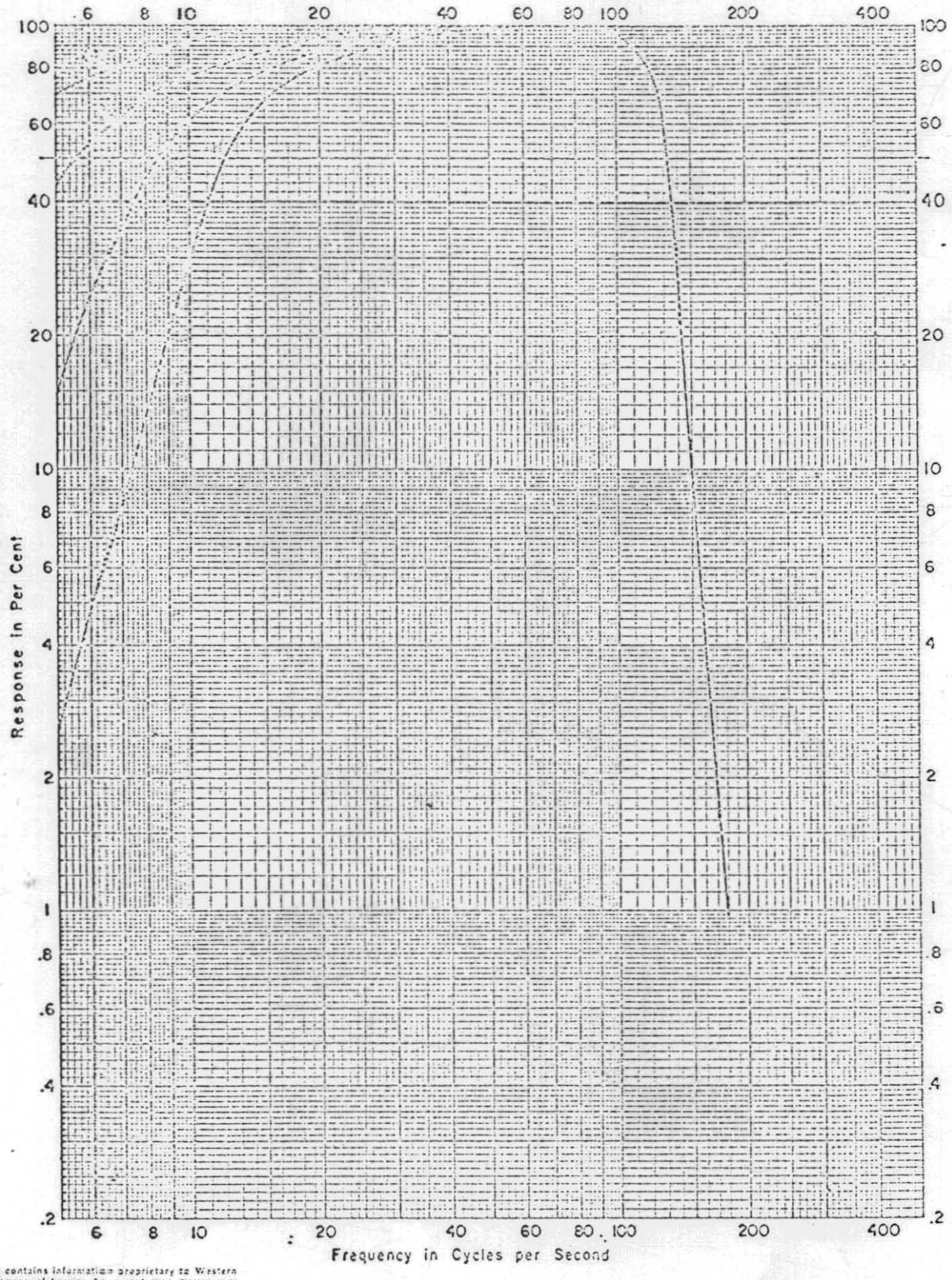
0680 42

AMPLITUDE RESPONSE

068043

SDS BINARY-GAIN AMPLIFIER
SERIES DFR-300
LOW CUT FILTERS

AMPLIFIER ONLY
HIGH CUT FILTERS-OUT
ALIAS FILTER - 2MS



This drawing contains information proprietary to Western Geophysical Company of America. Any reproduction, disclosure or use of this drawing is expressly prohibited except as Western Geophysical Company of America may otherwise agree in writing.

WESTERN GEOPHYSICAL

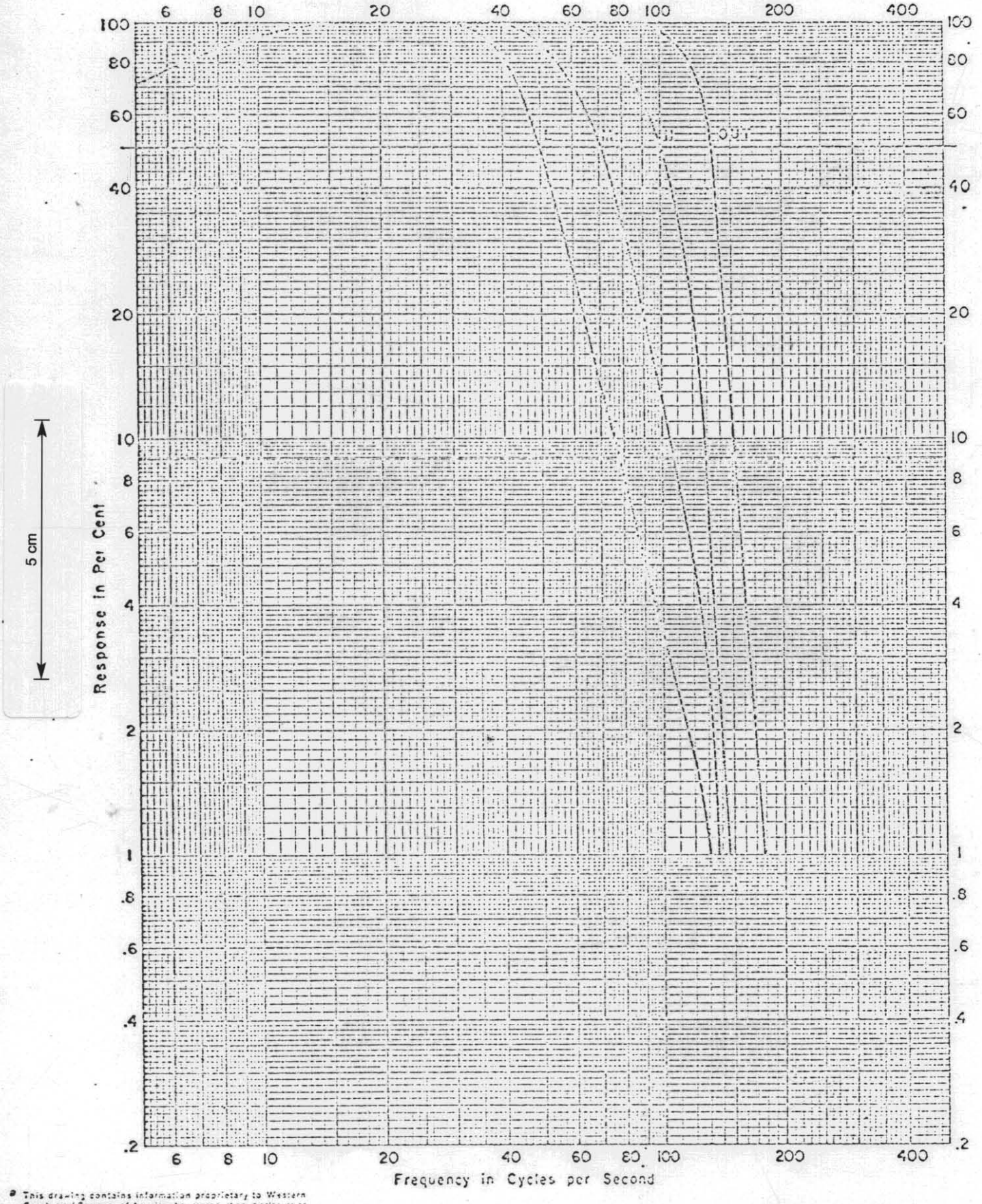
FIGURE 2.

AMPLITUDE RESPONSE

068044

SDS BINARY GAIN AMPLIFIER
SERIES DFR-300
HIGH CUT FILTERS

AMPLIFIER ONLY
LOW CUT FILTER - OUT
ALIAS FILTER - 2 M.S



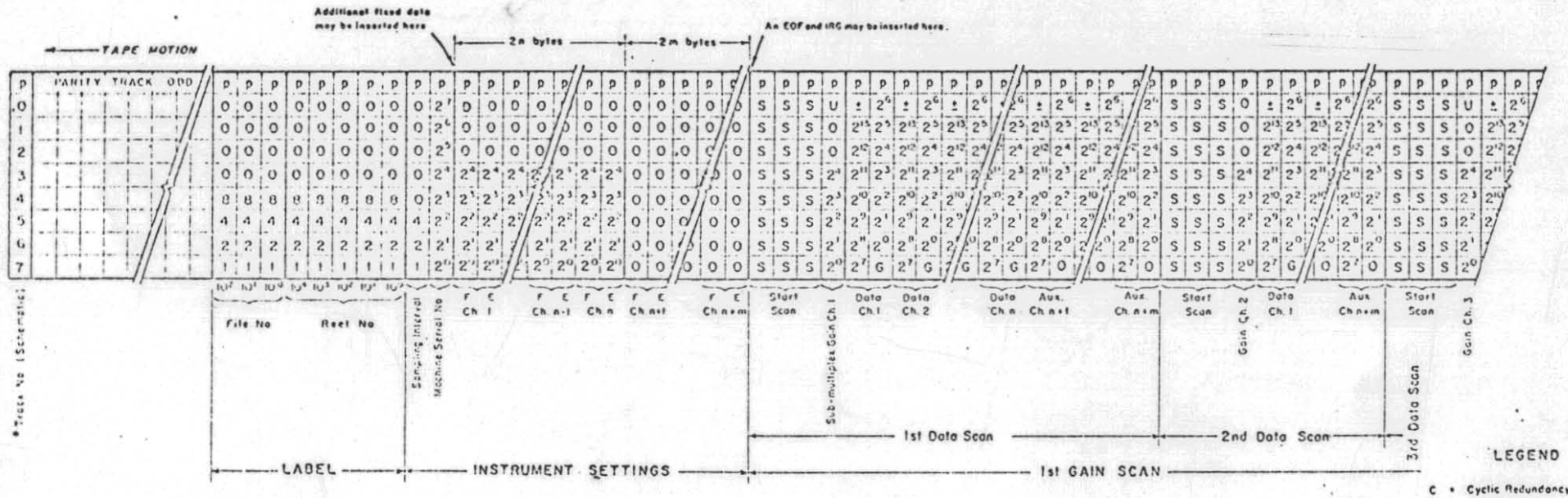
This drawing contains information proprietary to Western Geophysical Company of America. Any reproduction, disclosure or use of this drawing is expressly prohibited except as Western Geophysical Company of America may otherwise agree in writing.

WESTERN GEOPHYSICAL

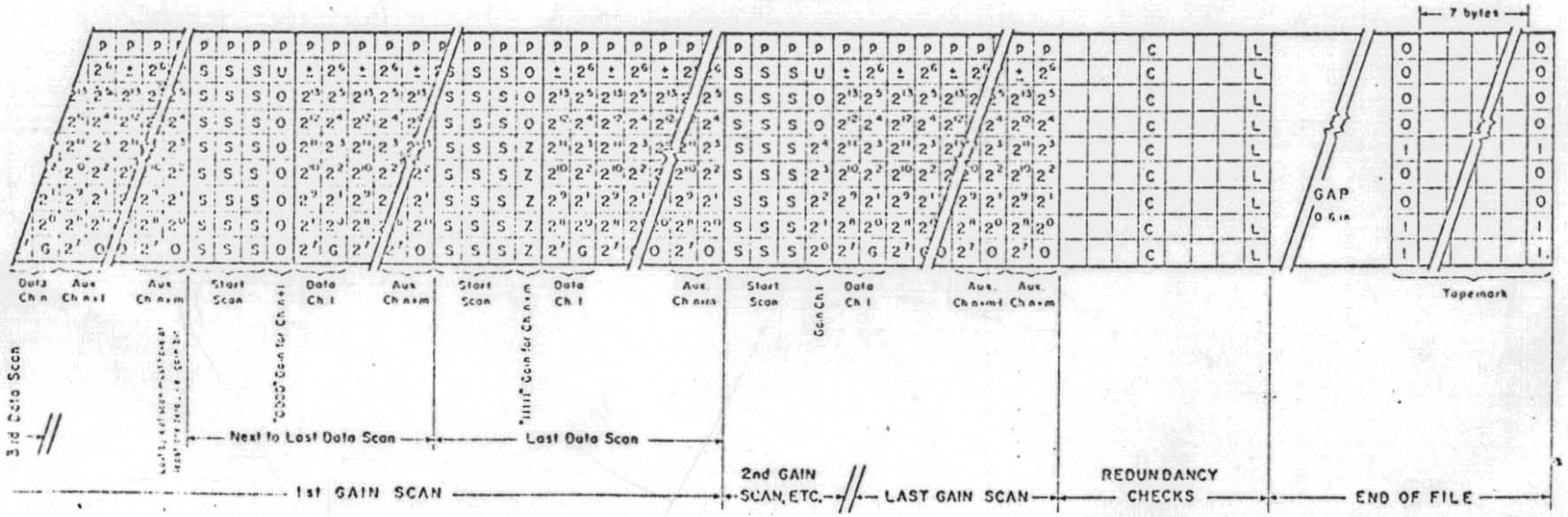
FIGURE 3.

5 cm

9-TRACK DIGITAL RECORDING FORMAT



* The actual order on the tape is, from top to bottom, 4, 6, 0, 1, 2, 8, 3, 7, 5.



LEGEND

- C = Cyclic Redundancy Check
- D = Data Channel Indicator
- E = Early Gain
- F = Fixed Gain
- G = Gain Change Indication
- L = Longitudinal Redundancy Check
- m = Number of Auxiliary Channels
- n = Number of Data Channels
- p = Parity Bit (odd)
- S = Start of Scan Code
- U = Upward Gain Change Indicator
- Z = End of Gain Scan
- 2* = Data Bit

WESTERN GEOPHYSICAL
DIVISION OF LITTON INDUSTRIES

0980945

APPENDIX 2
PART 3

068046

FINAL REPORT

OFFSHORE NAVIGATION, INC.

PROJECT 305

WESTERN GEOPHYSICAL COMPANY OF AMERICA

PARTY 64

for

ESSO STANDARD OIL (AUSTRALIA) LTD.

BASS STRAIT, AUSTRALIA

FEBRUARY - MARCH 1969

068047

A B S T R A C T

Project 305 was a XR Shoran controlled marine seismic survey for potential mineral deposits in the Bass Strait area, off the southeastern coast of Australia.

The principal involved was Esso Standard Oil (Australia) Ltd. (ESSO).

Western Geophysical Company of America (WESTERN) was the prime contractor and operator.

Offshore Navigation, Inc. (ONI) provided horizontal control for the survey.

068048

TABLE OF CONTENTS

	Page
The Shoran Radiopositioning System	1
Area of Operations	11
Field Operations Recap	11
General Information	12
Computing and Basic Control	12
Personnel	14
Distribution	15
Area of Operations Legend	16
Shoran Base Station Descriptions and Plats	17

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 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

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

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.

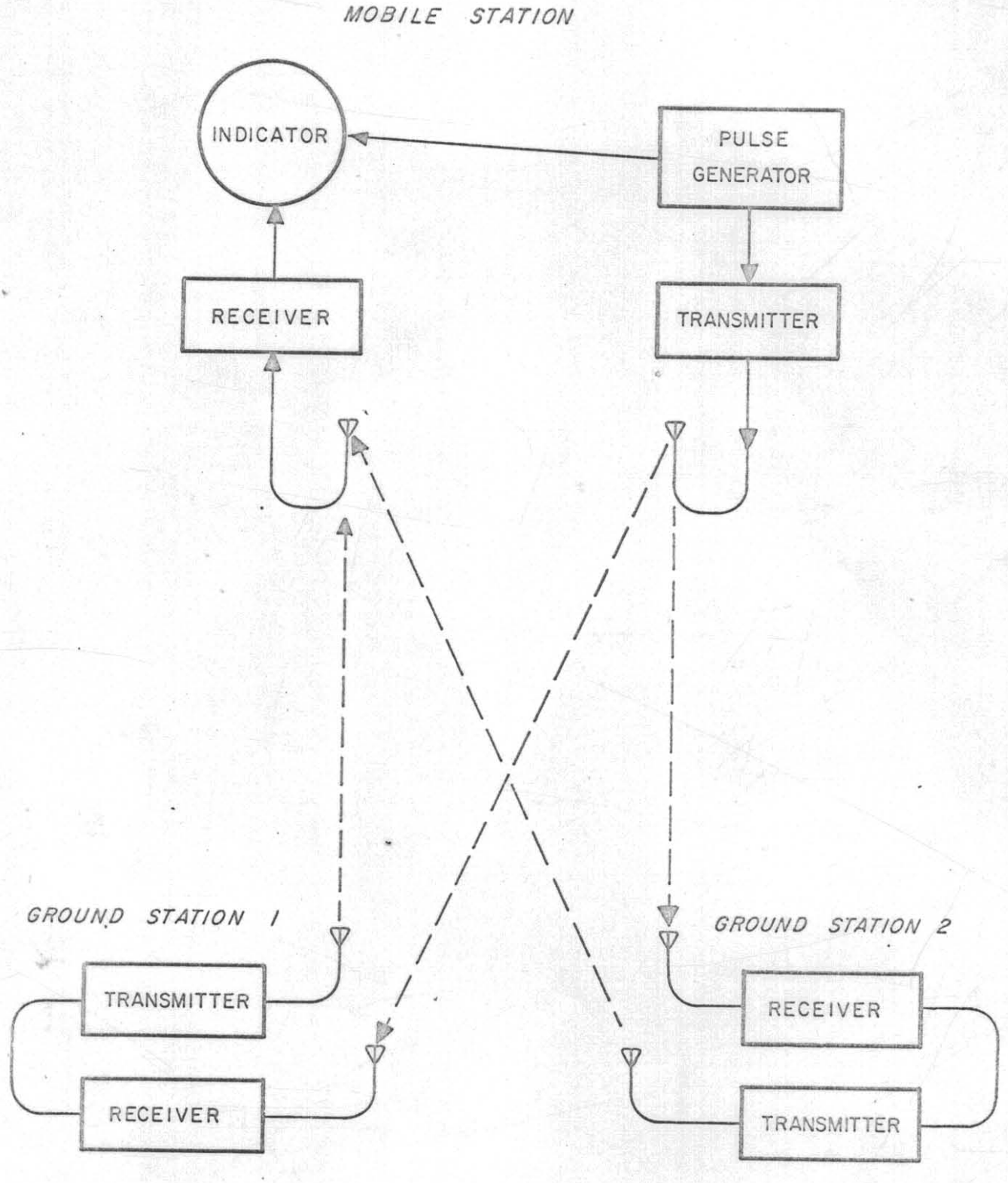


FIGURE 1
SIMPLIFIED BLOCK DIAGRAM OF BASIC RADIO EQUIPMENT OF A SHORAN SYSTEM

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 radio spectrum. Normally, three separate frequencies are used. Two of these are transmitted alternately by the

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

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

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

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

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

The factor, k, 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 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 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.

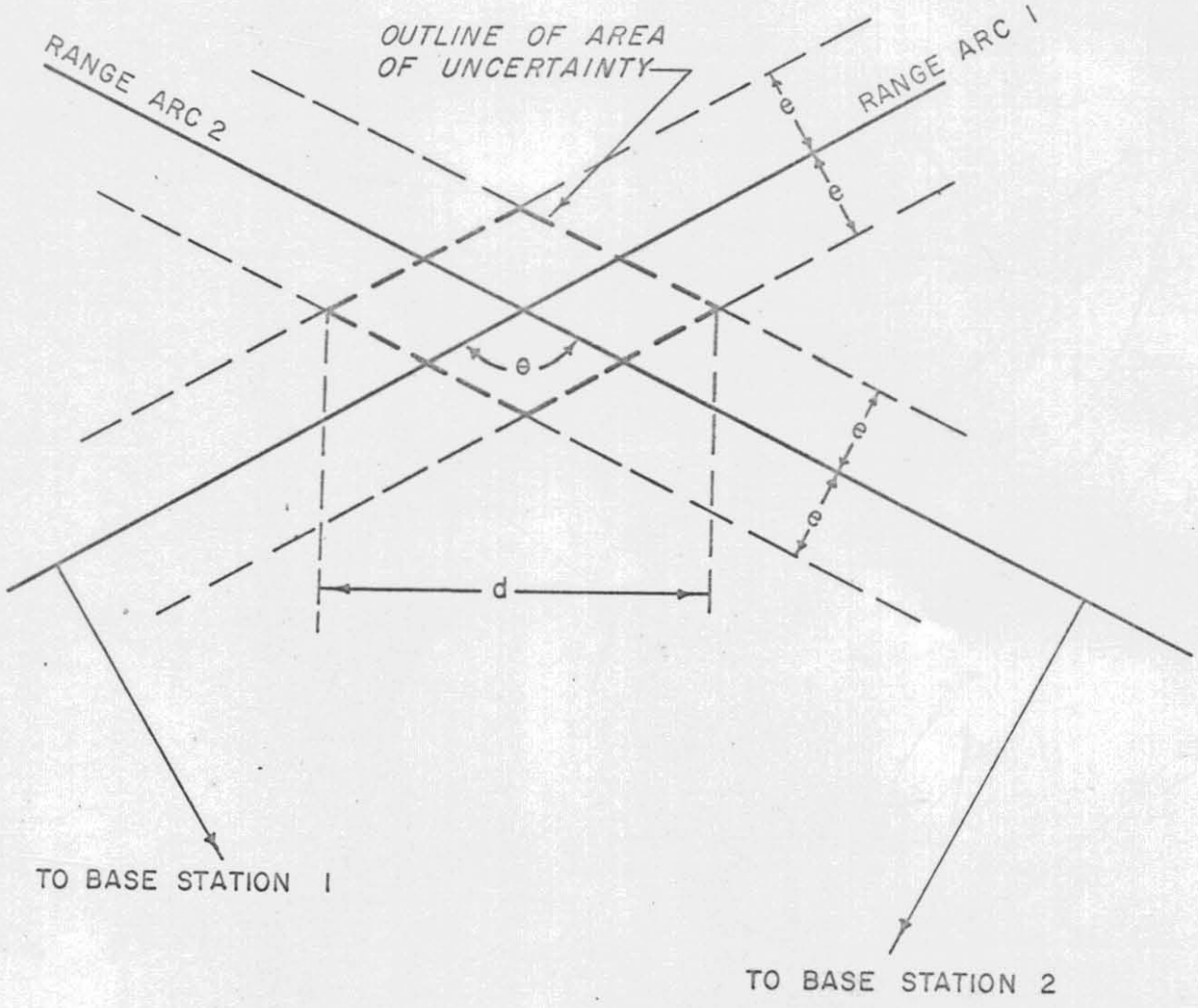
The instrumental accuracy of the Shoran equipment, when properly calibrated, is ± 50-75 feet on a single range. The overall position accuracy is related to the range accuracy by

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

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 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.



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

e = RANGE ERROR

θ = ANGLE OF INTERSECTION OF RANGE CIRCLES

5 cm

FIGURE 2

AREA OF UNCERTAINTY OF POSITION DUE TO ERROR IN RANGE MEASUREMENT

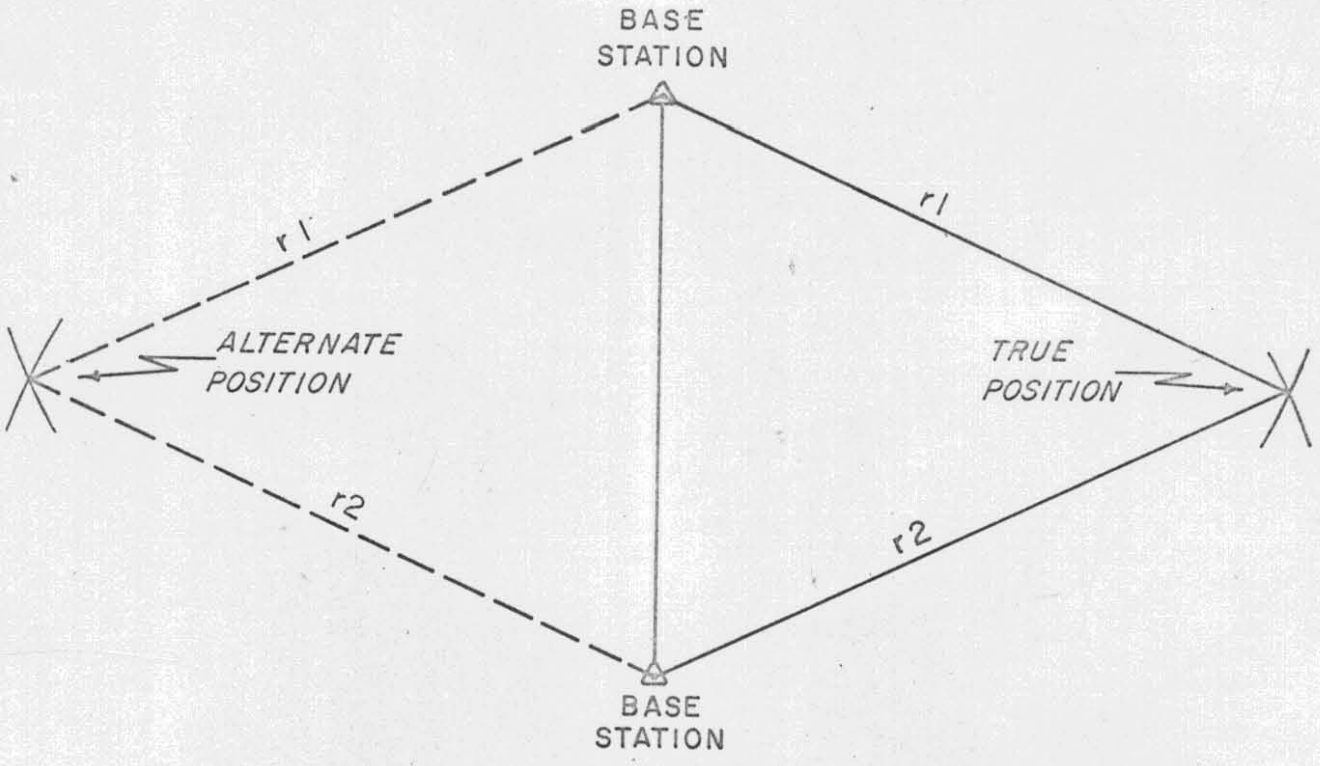
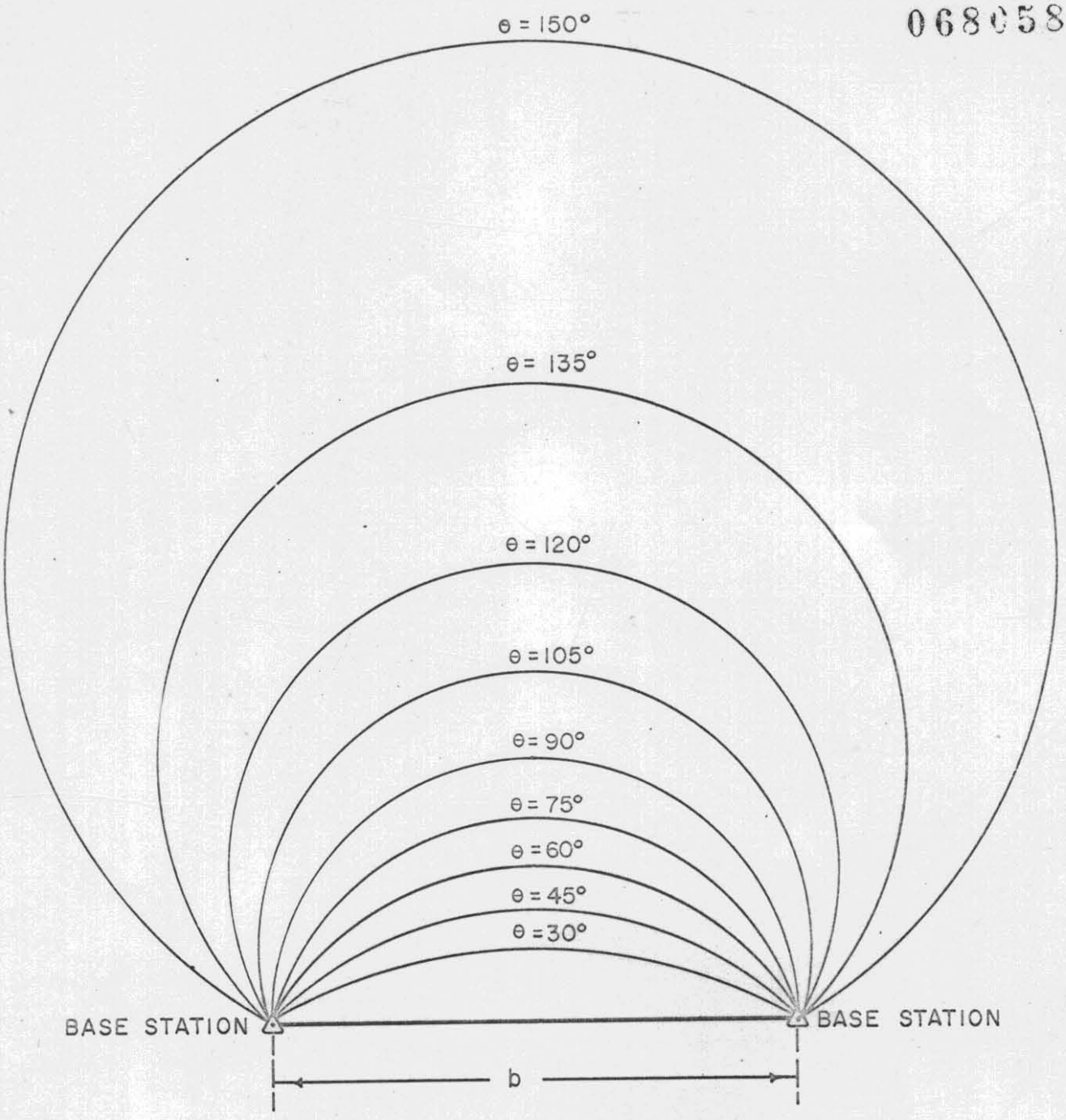


FIGURE 3

POSITION AMBIGUITY IN CIRCULAR RANGE SYSTEM

068058



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

FIGURE 4

RELATIVE AREA OF COVERAGE, CIRCULAR RANGING SYSTEM

II. AREA OF OPERATIONS

The program area extended from Cape Howe on the eastern boundary to Wilsons Promontory on the western boundary, and southward to Deal Island. The work area extended approximately 100 miles off the coast.

ONI's main base of operation was located at Lakes Entrance, Victoria, on 14 February 1969, with an alternate base located at Yarram, Victoria, on 27 February 1969. From these offices the activities of the field crew were directed and radiotelephone communications maintained.

III. FIELD OPERATIONS RECAP

The vessel utilized during the survey was the M/V WESTERN SPRUCE. Shoran indicating equipment had been installed prior to its departure from the United States.

Initial base station installations were made on 12 February 1969.

Actual seismic operations began on 14 February 1969 when the vessel occupied the first line and began shooting. Final Shoran readings for the client were observed on 21 March 1969.

III. FIELD OPERATIONS RECAP (continued)

At this time the M/V WESTERN SPRUCE was destroyed by fire, and the operation was concluded. Dismantling of the base stations was completed on 27 March 1969 and the equipment was packed for shipment to Singapore.

All ONI personnel were released and the base of operation closed on 28 March 1969.

IV. GENERAL INFORMATION

A. Satisfactory radiotelephone communications between the Shoran installations and the base of operation were maintained on the frequency of 2398 kilocycles.

B. The Shoran field survey notes were turned over to Mr. Heron, a WESTERN representative, at the completion of each trip.

V. COMPUTING AND BASIC CONTROL

Prior to the start of field operations, ONI in New Orleans predetermined the Shoran ranges and grid coordinates for each recording boat location to be occupied during the course of the survey. These preplots were prepared in accordance

V. COMPUTING AND BASIC CONTROL

with the program assignment chart furnished to ONI. Due to changes made in the initial program by ESSO, additional preplots were prepared in Sydney.

Coordinates of the four stations used to provide control for the survey were furnished by WESTERN. The coordinates appearing on the descriptions and plats are referred to the Australian Transverse Mercator Projection, Clarke 1858 Spheroid, Belt 7, Central Meridian 146° East. A False Northing of 1,000,000 yards is added.

VI. PERSONNEL

Name	Position
Benson, E.	Party Chief
Cosgrove, P.	Mobile Operator
Hackenbruck, D.	Mobile Operator
Owens, B.	Mobile Operator
Woody, D.	Mobile Operator
Watson, D.	Mobile Operator/ Base Operator
Bienz, W.	Base Operator
Binderman, B.	Base Operator
Forsyth, J.	Base Operator
Hinks, M.	Base Operator
Kingsley, B.	Base Operator
Martin, K.	Base Operator
Simmons, R.	Base Operator

VII. DISTRIBUTION

Western Geophysical Company
of America
Post Office Box 61
North Sydney, N.S.W. 2062
Australia — Four Copies

Offshore Navigation, Inc.
Post Office Box 23504
New Orleans, Louisiana 70123 — Two Copies

Offshore Navigation, Inc.
202 Roma Arcade
413-417 New South Head Road
Double Bay (Sydney) N.S.W. 2028
Australia — One Copy

REFERENCE CHART U.N.C. R-13

AUSTRALIA

STA. MT. NOWA NOWA

STA. MT. CANN (720)

CAPE HOWE

ORBOST

BAIRNSDALE

SALE

STA. BLACKWARRI (731)

WOODSDALE

APPROXIMATE PROGRAM AREA

147°00'

148°00'

149°00'

150°00'

38°00'

39°00'

WILSONS PROMONTORY

VICTORIA

TASMANIA

STA. DEAL ISLAND

TASMAN SEA

068064

N

5 cm

SCALE 1:1,000,000 OR-042

OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

SHORAN BASE STATION DESCRIPTIONS AND PLATES

STATION: Blackwarri (731)

LOCATED: North-northeast of Yarram, Australia.

ACCESS: Take the Gippsland Highway east from Yarram for two miles. Turn left onto a road leading to Traragon and continue through Won Wron. Take the first left turn on top of hill. Follow the dirt road until fork in road is reached. From the fork in the road the tri-station can be seen on the right approximately 1000 feet away. This is a drive-on site.

MARKER: 20 foot high steel leg with disk at top.

GENERAL: The owner is to be paid $10.00 each time we occupy the site.

Transportation, laundry, gas, oil and supplies can be obtained through Mr. Bill Vangall at Ships Inn in Yarram, Telephone 421, P. O. Box 120. A small airport located approximately 4 miles from Yarram can be used for charter flights for incoming and outgoing gear when needed.

ELEVATION: 700 yards.

SKETCH: See next page.

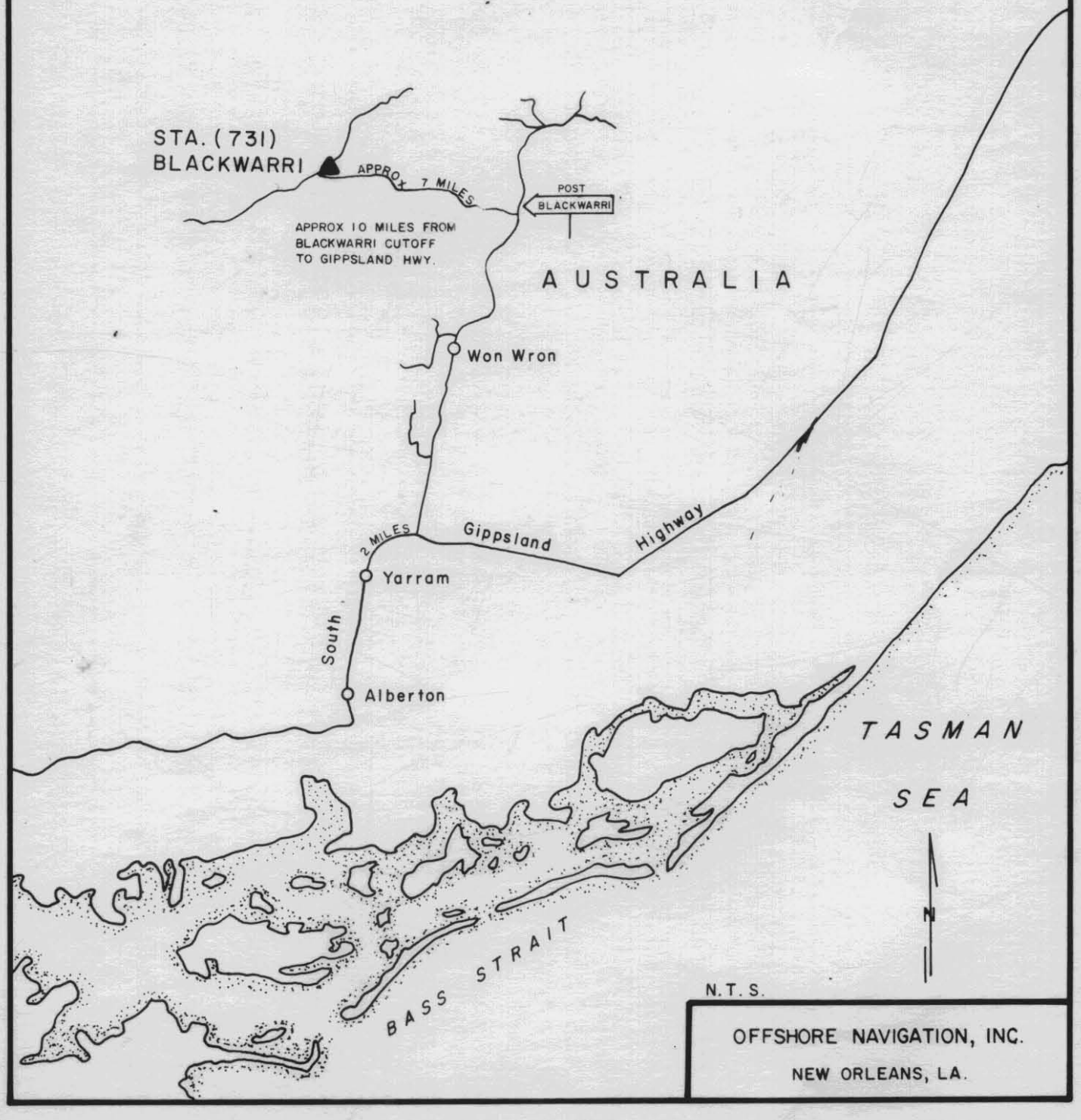
GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID BELT 7, C.M. 146°E	
Latitude	Longitude	North	East
38°24'16".20 S	146°38'55".65 E	1,265,299 yds.	461,979 yds.

5 cm

STA. (731) BLACKWARRI — AUSTRALIA

LAT.	38° 24' 16".20 S	N	1,265,299 yards
LONG.	146° 38' 55".65 E	E	461,979 yards
ELEV.	700 yards		

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 7, C.M. 146° E, F.N. = 1,000,000 YARDS



OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

STATION: Deal Island

LOCATED: On the southwest end of Deal Island.

ACCESS: Equipment and supplies must be carried from Port Albert, Victoria. This can be arranged by contacting Mr. Frank Gould at Port Albert, telephone 832343. Mr. Gould has a boat in which he makes regular supply runs to Bass Strait lighthouses. Equipment will be unloaded at Jetty which is 2 miles from the site. The Lightkeeper has a Land Rover which is available to transport equipment to within 125 yards of the site. From this point it must be packed up a bush track to the site. Water is available at the Lighthouse.

MARKER: A metal plate on the highest point of hill between two large rocks.

GENERAL: To occupy site permission must be obtained from The Regional Lighthouse Engineer, Shipping and Transport Department, 497 Collins St., Melbourne. Phone 620151.

ELEVATION: 333 yards.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID BELT 7, C.M. 146°E	
Latitude	Longitude	North	East
39°29'41"36 S	147°19'09"23 E	1,132,236 yds.	524,112 yds.

STATION DEAL ISLAND — TASMANIA

LAT.	39° 29' 41."36 S	N	1,132,236 yards
LONG.	147° 19' 09."23 E	E	524,112 yards
ELEV.	333 yards		

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 7, C.M. 146° E; F.N. = 1,000,000 YARDS



N

N.T.S

5 cm

OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

STATION: Mt. Cann (720)

LOCATED: Approximately 30 statute miles east-northeast of Orbost.

ACCESS: Follow the Princes Highway for approximately 35 miles east of the town of Orbost. Take the first road to the right after crossing the Bemm River bridge. It goes to the mountain.

GENERAL: A four-wheel drive vehicle is needed in wet weather. This is a drive-on site. A hut is located at the site. Permission to occupy it should be obtained from the Forestry office at Cann River.

ELEVATION: 585 yards.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID BELT 7, C.M. 146°E	
Latitude	Longitude	North	East
37°38'55"34 S	148°58'45"80 E	1,352,691 yds.	687,592 yds.

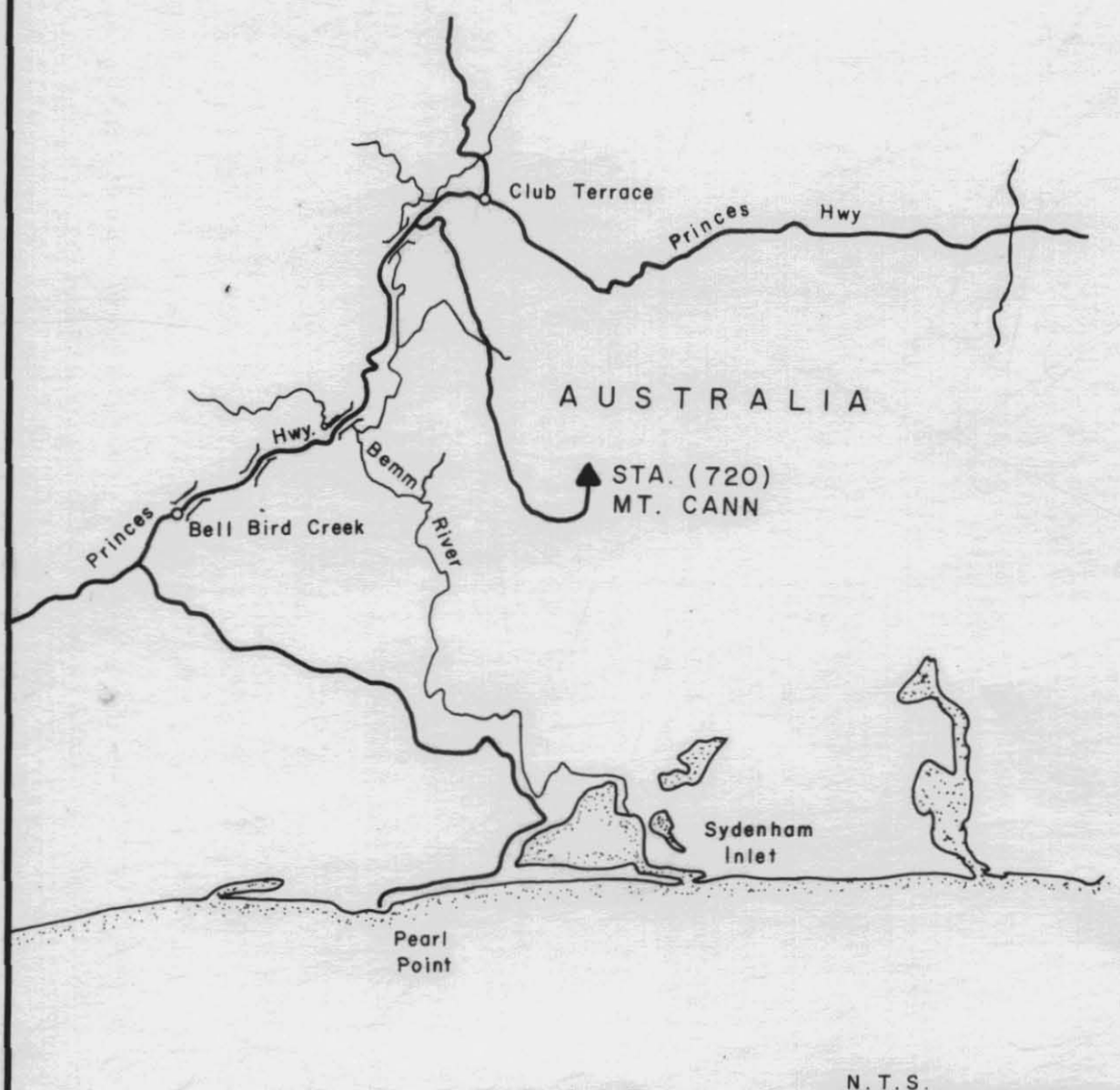
068070

STA. (720) MT. CANN — AUSTRALIA

LAT. 37° 38' 55".34 S N 1,352,691 yards
LONG. 148° 58' 45".80 E E 687,592 yards
ELEV. 585 yards

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 7, C.M. 146° E; F.N. = 1,000,000 YARDS

5 cm



N.T.S.

OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

STATION: Mt. Nowa Nowa

LOCATED: Northeast of Bairnsdale in the state of Victoria.

ACCESS: Follow the Princes Highway to the township of Nowa Nowa. Travelling east through town, take the first left turn. Pass a forestry camp until the sign "Mt. Nowa Nowa" is seen on a tree. Follow this road to the top of the mountain. There is a fire tower on top.

GENERAL: Water is available at the site in wet season. This is a drive-on site.

ELEVATION: 388 yards.

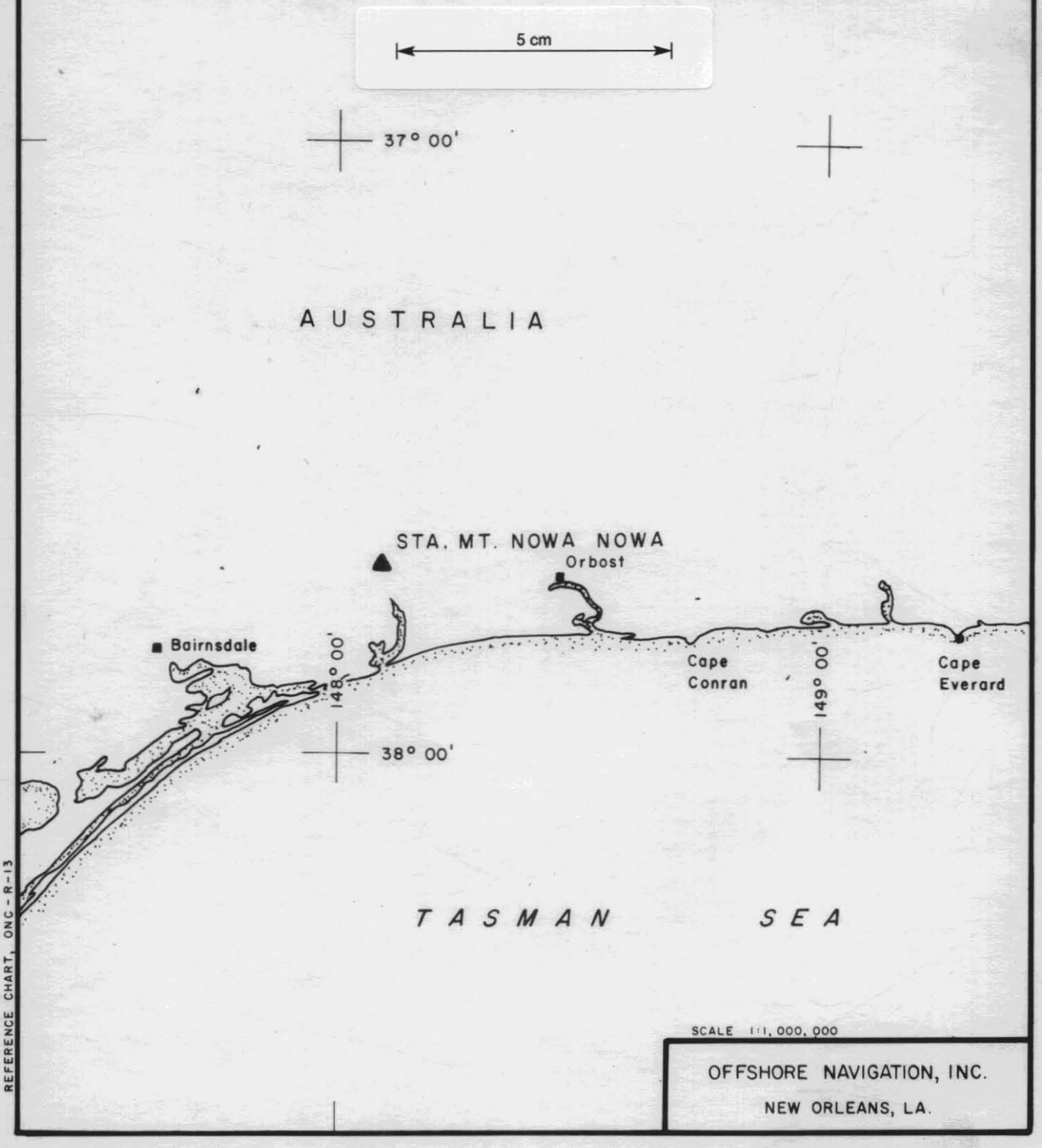
SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID BELT 7, C.M. 146° E	
Latitude	Longitude	North	East
37°41'36".90 S	148°05'30".03 E	1,349,561 yds.	601,770 yds.

STATION MT. NOWA NOWA — AUSTRALIA

LAT. 37° 41' 36".90 S N 1,349,561 yards
LONG. 148° 05' 30".03 E E 601,770 yards
ELEV. 388 yards

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 7, C.M. 146° E, F.N. = 1,000,000 YARDS



REFERENCE CHART, ONC-R-13

VICTORIA
TASMANIA

ESSO-HEMATITE VIC/P2

MAGELLAN P.E.P.63 Area 'B'

Mullet-1
T.D. 2463'

50 Mile Radius Kingfish Field

T A S M A N S E A

ESSO-HEMATITE T/P4

ESSO-HEMATITE VIC/P1

ESSO-HEMATITE VIC/P2

MAGELLAN T/P1

147° 45' 148° 00' 148° 15' 148° 30' 148° 45'

39° 15' 39° 30' 39° 45' 40° 00' 40° 15'

INSET MAP

146° 45' 147° 00' 147° 15'

38° 45' 39° 00'

ST MARGARET ISLAND

Woodside-1 T.D.5935'
Woodside-2 T.D.6862'
Diamond-2 T.D.4666'
Woodside-4 T.D.2694'

40 Mile Radius Barracouta Field

50 Mile Radius Kingfish Field

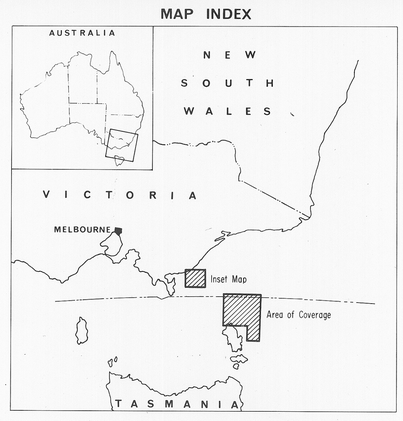
WOODSIDE VIC/P8

ESSO-HEMATITE VIC/P1

ESSO-HEMATITE VIC/P2

146° 45' 147° 00' 147° 15'

MAP INDEX



LEGEND

- Seismic shot point
- Velocity scan
- Dry and abandoned well
- --1000-- Structure contour in feet
- U/D Fault, 'D' downthrown side
- Unconformity
- Igneous intrusion
- Petroleum tenement boundary

EAST BASS BASIN
-Part 5/2

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

THE GIPPSLAND BASIN

VICTORIA - TASMANIA

068673

WATER DEPTH MAP

5 cm

CONTOUR INTERVAL : 20 FEET DATUM SEA LEVEL

Scale 1 : 100,000

2 1 0 2 4
MILES

AUTHOR P.M.COONEY, J.W.MILLIKEN, D.B.DEPEW DRAFTED BY : M.F. WEETMAN

TO ACCOMPANY FINAL SUBSIDY REPORT OF THE GIPPSLAND G-69A MARINE SEISMIC AND MAGNETIC SURVEY, JUNE, 1969

PLATE I

OR-042

Dwg. 1152/G/2

147° 45' 148° 00' 148° 15' 148° 30' 148° 45'

ESSO-HEMATITE VIC P2

VICTORIA TASMANIA

MAGELLAN P.E.P.63 Area 'B'

Mullet-1 T.D. 2463'

50 Mile Radius Kingfish Field

T A S M A N S E A

ESSO-HEMATITE T/P4

40 Mile Radius Barracouta Field

50 Mile Radius Kingfish Field

MAGELLAN T/P1

ESSO-HEMATITE VIC/P1

ESSO-HEMATITE VIC/P2

WOODSIDE VIC/P8

TOP OF STRZELECKI

CRYSTALLINE BASEMENT

Boundary between different Economic Basements

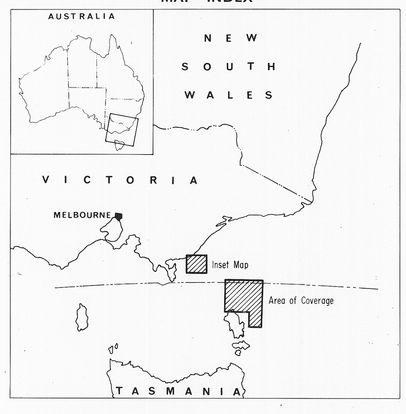
ST MARGARET ISLAND

39° 15' 39° 30' 39° 45' 40° 00' 40° 15' 38° 45' 39° 00' 39° 00'

146° 45' 147° 00' 147° 15' 148° 30' 148° 45'

INSET MAP

MAP INDEX



LEGEND

- Seismic shot point
- Velocity scan
- Dry and abandoned well
- —1000— Structure contour in feet
- U / D Fault 'D' downthrown side
- Unconformity
- Igneous intrusion
- Petroleum tenement boundary

EAST BASS BASIN Pack 5/13

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

THE GIPPSLAND BASIN

VICTORIA - TASMANIA

0680.4

STRUCTURE MAP ON ECONOMIC BASEMENT

5 cm

CONTOUR INTERVAL : 100 FEET DATUM : SEA LEVEL

Scale 1 : 100,000

2 1 0 2 4

MILES

AUTHOR P.M.COONEY, J.W.MILLIKEN, D.B.DEPEW DRAFTED BY : P.L. SPINNER

TO ACCOMPANY FINAL SUBSIDY REPORT OF THE GIPPSLAND G-69A MARINE SEISMIC AND MAGNETIC SURVEY, JUNE, 1969

PLATE II

OR-OA-2

DWG.1152/G/3

ESSO-HEMATITE VIC P2

VICTORIA
TASMANIA

MAGELLAN P.E.P. 63 Area 'B'

Mullet-1
T.D. 2463'

50 Mile Radius Kingfish Field

NO LATROBE PRESENT

T A S M A N S E A

ESSO-HEMATITE T/P4

147° 45' 148° 00' 148° 15' 148° 30' 148° 45'

39° 15' 39° 30' 39° 45'

INSET MAP

146° 45' 147° 00' 147° 15'

WOODSIDE P.E.P. 42

ST. MARGARET ISLAND

40 Mile Radius Barracouta Field

50 Mile Radius Kingfish Field

WOODSIDE

ESSO-HEMATITE VIC/P1

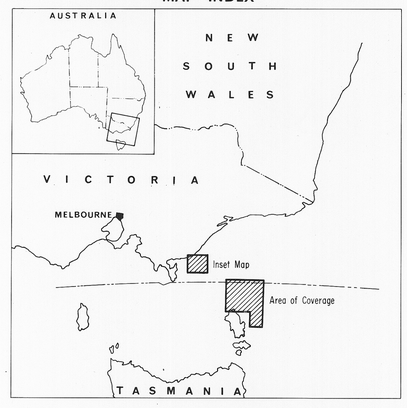
ESSO-HEMATITE VIC/P2

NO LATROBE PRESENT

38° 45' 39° 00' 40° 00' 40° 15'

MAGELLAN T/P1

MAP INDEX



LEGEND

- Seismic shot point
- Velocity scan
- Dry and abandoned well
- —1000— Structure contour in feet
- U / D Fault, 'D' downthrown side
- Unconformity
- Igneous intrusion
- Petroleum tenement boundary

EAST BASS BASIN
- Part S/14

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

THE GIPPSLAND BASIN

VICTORIA - TASMANIA

068075

STRUCTURE MAP ON

LATROBE DELTA TOPOGRAPHIC SURFACE

5 cm

CONTOUR INTERVAL : 100 FEET DATUM : SEA LEVEL

Scale 1 : 100,000

2 1 0 2 4

MILES

AUTHOR P.M.COONEY, J.W.MILLIKEN, D.B.DEPEW DRAFTED BY : P.L. SPINNER

TO ACCOMPANY FINAL SUBSIDY REPORT OF THE GIPPSLAND G-69A MARINE SEISMIC AND MAGNETIC SURVEY, JUNE, 1969

PLATE III

OR 042

Dwg 1152/6/4

ESSO-HEMATITE VIC P2

VICTORIA
TASMANIA

MAGELLAN P.E.P.63 Area 'B'

Mullet-1
T.D. 2463'

50 Mile Radius Kingfish Field

40 Mile Radius Barracouta Field

NO LAKES ENTRANCE PRESENT

MIOCENE CHANNEL CUT

MAGELLAN T/P1

T A S M A N S E A

ESSO-HEMATITE T/P4

ESSO HEMATITE VIC/P2

ESSO-HEMATITE VIC/P1

WOODSIDE VIC/P8

WOODSIDE P.E.P 42

ST MARGARET ISLAND

INSET MAP

147° 45' 148° 00' 148° 15' 148° 30' 148° 45'

39° 15' 39° 30' 39° 45'

146° 45' 147° 00' 147° 15'

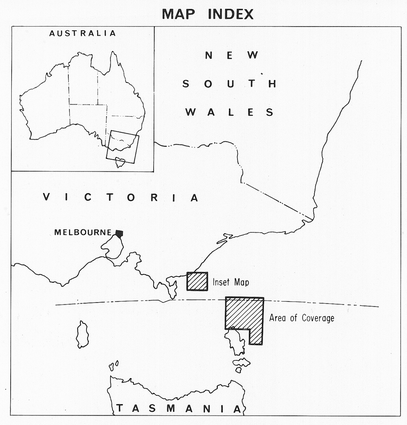
38° 45' 39° 00'

148° 30' 148° 45'

40° 00' 40° 15'

NO LAKES ENTRANCE PRESENT

MAP INDEX



LEGEND

- Seismic shot point
- Velocity scan
- Dry and abandoned well
- —1000— Structure contour in feet
- U / D Fault, 'D' downthrown side
- Unconformity
- Igneous intrusion
- Petroleum tenement boundary

EAST BASS BASIN
- Part 5/5

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

THE GIPPSLAND BASIN

VICTORIA - TASMANIA

068076

STRUCTURE CONTOUR MAP ON TOP OF LAKES ENTRANCE FM.

5 cm

CONTOUR INTERVAL 100 FEET DATUM SEA LEVEL

Scale 1 : 100,000

2 1 0 2 4
MILES

AUTHOR P.M.COONEY, J.W.MILLIKEN, D.B.DEPEW DRAFTED BY M. F. WEETMAN

TO ACCOMPANY FINAL SUBSIDY REPORT OF THE GIPPSLAND G-69A MARINE SEISMIC AND MAGNETIC SURVEY, JUNE, 1969

PLATE IV

OR-042

Dwg. 1152/6/5

VICTORIA
TASMANIA

ESSO-HEMATITE VIC P2

MAGELLAN P.E.P.63 Area 'B'

Mullet-1
T.D. 2463'

50 Mile Radius Kingfish Field

40 Mile Radius Barracouta Field

50 Mile Radius Kingfish Field

THICK

THICK

THICK

THIN

THICK

T A S M A N S E A

ESSO-HEMATITE T/P4

WOODSIDE

ESSO-HEMATITE VIC/P1

ESSO-HEMATITE VIC/P2

WOODSIDE F.E.P 42

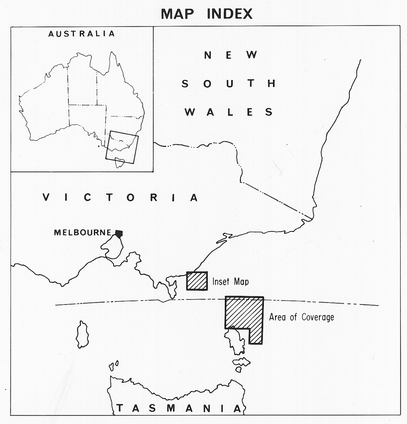
ST MARGARET ISLAND

MAGELLAN T/P1

147° 45'
148° 00'
148° 15'
148° 30'
148° 45'
39° 15'
39° 30'
39° 45'
147° 00'
147° 15'
146° 45'
38° 45'
39° 00'
40° 00'

INSET MAP

MAP INDEX



LEGEND

- Seismic shot point
- Velocity scan
- Dry and abandoned well
- --1000-- Structure contour in feet
- Fault, 'D' downthrown side
- Unconformity
- Igneous intrusion
- Petroleum tenement boundary

EAST BASS BASIN
- part S16

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

THE GIPPSLAND BASIN

VICTORIA - TASMANIA

G68C7

ISOPACH MAP OF LATROBE DELTA TOPOGRAPHIC SURFACE TO ECONOMIC BASEMENT

5 cm

CONTOUR INTERVAL : 100 FEET

Scale 1 : 100,000

2 1 0 2 4
MILES

AUTHOR P.M.COONEY, J.W.MILLIKEN, D.B.DEPEW DRAFTED BY : W. WEBER

TO ACCOMPANY FINAL SUBSIDY REPORT OF THE GIPPSLAND G-69A MARINE SEISMIC AND MAGNETIC SURVEY, JUNE, 1969

PLATE V

OR-062

Dwg. 1152/G/6

5

ESSO-HEMATITE VIC P2

VICTORIA
TASMANIA

MAGELLAN P.E.P.63 Area 'B'

Mullet-1
T.D. 2463'

50 Mile Radius Kingfish Field

THICK

MIOCENE CHANNEL CUT

THICK

THICK

THICK

T A S M A N S E A

U D

D U

147° 45' 148° 00' 148° 15' 148° 30' 148° 45'

39° 15' 39° 30' 39° 45'

ESSO-HEMATITE T/P4

INSET MAP

146° 45' 147° 00' 147° 15'

WOODSIDE F.E.P. 42

ST. MARGARET ISLAND

40 Mile Radius Barracouta Field

50 Mile Radius Kingfish Field

WOODSIDE

ESSO-HEMATITE VIC/P1

ESSO-HEMATITE T/P2

THICK

THIN

38° 45' 39° 00' 39° 15' 40° 00' 40° 15'

MAGELLAN T/P1

MAP INDEX

AUSTRALIA

N E W
S O U T H
W A L E S

V I C T O R I A

MELBOURNE

Inset Map

Area of Coverage

T A S M A N I A

LEGEND

- Seismic shot point
- Velocity scan
- Dry and abandoned well
- --1000-- Structure contour in feet
- U/D Fault 'U' 'D' downthrown side
- Unconformity
- Igneous intrusion
- Petroleum tenement boundary

EAST BASS BASIN
-part S17

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

THE GIPPSLAND BASIN

VICTORIA - TASMANIA

068078

ISOPACH MAP OF
LAKES ENTRANCE FM. TO
LATROBE DELTA TOPOGRAPHIC SURFACE

5 cm

CONTOUR INTERVAL : 100 FEET

Scale 1 : 100,000

2 1 0 2 4
MILES

AUTHOR P.M.COONEY, J.W.MILLIKEN, D.B.DEPEW DRAFTED BY : M.F. WEETMAN

TO ACCOMPANY FINAL SUBSIDY REPORT OF THE GIPPSLAND G-69A MARINE SEISMIC AND MAGNETIC SURVEY, JUNE, 1969

PLATE VI

OR-042

Dwg. 1152/6/7

147° 45' 148° 00' 148° 15' 148° 30' 148° 45'

ESSO-HEMATITE VIC P2

VICTORIA
TASMANIA

MAGELLAN P.E.P.63 Area 'B'

Mullet-1
T.D. 2463'

39° 15'

50 Mile Radius Kingfish Field

39° 30'

T A S M A N S E A

39°45'

ESSO-HEMATITE T/P4

MAGELLAN T/P1

147° 45' 148° 00' 148° 15'

INSET MAP

146° 45' 147° 00' 147° 15'

ST MARGARET ISLAND

40 Mile Radius Barracouta Field

50 Mile Radius Kingfish Field

38° 45'

ESSO HEMATITE VIC/PI

WOODSIDE VIC/P8

39°00'

ESSO HEMATITE VIC/P2

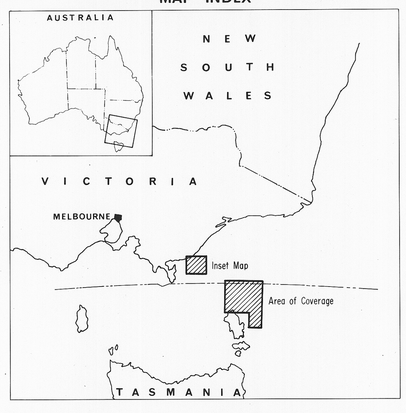
146° 45' 147° 00' 147° 15'

148° 30' 148° 45'

40° 00'

40° 15'

MAP INDEX



LEGEND

- Seismic shot point
- Velocity scan
- Dry and abandoned well
- —1000— Structure contour in feet
- U / D Fault, 'D' downthrown side
- Unconformity
- Igneous intrusion
- Petroleum tenement boundary

EAST BASS BASIN
-part S/8

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

THE GIPPSLAND BASIN

VICTORIA - TASMANIA

SHOT POINT MAP

5 cm

068c79

CONTOUR INTERVAL : 100 FEET DATUM : SEA LEVEL

Scale 1 : 100,000

2 1 0 2 4
MILES

AUTHOR P.M.COONEY, J.W.MILLIKEN, D.B.DEPEW DRAFTED BY :

TO ACCOMPANY : FINAL SUBSIDY REPORT OF THE GIPPSLAND G-69A MARINE SEISMIC AND MAGNETIC SURVEY, JUNE, 1969

PLATE VII OR-042

Dwg 1152/6/8