

028001

ESSO

**Offshore Otway ER-68
Seismic & Magnetic Survey**

TPR OR-064A

OTWAY/KING PART-V*

028002

FINAL REPORT
OFFSHORE NAVIGATION, INC.
PROJECT 305

WESTERN GEOPHYSICAL COMPANY OF AMERICA

OTWAY BASIN, AUSTRALIA
ER-68 AREA

028003

FINAL REPORT
OFFSHORE NAVIGATION, INC.
PROJECT 305

WESTERN GEOPHYSICAL COMPANY OF AMERICA

PARTY 64

FOR

ESSO STANDARD OIL (AUSTRALIA) LTD.

ER-68 AREA
OTWAY BASIN, AUSTRALIA

OCTOBER - NOVEMBER 1968

A B S T R A C T

Project 305 was a Shoran-controlled, marine seismic survey for potential mineral deposits in the Otway Basin area off the southern coast of Australia. (ER-68 AREA)

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) employed a Shoran radiolocation system to provide horizontal control for the survey.

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I. THE SHORAN RADIOPOSITIONING SYSTEM

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

The Shoran mobile unit measures the 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:

$$\text{Total distance covered} = \text{Elapsed time} \times \text{velocity}$$

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.

MOBILE STATION

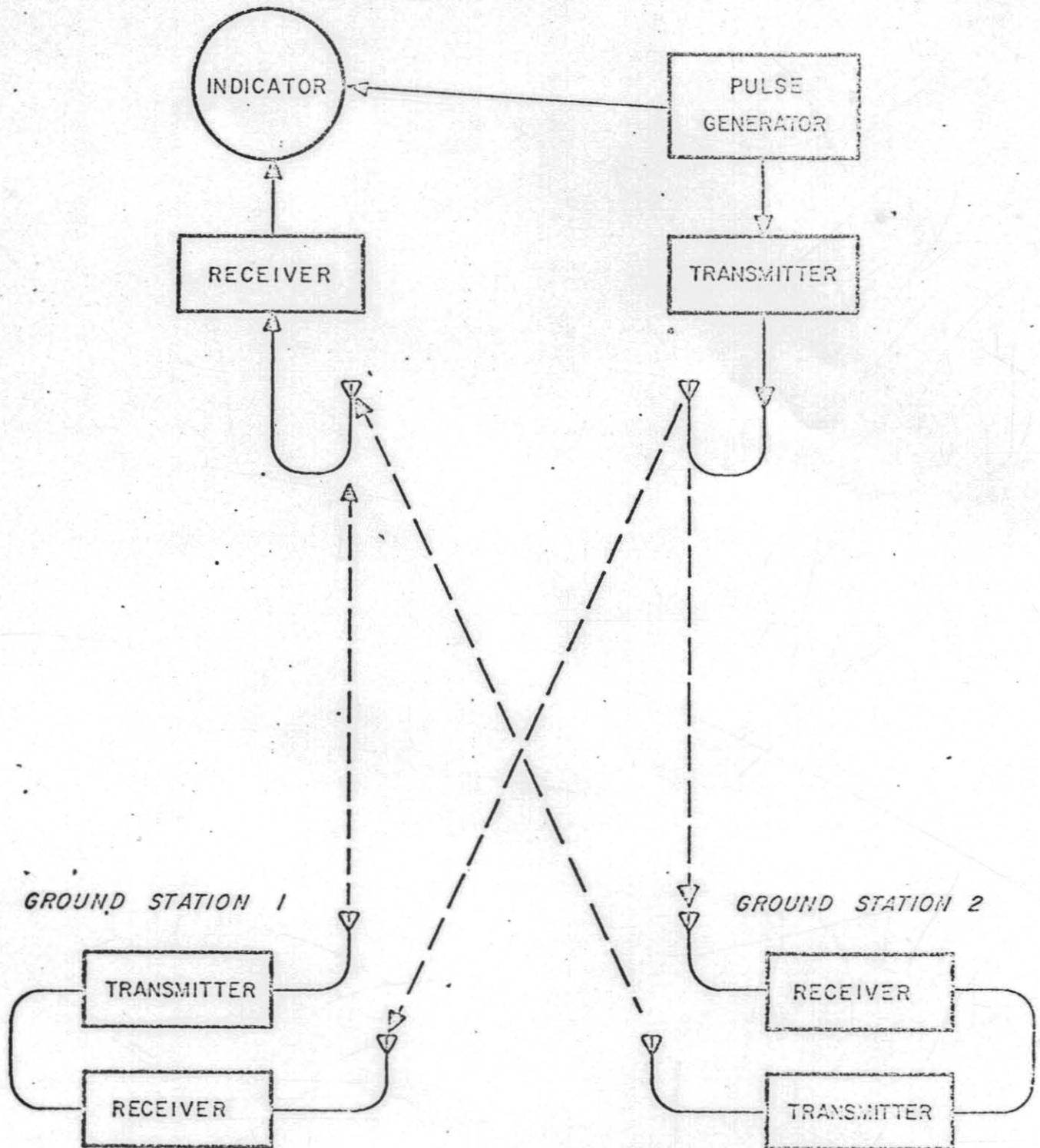


FIGURE 1
SIMPLIFIED BLOCK DIAGRAM OF BASIC RADIO
EQUIPMENT OF A SHORAN SYSTEM

I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

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

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

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

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

where,

d = estimated maximum range, in miles
h₁ = height of mobile station antenna, in feet, above sea level
h₂ = 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 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 , may be several times greater than normal. In some marine areas of the world, this phenomenon occurs quite regularly during certain seasons.

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

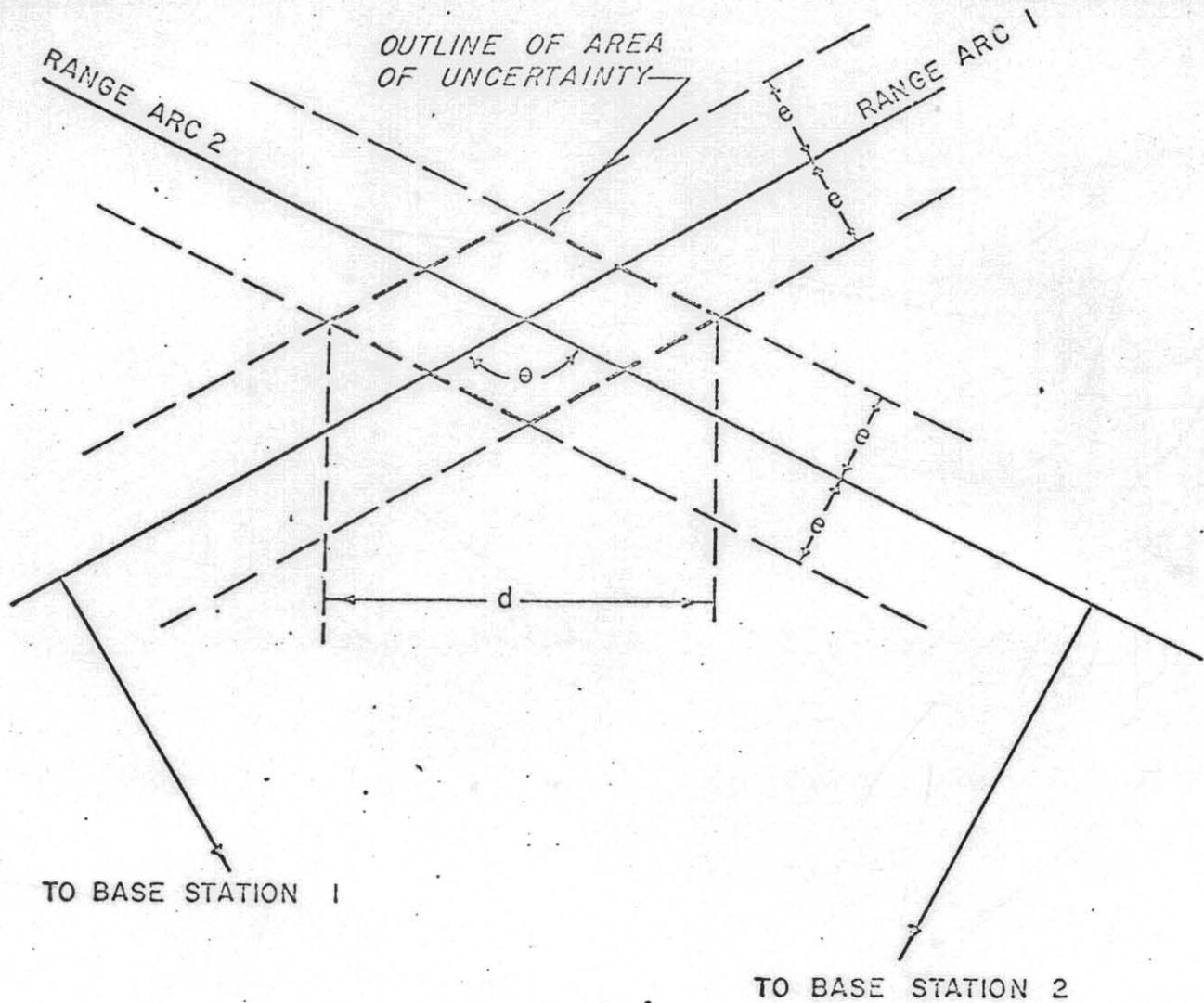
I. THE SHORAN RADIOPOSITIONING SYSTEM (continued)

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

FIGURE 2

AREA OF UNCERTAINTY OF POSITION
DUE TO ERROR IN RANGE MEASUREMENT

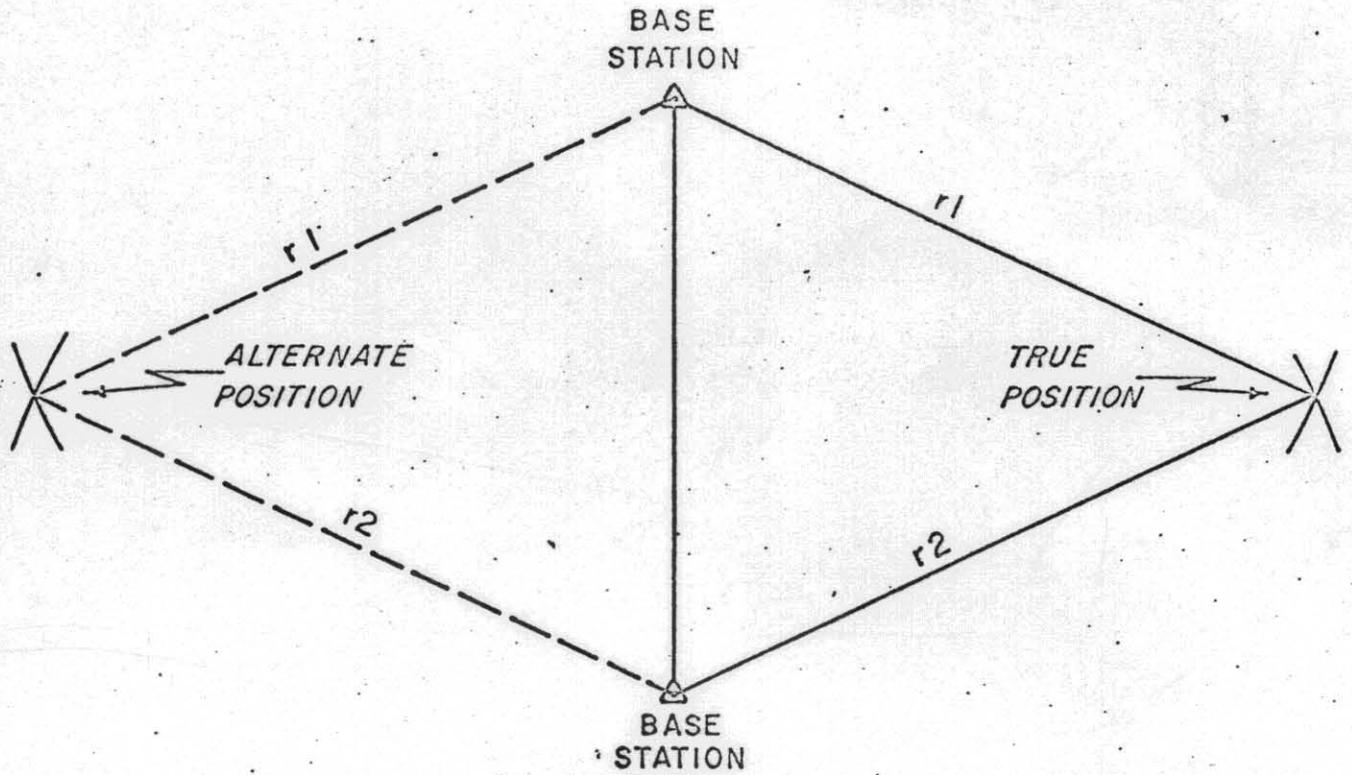
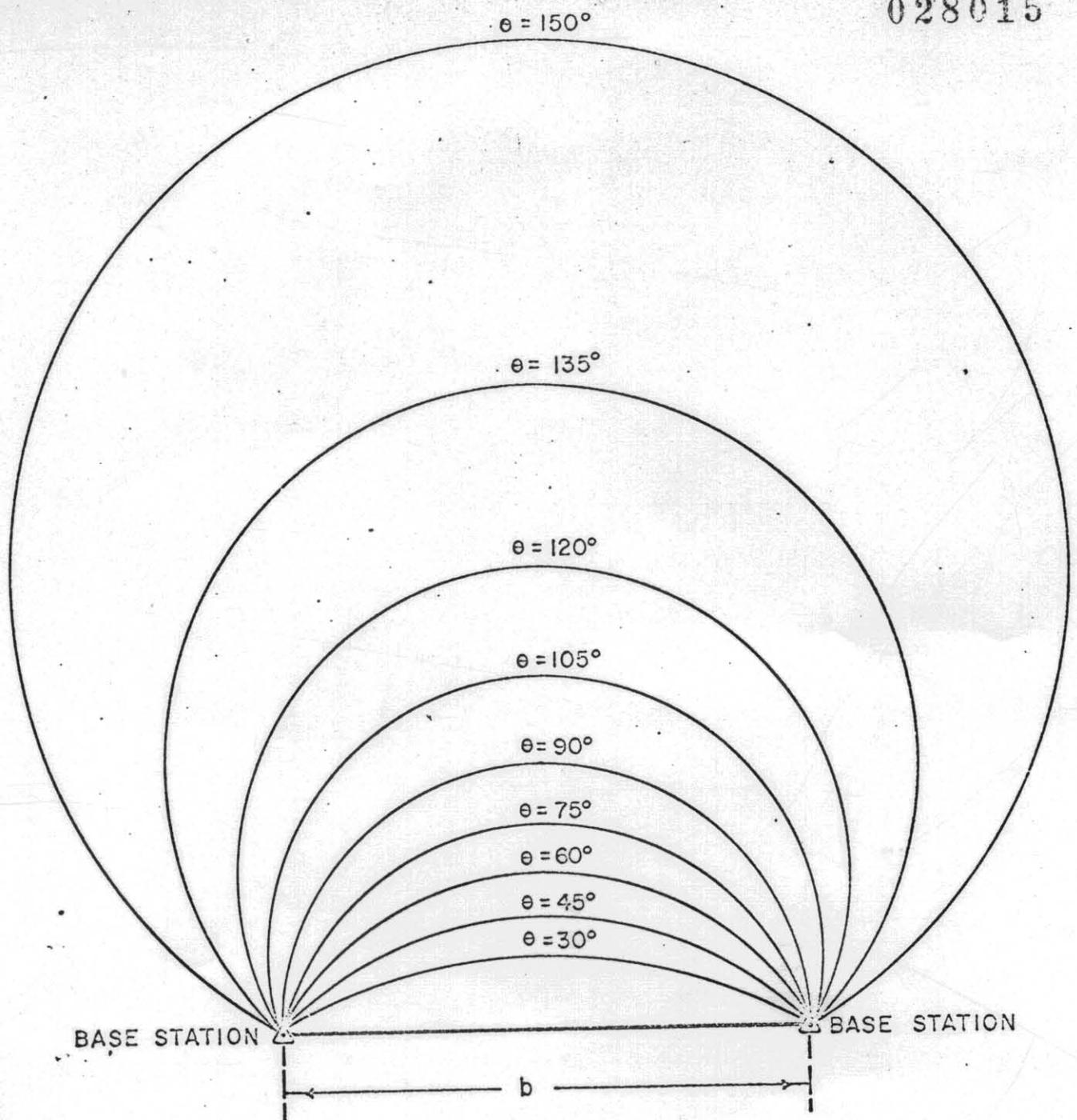


FIGURE 3

POSITION AMBIGUITY IN CIRCULAR RANGE
SYSTEM



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

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

WHERE θ IS ANGLE OF INTERSECTION BETWEEN RANGE CIRCLES

APPENDIX A

RELATIVE AREA OF COVERAGE, CIRCULAR RANGING SYSTEM

II. AREA OF OPERATIONS

The program area extended from Cape Jervis on the west to Cape Otway on the east, and extended approximately 70 miles off the south-southeastern coast of Australia.

ONI's base of operation was established at Portland in the state of Victoria. From this office activities of the field crew were directed and radiotelephone communications maintained.

III. OPERATIONS RECAP

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

All equipment was shipped from Tasmania to Melbourne on board the M/V WESTERN SPRUCE. On 17 September 1968 all base stations were loaded on a truck and transported to Portland.

Initial base station installations were completed on 20 September. The actual seismic operation commenced on 10 October 1968 when first readings for the client were observed. At this time a 2400 meter cable was used. The last shotpoint using this cable was on 6 November, using a shotpoint interval of 660 feet.

III. OPERATIONS RECAP (continued)

Upon completion of the work in this area, base stations were moved to the next prospect for further work under WESTERN's control. The base of operation remained in Portland for the next operation.

IV. GENERAL INFORMATION

- A. Satisfactory radiotelephone communication between Shoran installations and the base of operation was maintained on the frequency of 2398 kilocycles.
- B. A calibration of all equipment was carried out prior to the start of the operation, and an error was discovered in the coordinates for Station Mount Richmond. A set of up-dated coordinates published by the Government was obtained from a local surveyor in Portland. These new coordinates were used and the calibration then proved to be correct.

V. MAPPING 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 with the program assignment chart furnished by ESSO, and at the shotpoint interval specified by WESTERN.

V. MAPPING AND BASIC CONTROL (continued)

Due to the change in coordinates of Mount Richmond, the east end of the prospect had to be replotted. As the vessel was in the area and ready to work, the client decided to have the preplots done by the I.B.M. Data Service Center in Sydney.

For computing purposes the Australian Transverse Mercator Projection, based on the Clarke 1858 Spheroid, Belts 6 and 7, with Central Meridians of 141° and 146° East respectively, was employed. A False Northing of 1,000,000 yards was used.

Coordinates for the stations occupied were furnished by WESTERN.

VI. PERSONNEL

<u>Name</u>	<u>Position</u>
Easterbrook, I.	Party Chief
Adams, H.	Mobile Operator
Hackenbruch, D.	Mobile Operator
Killalea, I.	Mobile Operator
Bienz, W.	Base Operator
Binderman, B.	Base Operator
Cartner, I.	Base Operator
Kingsley, B.	Base Operator
Martin, K.	Base Operator
Price, W.	Base Operator

VII. DISTRIBUTION

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Australia

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New Orleans, Louisiana 70123

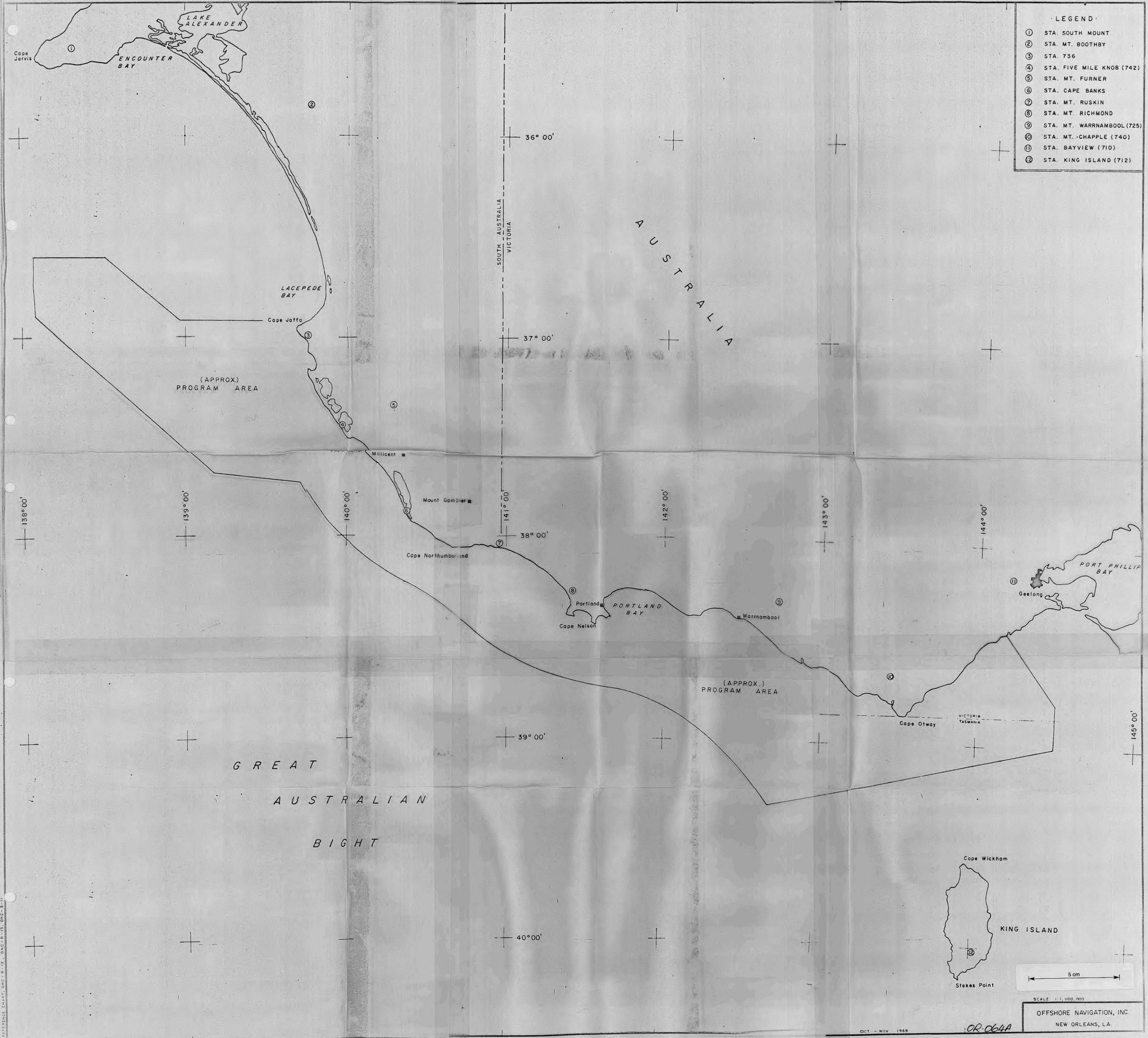
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Double Bay (Sydney) N.S.W.
Australia 2028

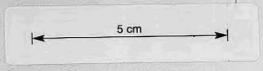
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LEGEND

①	STA. SOUTH MOUNT
②	STA. MT. BOOTHBY
③	STA. 736
④	STA. FIVE MILE KNOB (742)
⑤	STA. MT. FURNER
⑥	STA. CAPE BANKS
⑦	STA. MT. RUSKIN
⑧	STA. MT. RICHMOND
⑨	STA. MT. WARRNAMBOOL (725)
⑩	STA. MT. CHAPPLE (740)
⑪	STA. BAYVIEW (710)
⑫	STA. KING ISLAND (712)



REFERENCE CHART, ONC-R-12, ONC-R-13, ONC-R-14



SCALE 1:1,000,000
 OFFSHORE NAVIGATION, INC.
 NEW ORLEANS, LA.

OCT - NOV 1968

OR-064A

STATION: SOUTH MOUNT

LOCATED: Approximately 45 statute miles south-southeast of Adelaide, South Australia, or 13 miles northeast of Cape Jervis.

ACCESS: Proceed west on the Princess Highway from the town of Murray Bridge to Callington, Strathalbyn and Victor Harbour. Take the Cape Jervis road from Victor Harbour until the road junction to Normanville is reached. Signpost reads: 3 mile Hayflat, 10 mile Normanville.

MARKER: Trig marker is at the junction opposite a farmhouse.

GENERAL: Water and supplies should be carried. Station is a drive-on site.

ELEVATION: 412 yards.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Belt 6, C.M. 141°	
Latitude	Longitude	East	North
35°33'34"11 S	138°20'02"80 E	135,634 yards	1,607,226 yards

028022

STA. SOUTH MOUNT — AUSTRALIA

LAT. 35° 33' 34".11 S

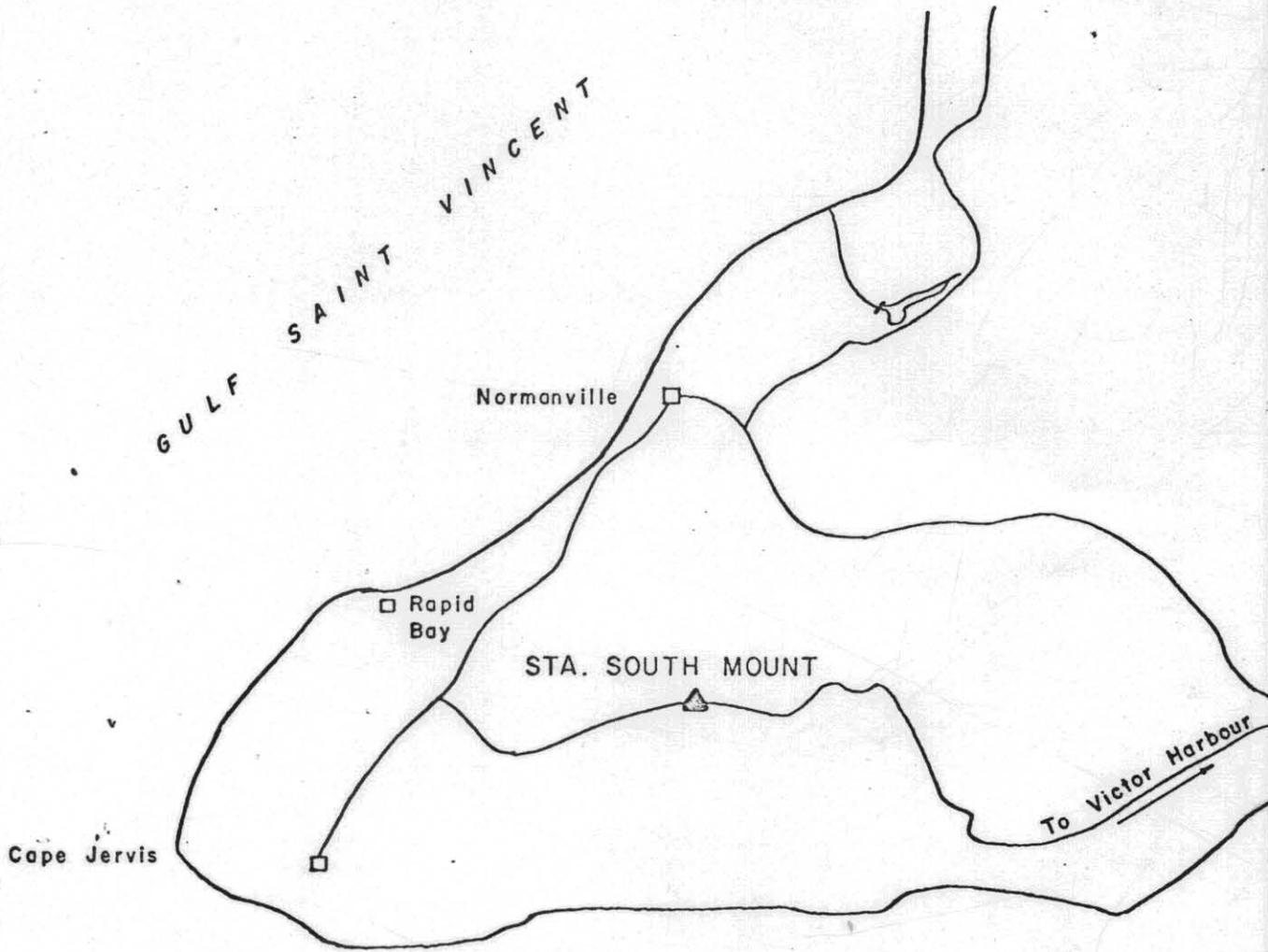
N 1,607,226 yards

LONG. 138° 20' 02".80 E

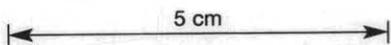
E 135,634 yards

ELEV. 412 yards

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 6, C.M. 141° E; F.N. = 1,000,000 YARDS



G R E A T
A U S T R A L I A N
B I G H T



OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

STATION: MOUNT BOOTHBY

LOCATED: About 85 miles north of Kingston, South Australia.

ACCESS: Take the Princess Highway west from Kingston until the road to Culburra is seen on the right. Follow this road for about 19 miles until a National Park sign is seen on left side of road. At this point a fence runs to the west. There is an overgrown track at this point leading to top of the hill.

MARKER: Standard Trig Marker.

GENERAL: The Manager of the Mount Boothby Estate will supply tractor and direct to the site. Water and supplies must be carried.

ELEVATION: 135 yards.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Belt 6, C.M. 141° E	
Latitude	Longitude	East	North
35°51'33"05 S	139°46'08"88 E	278,407 yards	1,573,673 yards

028024

STA. MT. BOOTHBY — AUSTRALIA

LAT. 35° 51' 33".05 S

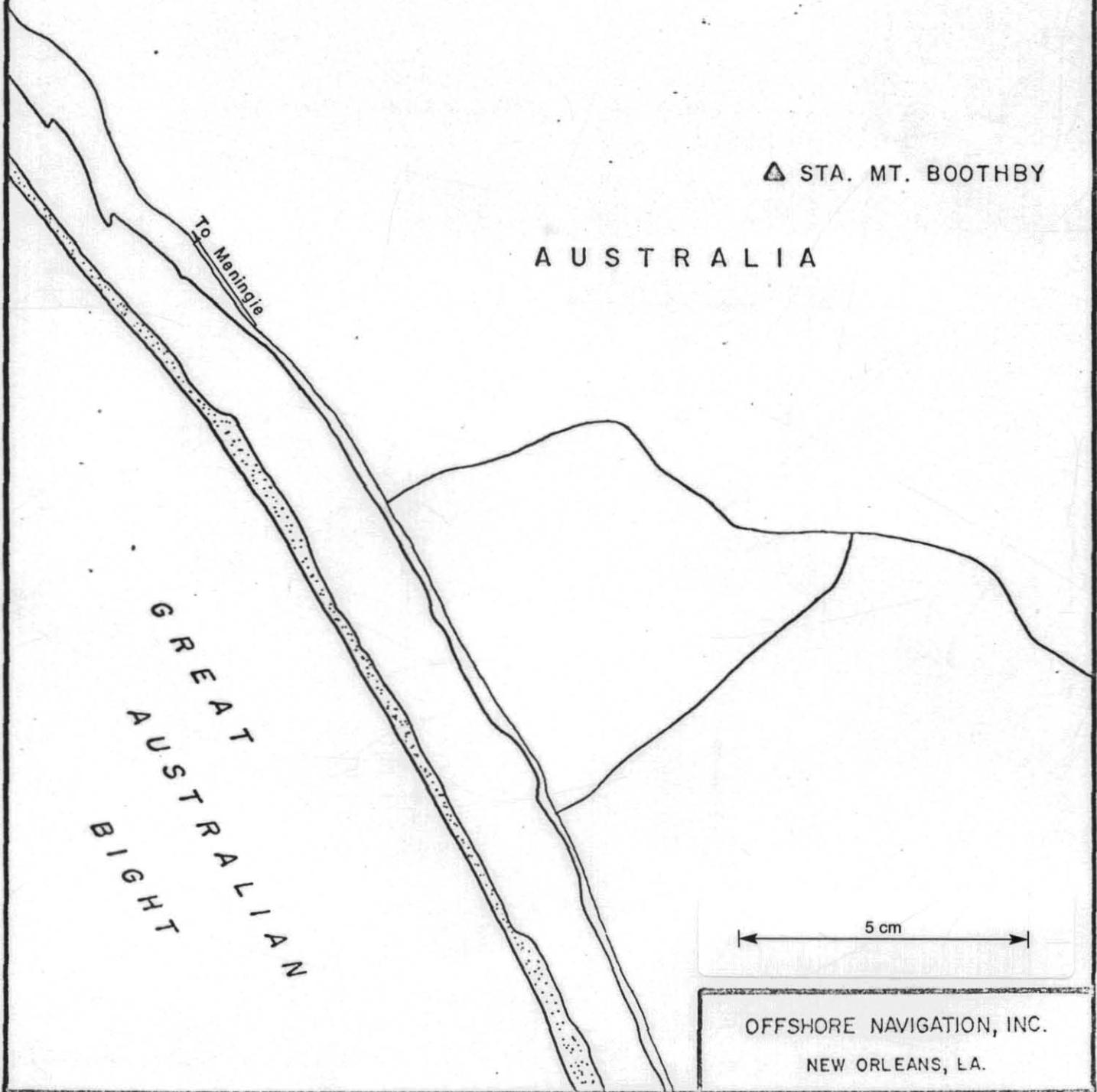
N 1,573,673 meters

LONG. 139° 46' 08".88 E

E 278,407 meters

ELEV. 135 yards

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 6, C.M. 141°E; F.N. = 1,000,000 YARDS



▲ STA. MT. BOOTHBY

A U S T R A L I A

G R E A T
A U S T R A L I A N
B I G H T

5 cm

OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

STATION: 736

LOCATED: About 11 miles south of Kingston in South Australia.

ACCESS: Follow the Kingston-Robe road south for about 11 miles until a dirt road is seen on the right. Follow this road for about 2 miles until a farmhouse is seen on the left. There is a track through the farm to the site.

MARKER: A 35 foot tower.

GENERAL: The owner of the farm, Mr. Holmes, can be relied on for the use of tractor and directions. Water can be obtained at the farm.

ELEVATION: 66 yards.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Belt 6, C.M. 141°	
Latitude	Longitude	East	North
36°59'31"05 S	139°45'12"24 E	278,629 yards	1,436,177 yards

028026

STA. 736 — AUSTRALIA

LAT. 36° 59' 31".05 S

N 1,436,177 meters

LONG. 139° 45' 12".24 E

E 278,629 meters

ELEV. 66 yards

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 6, C.M. 141°E, F.N. = 1,000,000 YARDS

G R E A T
A U S T R A L I A N
B I G H T

Kingston
South East

△ STA. 736

■ Mount Benson

A U S T R A L I A

Cape Dombey

Robe

5 cm

OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

STATION: FIVE MILE KNOB (742)

LOCATED: About 60 miles northwest of Mt. Gambier in South Australia.

ACCESS: Take the Princess Highway west from Mt. Gambier to Beachport turnoff. Follow this road into township of Beachport. The site is on a prominent hill five miles north of town. Local garage owner has landrover which can be hired to set station. Tent was erected at base of knob and coax cables strung up to tower on top of knob.

GENERAL: Supplies and water can be obtained in Beachport. Contact Mr. Harry Haines.

ELEVATION: 51 Yards.

SKETCH: See next page.

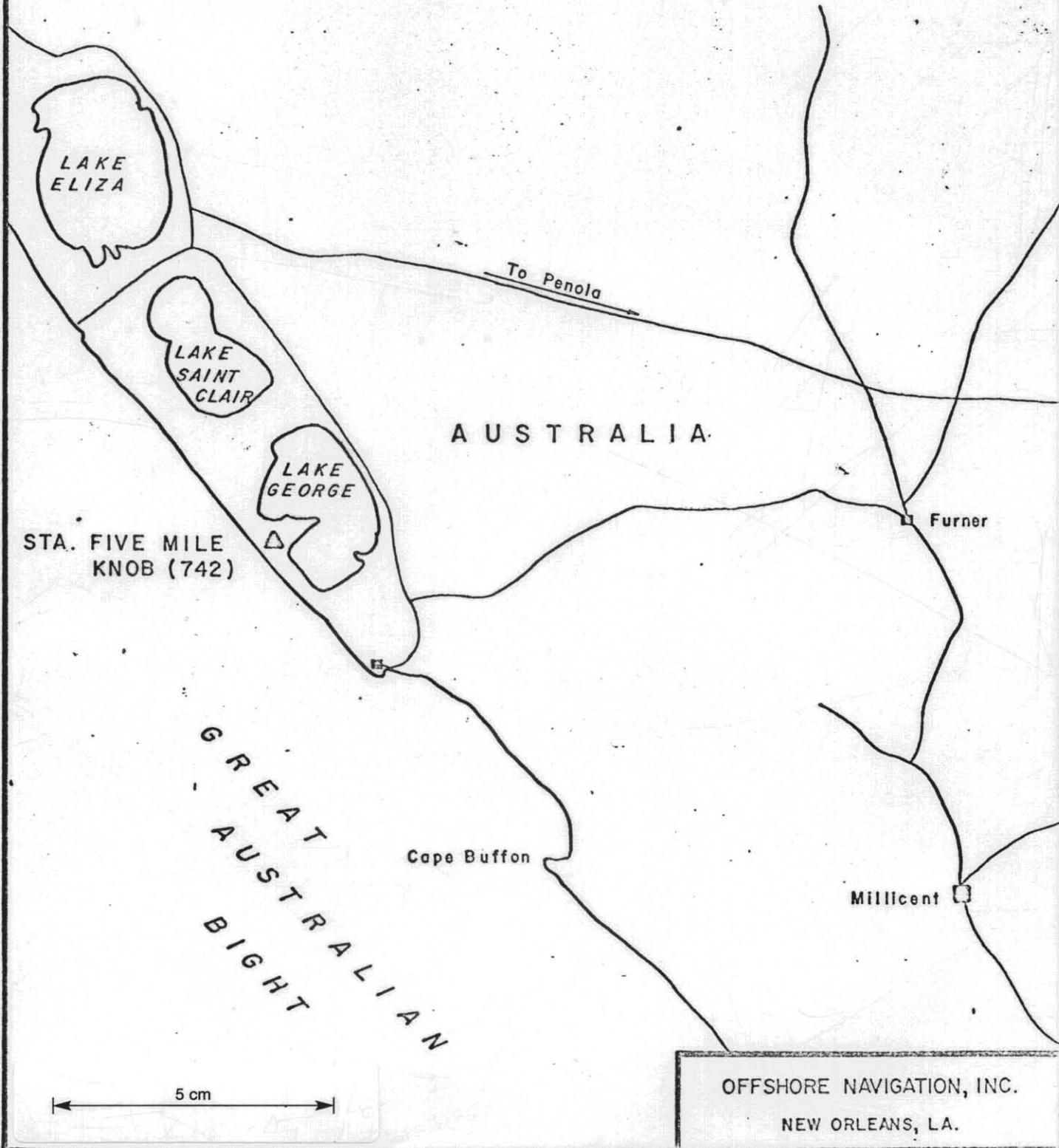
GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Belt 6, C.M. 141°	
Latitude	Longitude	East	North
37°26'12"15 S	139°57'49"97 E	299,713 vds.	1,382,441 vds.

STA. FIVE MILE KNOB (742) — AUSTRALIA

LAT. 37° 26' 12".15 S
LONG. 139° 57' 49".97 E
ELEV. 51 yards

N 1,382,441 yards
E 299,713 yards

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 6, C.M. 141° E; F.N. = 1,000,000 YARDS



STATION: MOUNT FURNER

LOCATED: About 45 miles northwest of the town of Mt. Gambier in South Australia.

ACCESS: Take the Princess Highway west from Mt. Gambier to the Robe-Penola junction. At this point take the right road to Penola. Follow this road for eight miles until a wire fence is seen on the left bearing off in a westerly direction. Follow along fence for about 3/4 mile. Trig marker will be seen on right side.

MARKER: A standard marker.

GENERAL: A four-wheel drive vehicle should be used. Water and supplies must be carried to the site.

ELEVATION: 66 yards.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Belt 6, C.M. 141°E	
Latitude	Longitude	East	North
37°20'14"24 S	140°17'56"87 E	332,073 yards	1,394,807 yards

028030

STA. MT. FURNER — AUSTRALIA

LAT. 37° 20' 14".24 S

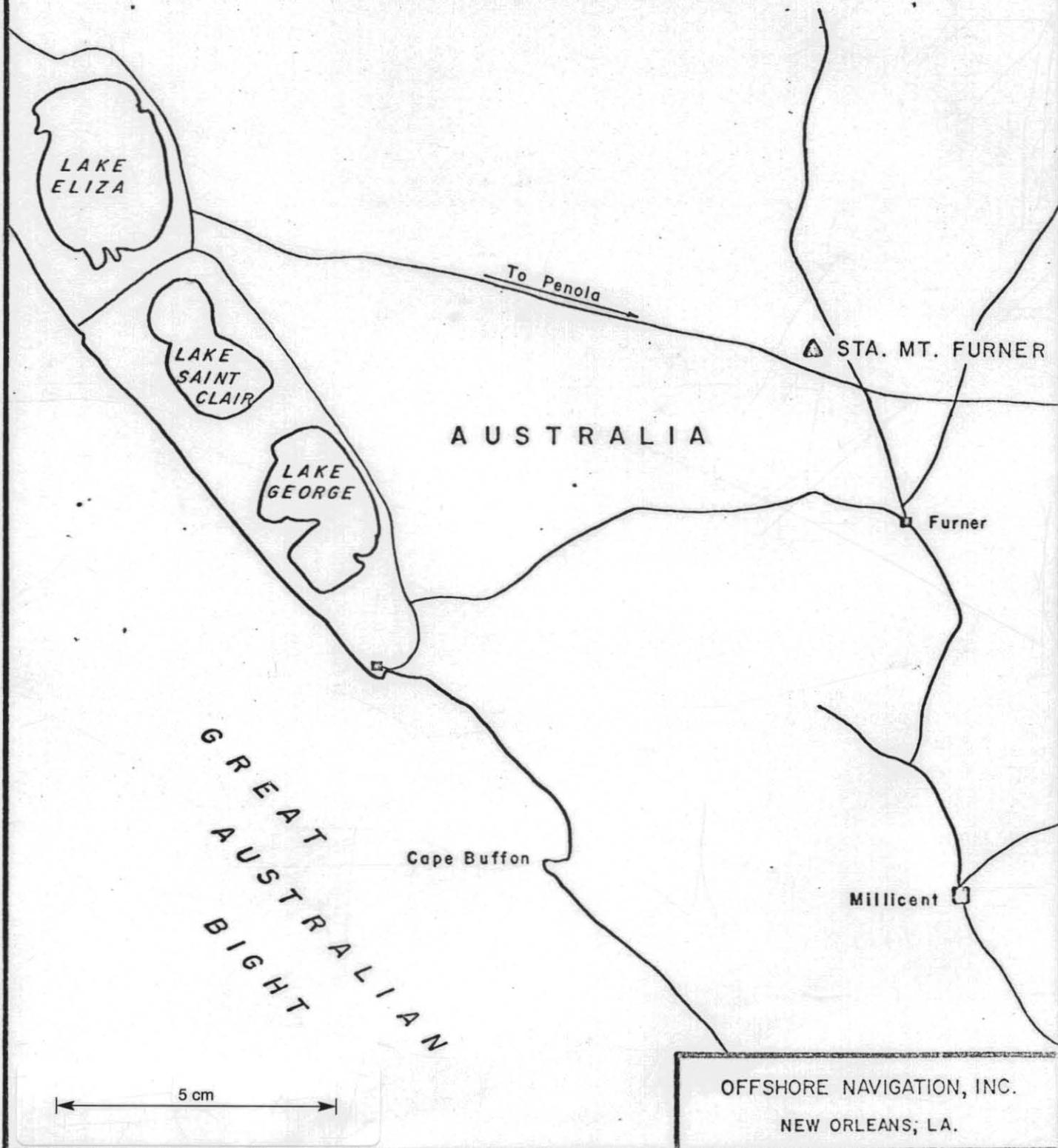
N 1,394,807 yards

LONG. 140° 17' 56".87 E

E 332,073 yards

ELEV. 66 yards

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 6, C.M. 141° E; F.N. = 1,000,000 YARDS



STATION: CAPE BANKS

LOCATED: About 35 miles southwest of Mt. Gambier in South Australia.

ACCESS: Take the Kongorong, Cape Banks road all the way to a small village at the end of the road. Here a dirt track leads off to the Cape Banks Lighthouse.

MARKING: The tower was erected at the southeast corner of the fence surrounding the lighthouse.

GENERAL: Permission to occupy the site must be obtained from the Department of Shipping and Transport in Adelaide.
Water and supplies must be carried in.

ELEVATION: Sea Level.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Belt 6, C.M. 141°E	
Latitude	Longitude	East	North
37°53'59"12 S	140°22'38"88 E	340,118 yards	1,326,588 yards

028032

STA. CAPE BANKS — AUSTRALIA

LAT. 37° 53' 59".12 S

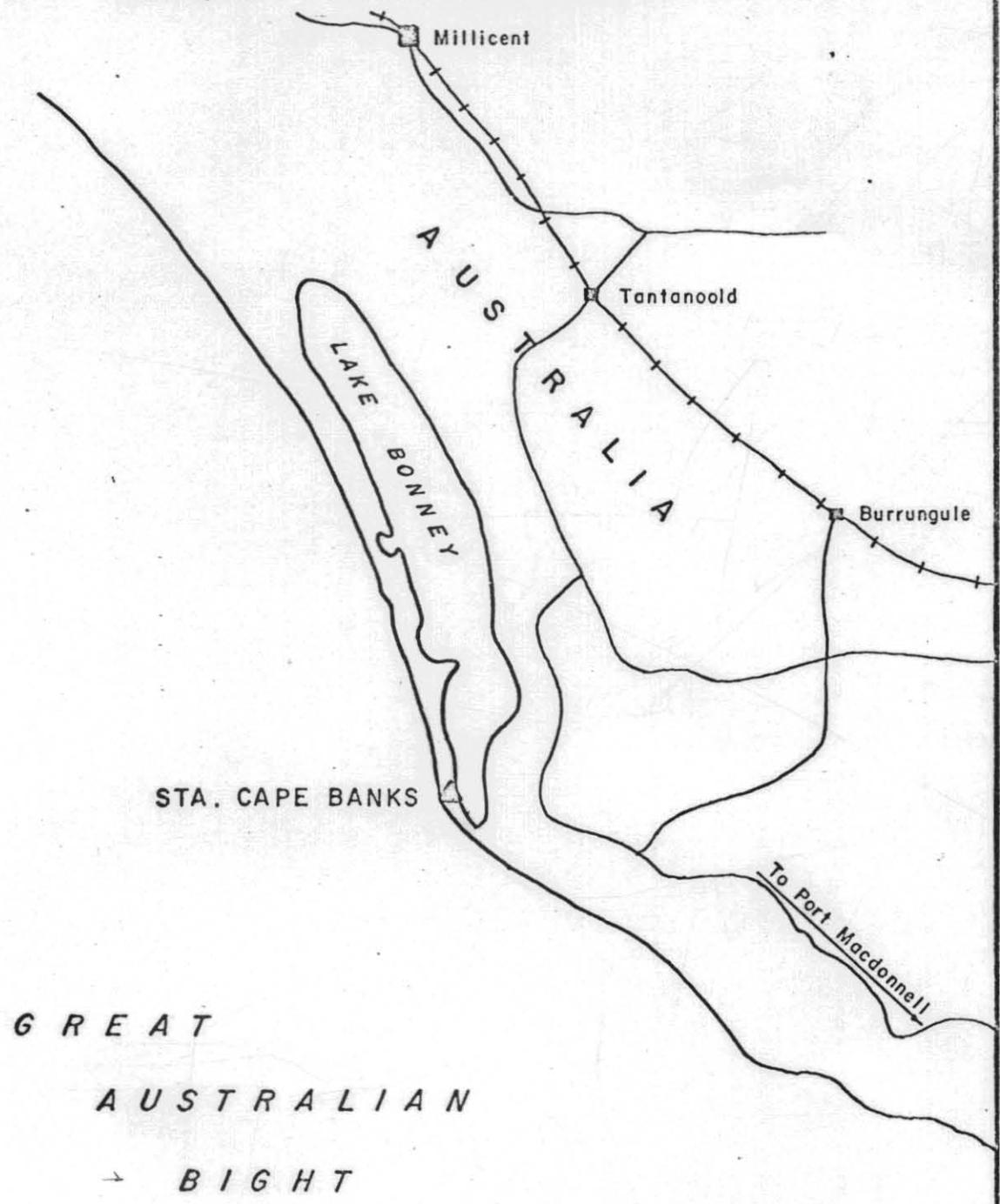
N 1,326,588 yards

LONG. 140° 22' 38".88 E

E 340,118 yards

ELEV. Sea Level

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 6, C.M. 141° E; F.N. = 1,000,000 YARDS



G R E A T
A U S T R A L I A N
B I G H T

5 cm

OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

STATION: MOUNT RUSKIN

LOCATED: On the Victoria-South Australia border, about two miles west of the township of Nelson.

ACCESS: From Nelson take the road west toward Mt. Gambier for about two miles. This point is on the border. A steel gate will be sighted on the left-hand side of the road with a track leading through the field. Follow the track to the top of the hill where the site is located.

MARKING: A steel stake.

GENERAL: Water and supplies should be obtained in Portland or Mt. Gambier.

ELEVATION: 66 yards.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Belt 6, C.M. 141° E	
Latitude	Longitude	East	North
38°02'55"27 S	140°57'57"22 E	396,726 yds.	1,308,709 yds.

028034

STA. MT. RUSKIN — AUSTRALIA

LAT. 38° 02' 55".27 S

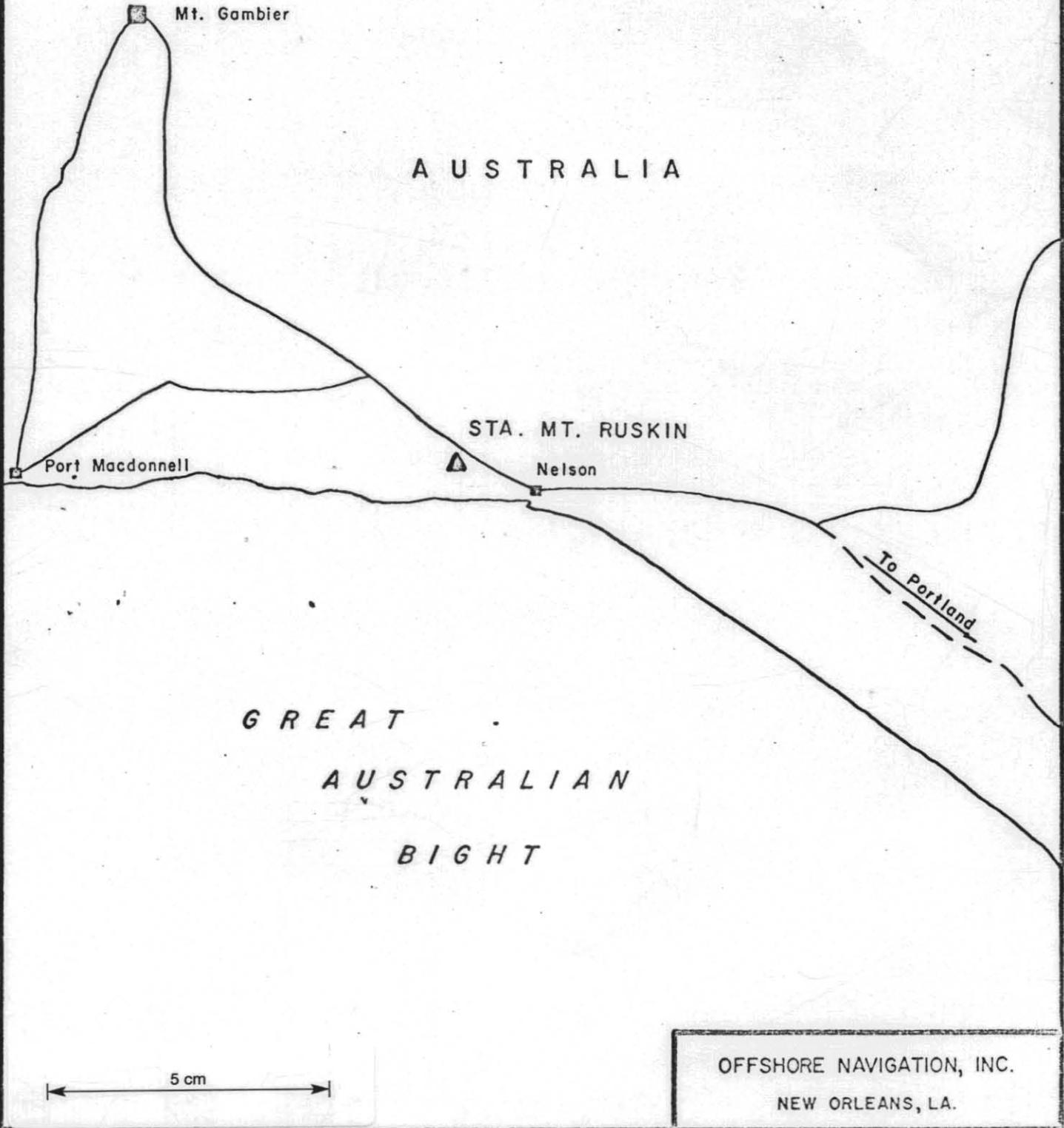
N 1,308,709 yards

LONG. 140° 57' 57".22 E

E 396,726 yards

ELEV. 66 yards

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
BELT 6, C. M. 141°E, F.N. = 1,000,000 YARDS



STATION: MOUNT RICHMOND

LOCATED: About 13 miles northwest of Portland, Victoria. Take the road west for about 13 miles toward Nelson. Turn left onto a dirt road marked National Park. This road leads to the top of the hill where the site is. It can easily be reached with a two-wheel drive vehicle.

MARKER: Standard trig marker.

GENERAL: Water and supplies must be obtained in Portland.

ELEVATION: 250 yards

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Belt 6, C.M. 141°E	
Latitude	Longitude	East	North
38°16'09"11 S	141°25'07"40 E	440,075 yds.	1,281,851 yds.

028036

STA. MT. RICHMOND — AUSTRALIA

LAT. 38° 16' 09".11 S

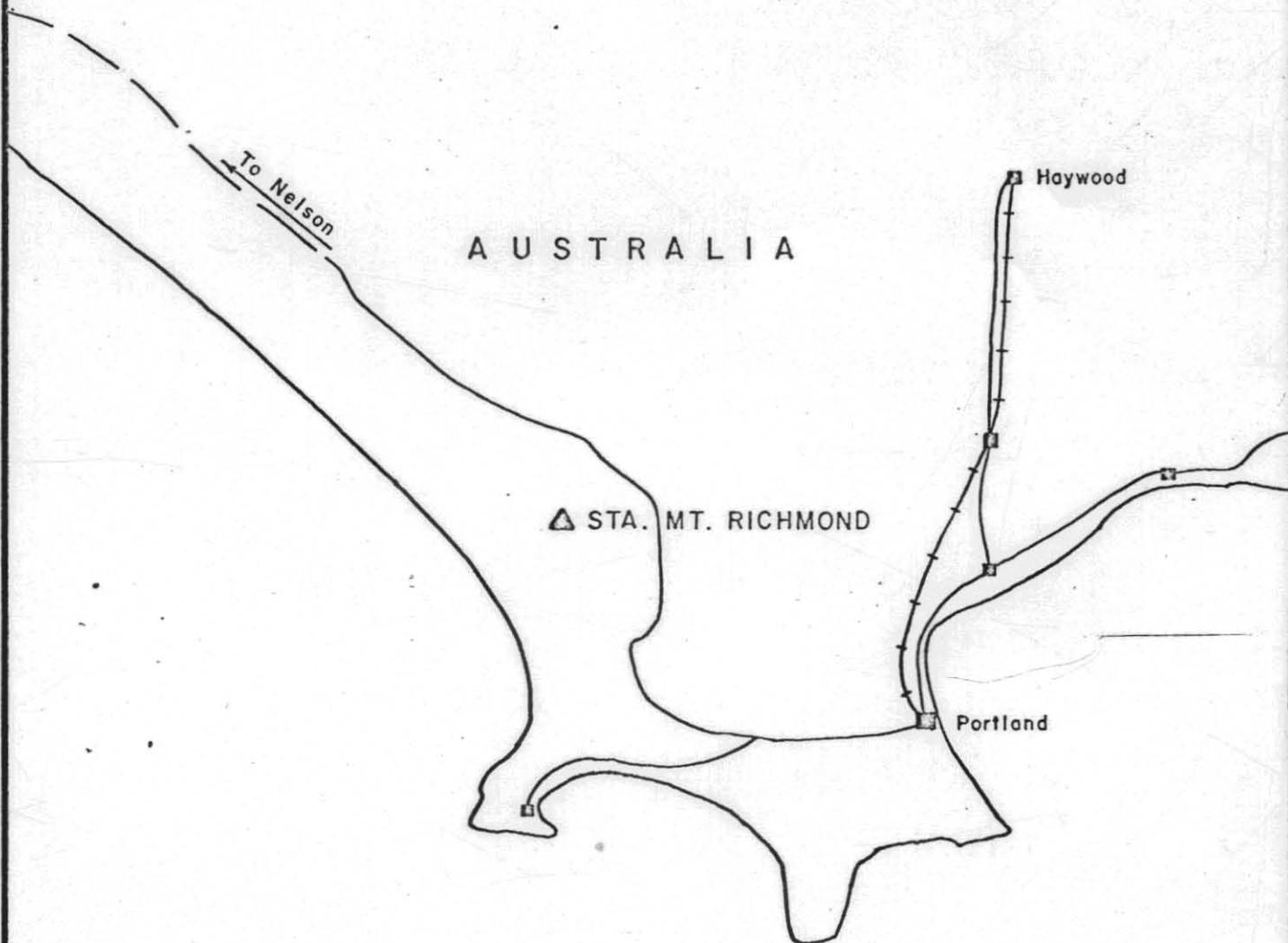
N 1,281,851 yards

LONG. 141° 25' 07".40 E

E 440,075 yards

ELEV. 250 yards

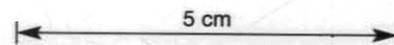
AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE SPHEROID
BELT 6, C.M. 141° E, F.N. = 1,000,000 YARDS



G R E A T

A U S T R A L I A N

B I G H T



OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

STATION: MOUNT WARRNAMBOOL (725)

LOCATED: About 14 miles northeast of Warrnambool, Victoria.

ACCESS: Take highway east from Warrnambool through the township of Panmure. The hill will be sighted on left side of Highway about two miles east of Panmure. A gate with a cattle stop leading to a farmhouse will be seen at this point. A track leads past the farmhouse to the top of the hill. There is a Forestry hut on this site which can be used by contacting the Forestry Department in Warrnambool.

MARKER: Standard 12 foot high trig marker structure.

GENERAL: Water is available at the farmhouse. A tractor is also available, which is needed in wet season. The land is owned by Mr. J. Donohue.

ELEVATION: 237 yards.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Zone 6, C.M. 141°	
Latitude	Longitude	East	North
38°18'26"61 S	142°44'25"34 E	566,485 yds.	1,275,738 yds.

STA. MT. WARRNAMBOOL (725) — AUSTRALIA

LAT. 38° 18' 26".61 S

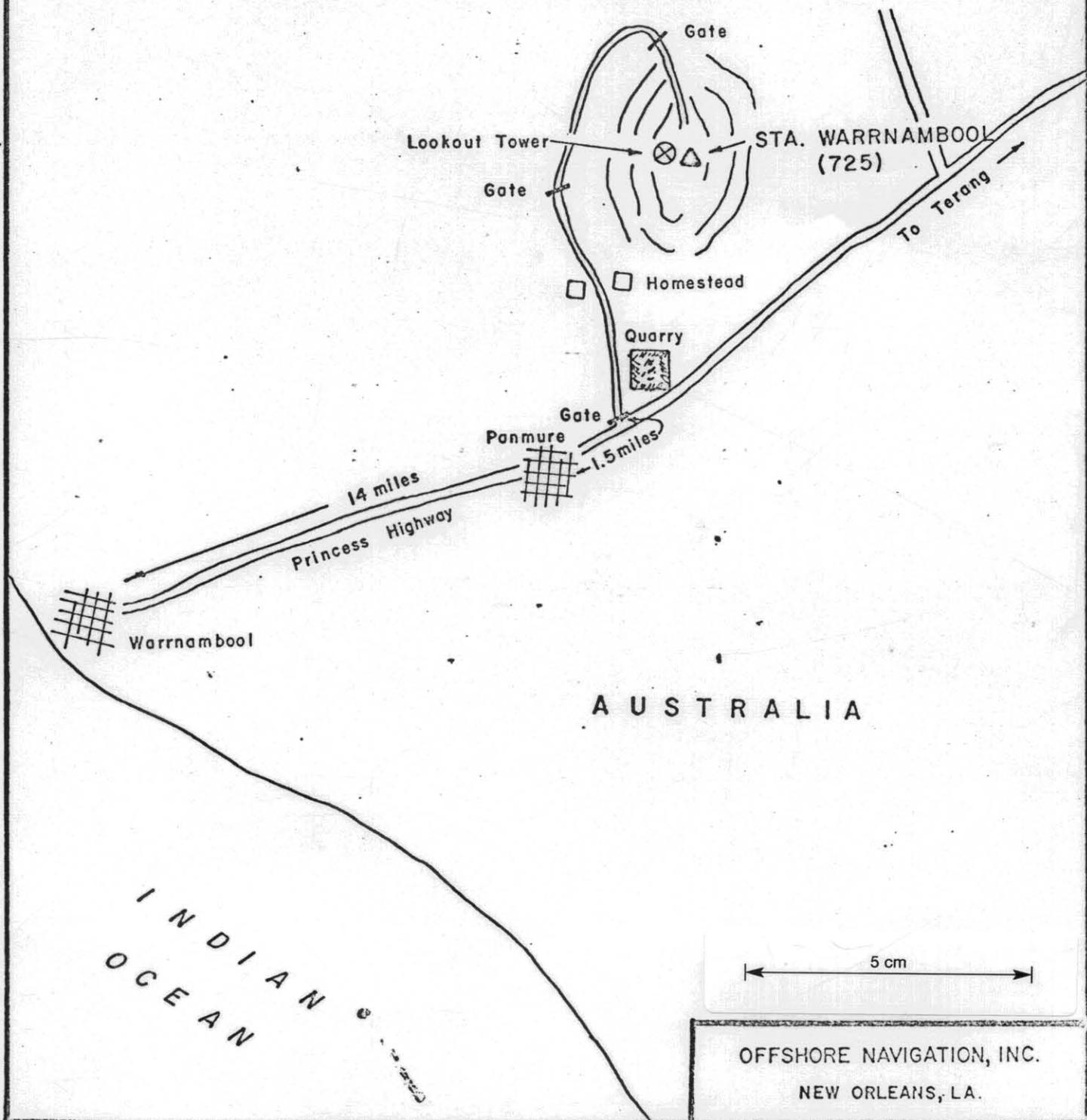
N 1,275,738 yards

LONG. 142° 44' 25".34 E

E 566,485 yards

ELEV. 237 yards

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID
ZONE 6, C.M. 141° E; F.N. = 1,000,000 YARDS



STATION: MT. CHAPPLE (740)

LOCATED: About 30 miles south of Colac, Victoria, in village of Wyelangta.

ACCESS: Proceed on road south from Colac through Barongarook, Gellibrand to Wyelangta. Is accessible by motor vehicle.

MARKER: Shoran station was located on a reference marker which was offset 93.54 feet at an azimuth of 103° from Tri-station Mt. Chapple, and approximately 200 feet west of the Wyelangta Victoria Post Office. The reference marker is a one-half inch copper tube set in a cement block.

The tri-station plaque is set in a cement block with two one-inch galvanized pipes driven into the ground on the east and west sides of the cement block.

GENERAL: Supplies and water can be obtained in the area.

ELEVATION: 602 yards.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID BELT 7, C.M. 146°	
Latitude	Longitude	East	North
38°39'51"15 S	143°27'09"00 E	157,494 yards	1,230,618 yards

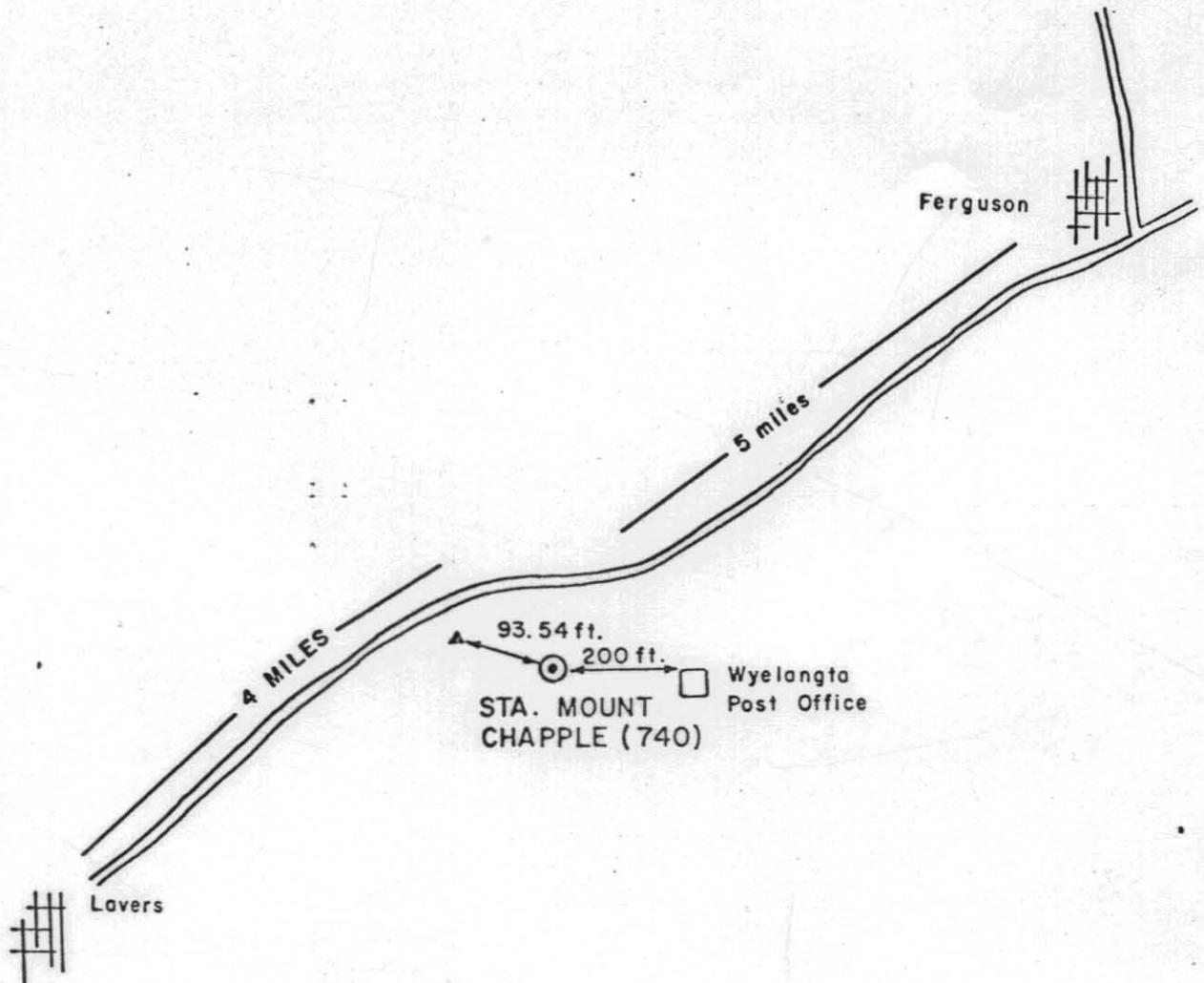
STA. MOUNT CHAPPLE (740)—AUSTRALIA

LAT. 38°39'51".15 S
LONG. 143°27'09".00 E
ELEV. 602 yards

AUSTRALIAN TRANSVERSE MERCATOR PROJECTION, CLARKE 1858 SPHEROID

BELT 6, C.M. 141° E
N = 1,230,867 yards
E = 633,462 yards

BELT 7, C.M. 146° E
N = 1,230,618 yards
E = 157,494 yards



OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

STATION: BAYVIEW (710)

LOCATED: On a prominent hill about ten miles west of Geelong, Victoria, and about seven miles north-northeast of the town of Moriac.

ACCESS: Local inhabitants of Moriac can give directions. Site can be reached with a regular vehicle in dry weather.

MARKING: Standard trig marker.

ELEVATION: 232 yards.

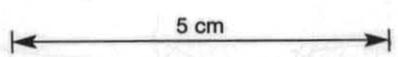
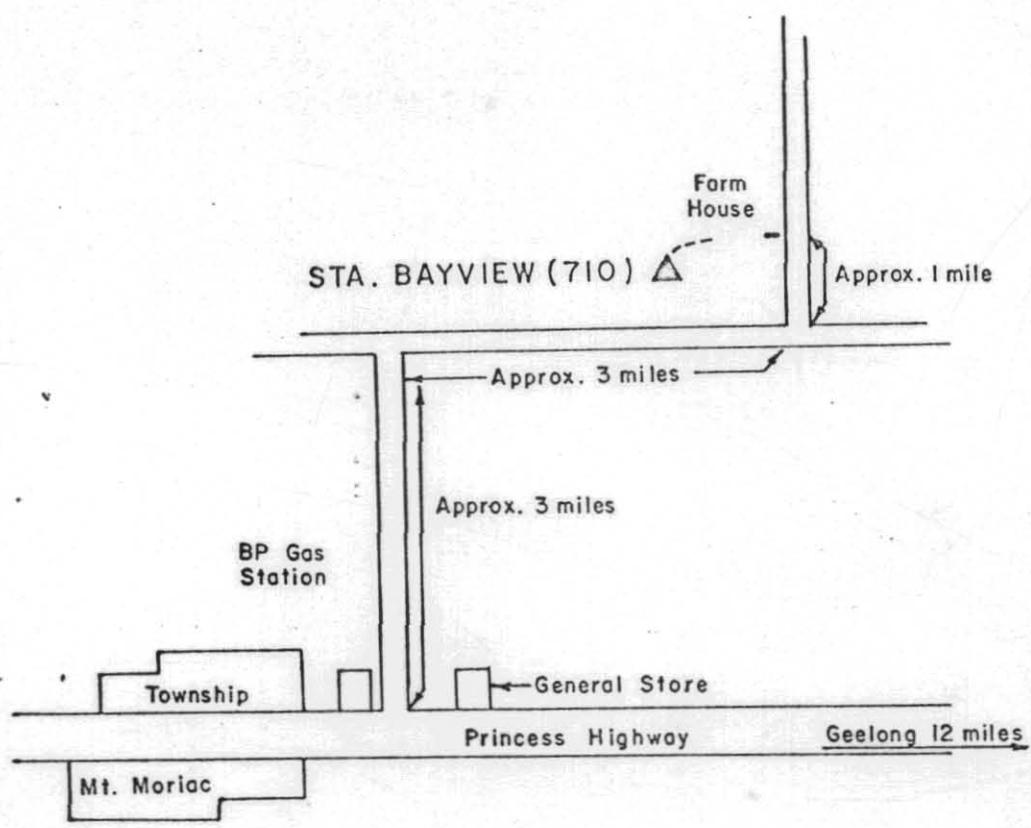
SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Zone 7, C.M. 146°	
Latitude	Longitude	East	North
38°09'44"06 S	144°12'08"68 E	227,698 yds.	1,293,255 yds.

STA. (710) BAYVIEW — AUSTRALIA

LAT. 38° 09' 44".06 S N 1,293,255 yards
LONG. 144° 12' 08".68 E E 227,698 yards
ELEV. 232 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: KING ISLAND (712)

LOCATED: On the southern end of King Island, Tasmania.

ACCESS: Equipment can be flown in to the airport or landed by boat at Naracoopa. A local trucking contractor, Mr. Reg. Philpot, can be hired to transport equipment to the station which is 15 miles south of Curry and 3 miles north of Grassy on property belonging to Mr. John Lindsay, telephone Lymwood 212.

MARKER: A 12 foot steel structure.

GENERAL: Mr. Lindsay can be relied on to carry equipment from his house to station site with his tractor. Water can be obtained at the farmhouse, and foodstuffs are readily obtainable from Curry.

ELEVATION: 233 yards.

SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID Belt 7, C.M. 146°	
Latitude	Longitude	East	North
40°02'10"35 S	144° 01'07"04 E	215,045 yards	1,065,350 yards

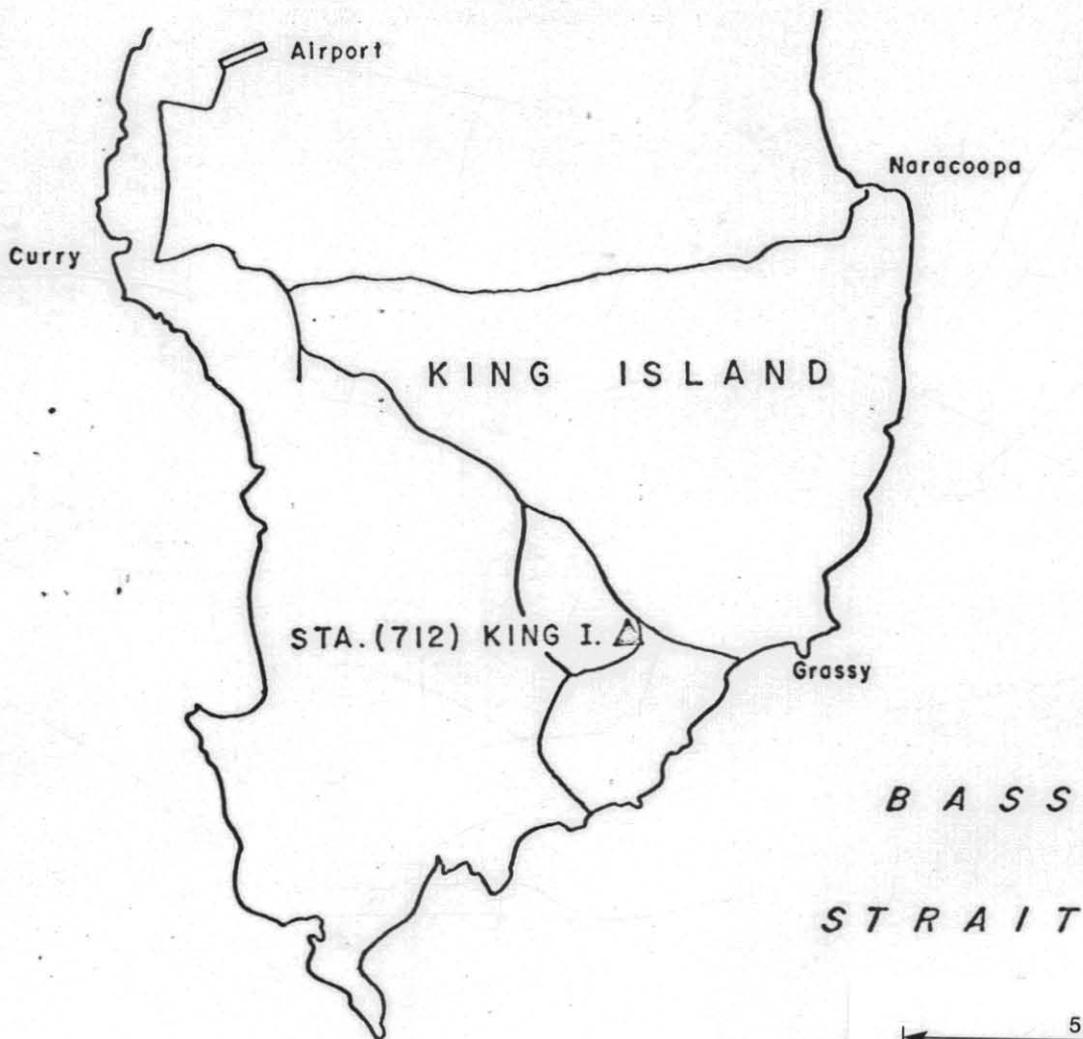
028044

STA. (712) KING ISLAND — TASMANIA

LAT. 40° 02' 10".35 S
LONG. 144° 01' 07".04 E
ELEV. 233 yards

N 1,065,350 yards
E 215,045 yards

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



SCALE 1:250,000

OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

028045

FINAL OPERATIONS REPORT

AUSTRALIA MARINE SEISMIC SURVEY

OTWAY BASIN ER - 68

FOR

ESSO STANDARD OIL (AUSTRALIA) LIMITED

BY

WESTERN GEOPHYSICAL COMPANY OF AMERICA

PARTY 64

OCTOBER - NOVEMBER 1968

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PLATES

- I. Location Map
- II. 2400 Meter Streamer Cable Diagram
- IIIa. 1600 Meter Streamer 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 Otway Basin off the coast of the States of Victoria and South Australia in Australia, operations commenced on September 12, 1968 and were completed on November 15, 1968. The area surveyed was Otway Basin.

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 413-417 New South Head Road, Double Bay, New South Wales, Australia.

B. Base of Operations

Portland, Victoria was used as the base of operations for the project. Good harbour facilities and daily air service was available, and the town provided a good source of supply.

C. Weather

The weather provided a continual source of

harassment to the operation. Over the period of the project 12 days were lost which were directly attributed to excessive noise levels created by rough seas.

D. Surveying Technique

The Shoran direct ranging method was employed for positioning control. The equipment included track plotter and digital print out system. Ten land based stations were used for the project.

E. Chronology

- September 12, 1968 : Tied to Docks at Devonport.
September 12, 1968 : Changing cable to 2400 meter.
September 15, 1968 : Conversion to 2400 meter cable completed.
September 17, 1968 : Oxygen and stores taken on at Melbourne. Power supply blew out 75% of all G.A.U. amplifiers. Sent amplifiers to the States for repair.
October 10, 1968 : First day of production started shooting on Line ER23.
November 7, 1968 : Converting cable from 2400 meter to 1600 meter.

November 10, 1968 : Shot portion of Line ER28 using 1600 meter, 24 group cable. Discontinued line due to crayfish pots.

November 15, 1968 : After four days of extreme weather conditions decision made to shoot in side of Rivoli Bay.

III. RECORDING OPERATIONS

A. Survey Vessel: M/V "Western Spruce" - 119 feet 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, $\frac{1}{2}$ inch gapless tape format, binary gain controlled amplifiers.

On-board Display - Raytheon Precision Depth Recorder, driven by output of trace 22, through 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 consisted of 32 crystal geophones in a tapered noise cancelling array, and were 230 feet in length. Dead sections 100 feet in length separated each "live" group, giving a group centre spacing of 330 feet. Refer to Plate II. The streamer cable buoyancy was adjusted to run at an average depth of 45 feet, and depth was maintained by eight CONDEP pressure cable depth controllers, to plus or minus 7 feet. For line ER28 a 1600 meter cable was used which consisted of removing the 100 feet "dead" sections thus providing a group centre spacing of 230 feet. Refer to Plate IIA.

D. Recording Technique

With the AQUAPULSE system, four "guns", in a rectangular array, were trailed at a depth of about 30 feet. The gun pulse monitoring system was used in conjunction with M.P.8 Geospace phones and 300 Hz galvonometers. 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 pressure decided on was Oxygen 50 lbs. sq. in., Propane 20 lbs. sq. in. with a fill time of 1.5 seconds. Under continuous-tow operations, a metered oxygen/propane mixture was fired electrically at intervals such that four pulses per 330 feet, or approximately 64 pulses per mile were produced using the 2400 meter cable and 3 pulses per 230 feet for the 1600 meter cable.

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.

B. Processing

The digital tapes were air-shipped to Sydney, to

Geophysical Services International for
processing.

V. KEY FIELD PARTY PERSONNEL

A. Esso Standard Oil (Australia) Limited

<u>Name</u>	<u>Position</u>
R. Stone	Client Representatives
A. Martens	CI
I. Criss	

B. Western Geophysical Company of America

<u>Name</u>	<u>Position</u>
V. Smith	Supervisor
V. Hearon	Operations Manager
P. Cooper	Coordinator
K. Dunwoody	Observer
R. Adams	Gun Captain
A. Shirley	Instrument Supervisor

C. Offshore Navigation, Incorporated

<u>Name</u>	<u>Position</u>
I. Easterbrook	Party Chief
D. Hackenbruck	Mobile Operator
H. Adams	Mobile Operator

VI. STATISTICAL SUMMARY

<u>Line</u>	<u>Positions</u>	<u>Positions Occupied</u>	<u>Statute Miles</u>
ER23	1 - 79	79	9.81
ER36	80 - 184	104	13.06
* ER38	185 - 338	154	19.19
ER15	339 - 543	204	25.56
ER30	544 - 814	271	33.81

<u>Line</u>	<u>Positions</u>	<u>Positions Occupied</u>	<u>Statute Miles</u>
ER11	815 - 924	110	13.69
ER40	925 - 1094	170	21.19
ER21	1095 - 1158	64	7.94
ER32 *	1159 - 1277,		
	1272A - 1365	213	26.57
ER34	1366 - 1514	149	18.56
ER13	1515 - 1684	170	21.19
ER17	1685 - 1761	77	9.56
ER19	1762 - 1850	89	11.06
ER25	1851 - 2011	161	20.06
ER20	2012 - 2144	133	16.56
ER22	1245 - 2296	152	18.94
ER24	2297 - 2479	183	22.81
ER26	2480 - 2629	150	18.69
ER7	2630 - 2809	180	22.44
ER5	2810 - 2972	163	20.31
ER9	2973 - 3064	92	11.44
ER16	3065 - 3157	93	11.56
ER14	3158 - 3253	96	11.94
ER12	3254 - 3371	118	14.69
ER10	3372 - 3495	124	15.44
ER8	3496 - 3609	114	14.19
ER6	3610 - 3687	78	9.69
ER4	3688 - 3783	96	11.94
ER2	3784 - 4343	560	69.94
ER1	4344 - 4576	233	29.06
ER3	4577 - 4991	415	51.81
ER18	4992 - 5076	85	10.56
ER42	5112 - 5328	217	27.06
ER48	5329 - 5468	140	17.44
ER27	5469 - 5606	138	17.19
ER29	5607 - 5848	242	30.19
ER31	5849 - 5924	76	9.44
ER33	5925 - 6094	170	21.19
ER35	6095 - 6146	52	6.44
ER37	6147 - 6311	165	20.56
ER44	6312 - 6684	373	46.56
ER49	6685 - 6940	256	31.94
ER46	6941 - 7033	93	11.56
ER47	7034 - 7144	111	13.81
ER45	7145 - 7366	222	27.69
ER43	7367 - 7471	105	13.06
ER41	7472 - 7579	108	13.44
ER39	7580 - 7755	176	21.94
ER56	7756 - 7901	146	18.19
ER61	7902 - 8026	125	15.56
ER59	8027 - 8170	144	17.94
ER54	8171 - 8326	156	19.44

<u>Line</u>	<u>Positions</u>	<u>Positions Occupied</u>	<u>Statute Miles</u>
ER57	8327 - 8475	149	18.56
ER51	8476 - 8558	83	10.31
ER53	8559 - 8649	91	11.31
ER55	8650 - 8723	74	9.19
ER50	8724 - 8843	120	14.94
ER28 **	8844 - 8975	132	11.45
	TOTAL:	<u>8933</u>	<u>1109.66</u>

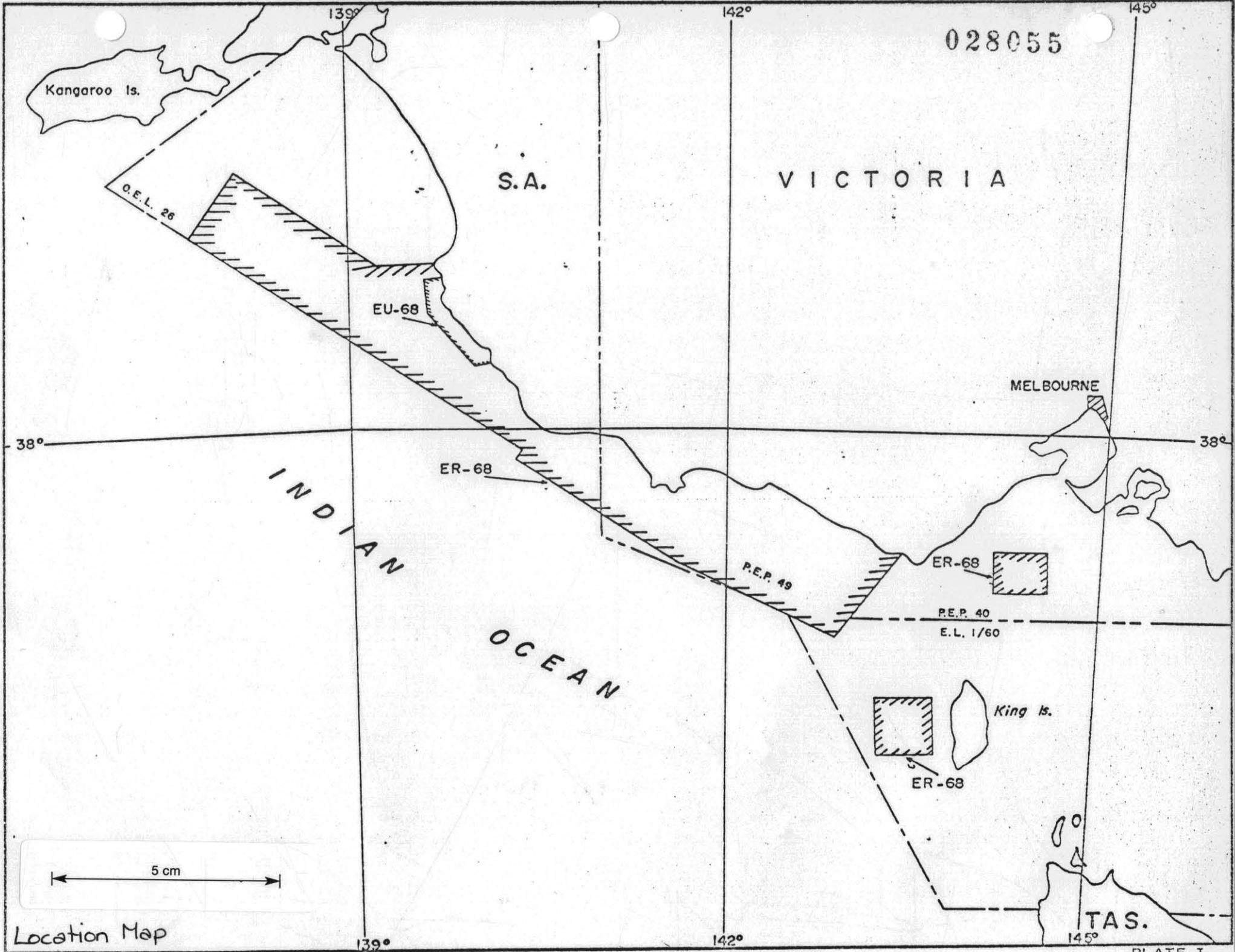
* Chargeable turn around to avoid fishing boat.

** Recorded with 1600 meter cable.

Note: SP's 5077 - 5111 no good and not charged.

* Line 38 - Gun Center to Group 24 Center - 870'.

028055

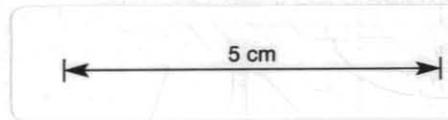
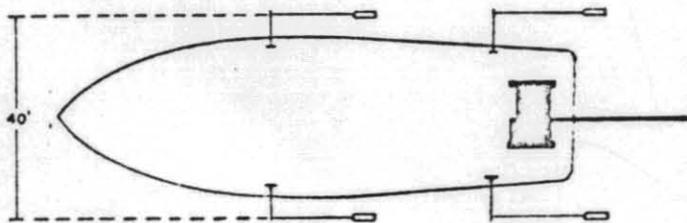
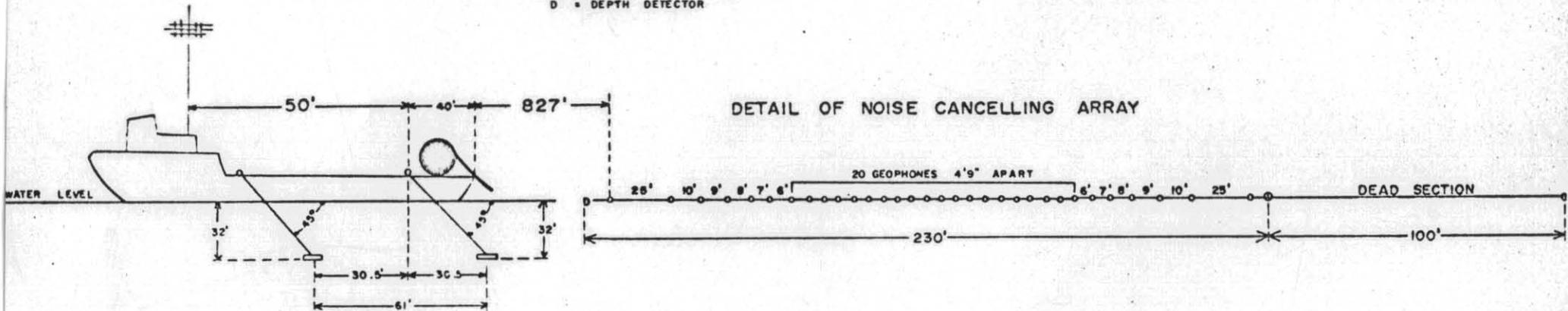
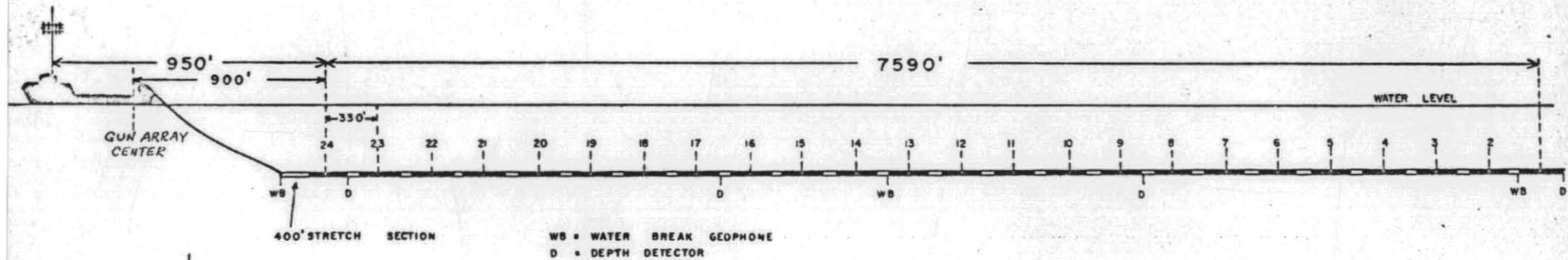


5 cm

Location Map

ESSO SEISMIC SURVEY 1968

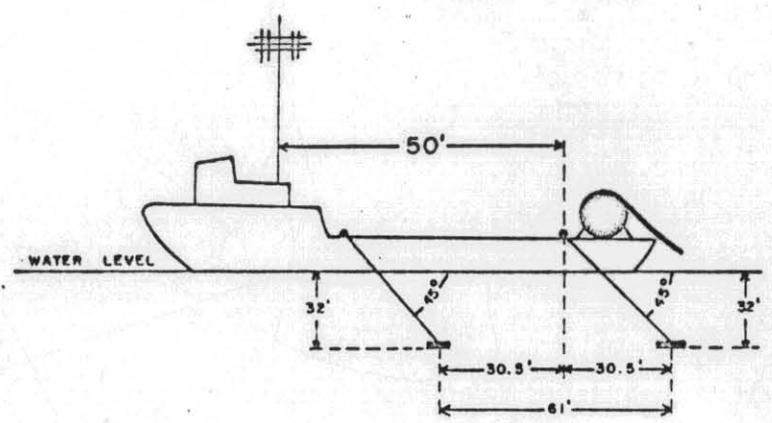
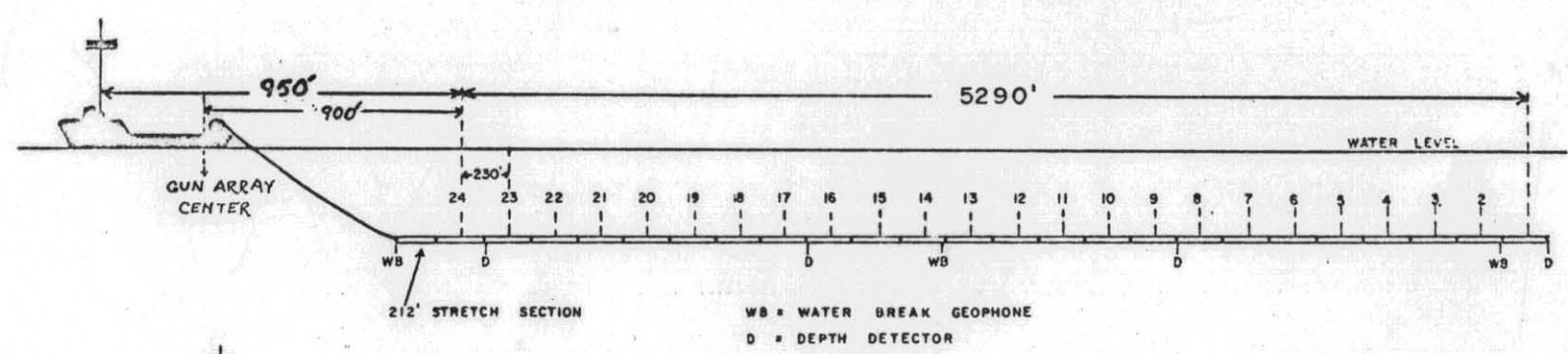
DIAGRAM OF 7590 Ft. STREAMER CABLE



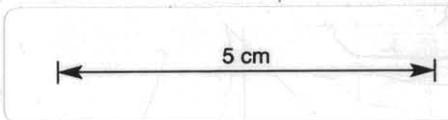
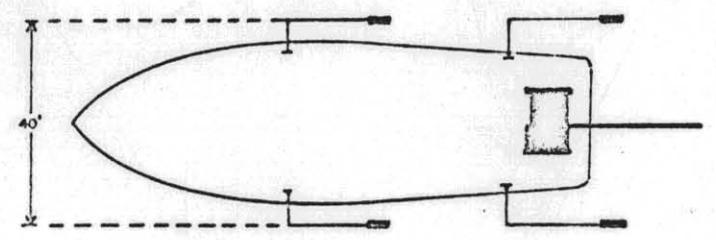
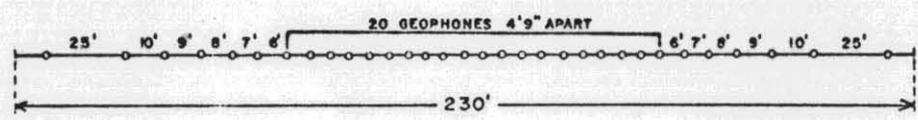
**WESTERN
GEOPHYSICAL**
DIVISION OF LITTON INDUSTRIES

ESSO SEISMIC SURVEY 1968

DIAGRAM OF 5290 Ft. STREAMER CABLE



DETAIL OF NOISE CANCELLING ARRAY



WESTERN
GEOPHYSICAL
DIVISION OF LITTON INDUSTRIES

GENERAL DESCRIPTION and SPECIFICATIONSDFR-300 BINARY GAIN SEISMIC SYSTEM (HIGH GAIN)1. General Information1.0 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 $\times 163,840$.

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, $\frac{1}{2}$ -inch wide, on 8 $\frac{1}{2}$ 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. Specifications2.1 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 μ v 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	± $\frac{1}{2}$ least significant bit
Negative numbers	1's complement
Linearity	Better than 0.01%
Slope error	Better than 0.01%
Zero error	Better than 0.01%
Conversion time	12 μ s

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	$\frac{1}{2}$ " (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

8 $\frac{1}{2}$ " 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.

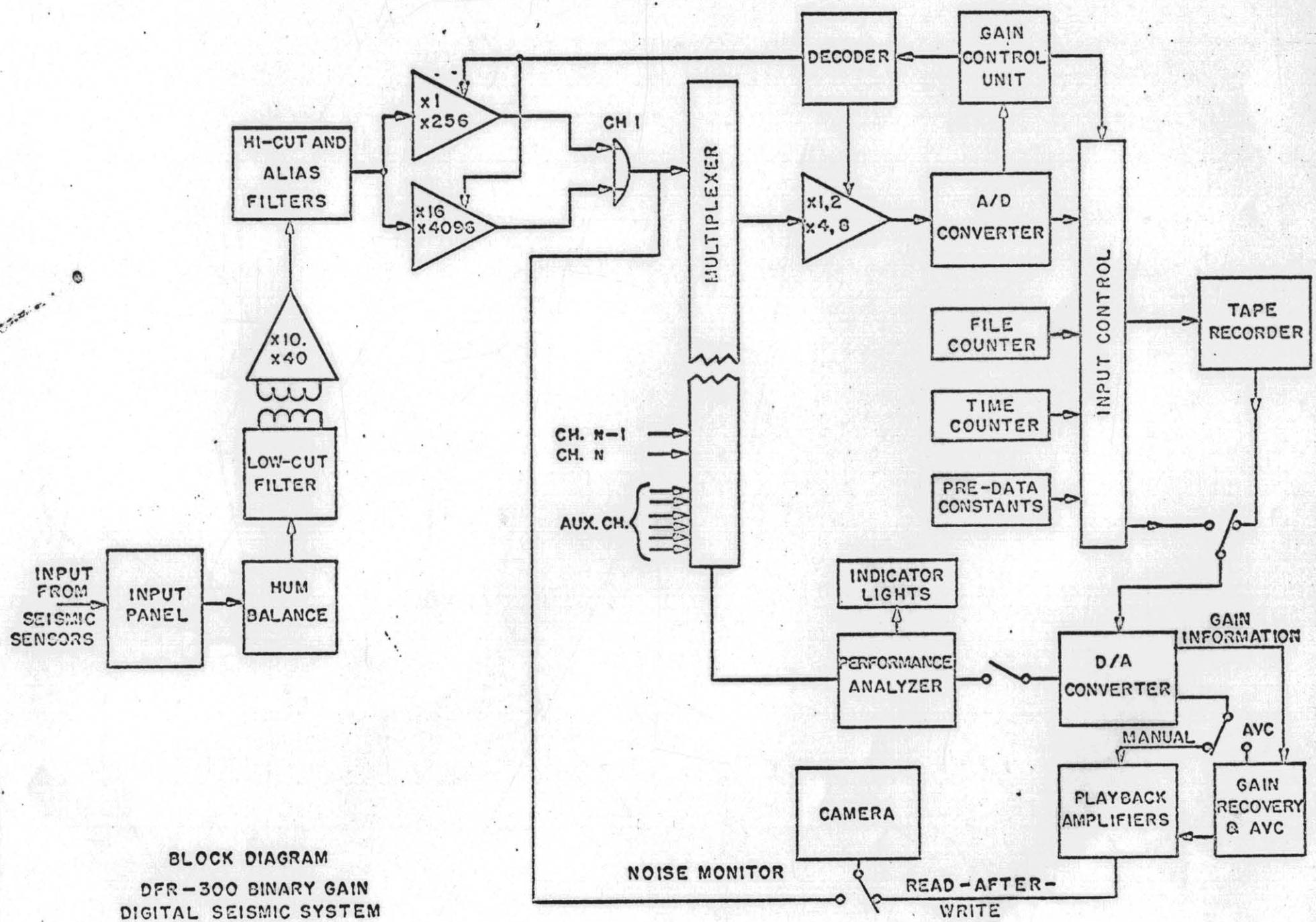


Figure 1

BLOCK DIAGRAM
DFR-300 BINARY GAIN
DIGITAL SEISMIC SYSTEM

AMPLITUDE RESPONSE

028068

SDS BINARY GAIN AMPLIFIER

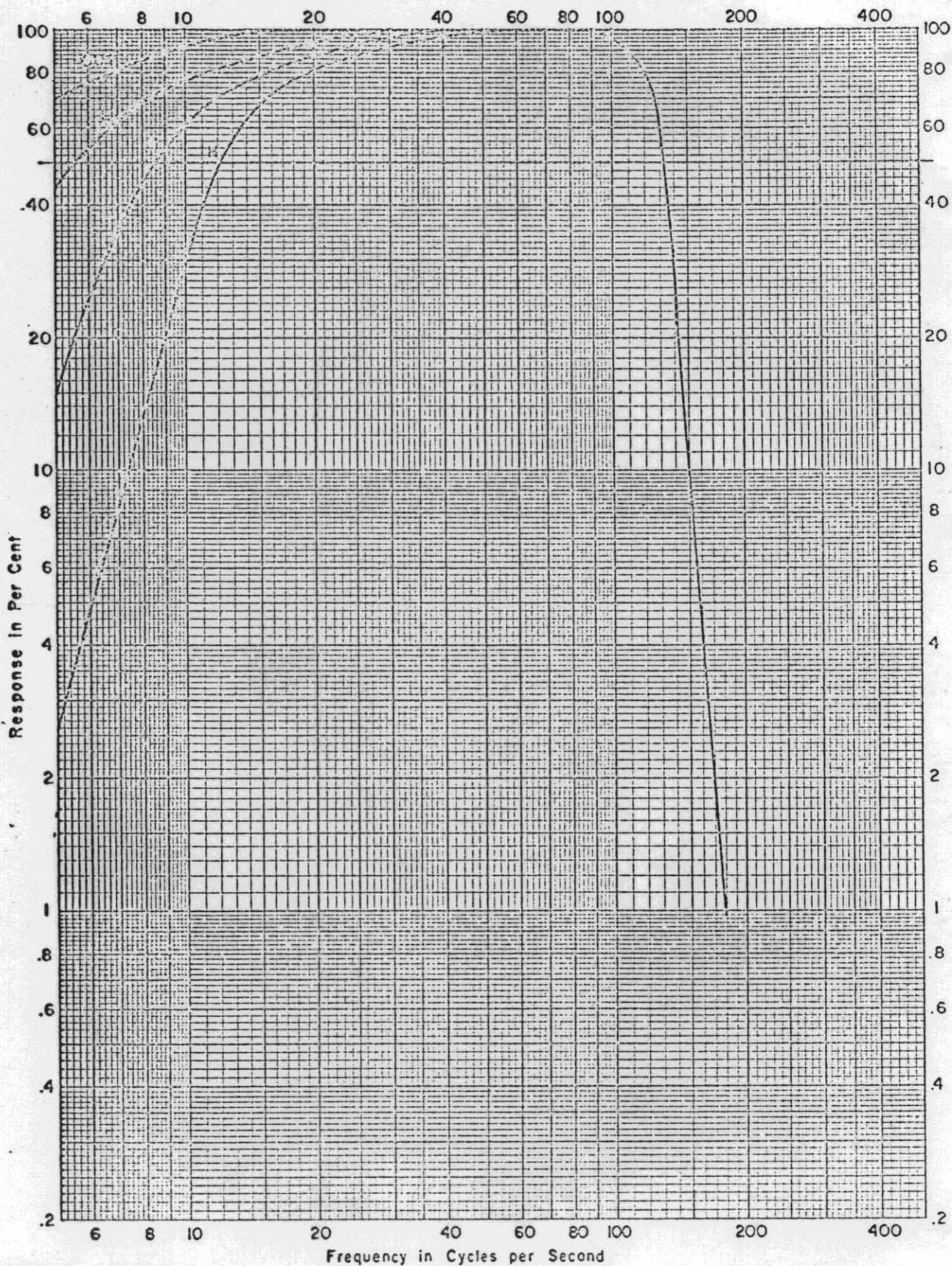
AMPLIFIER ONLY

SERIES DFR-300

HIGH CUT FILTERS-OUT

LOW CUT FILTERS

ALIAS FILTER - 2MS



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FIGURE 2.

WESTERN
GEOPHYSICAL

AMPLITUDE RESPONSE

028069

SDS BINARY GAIN AMPLIFIER

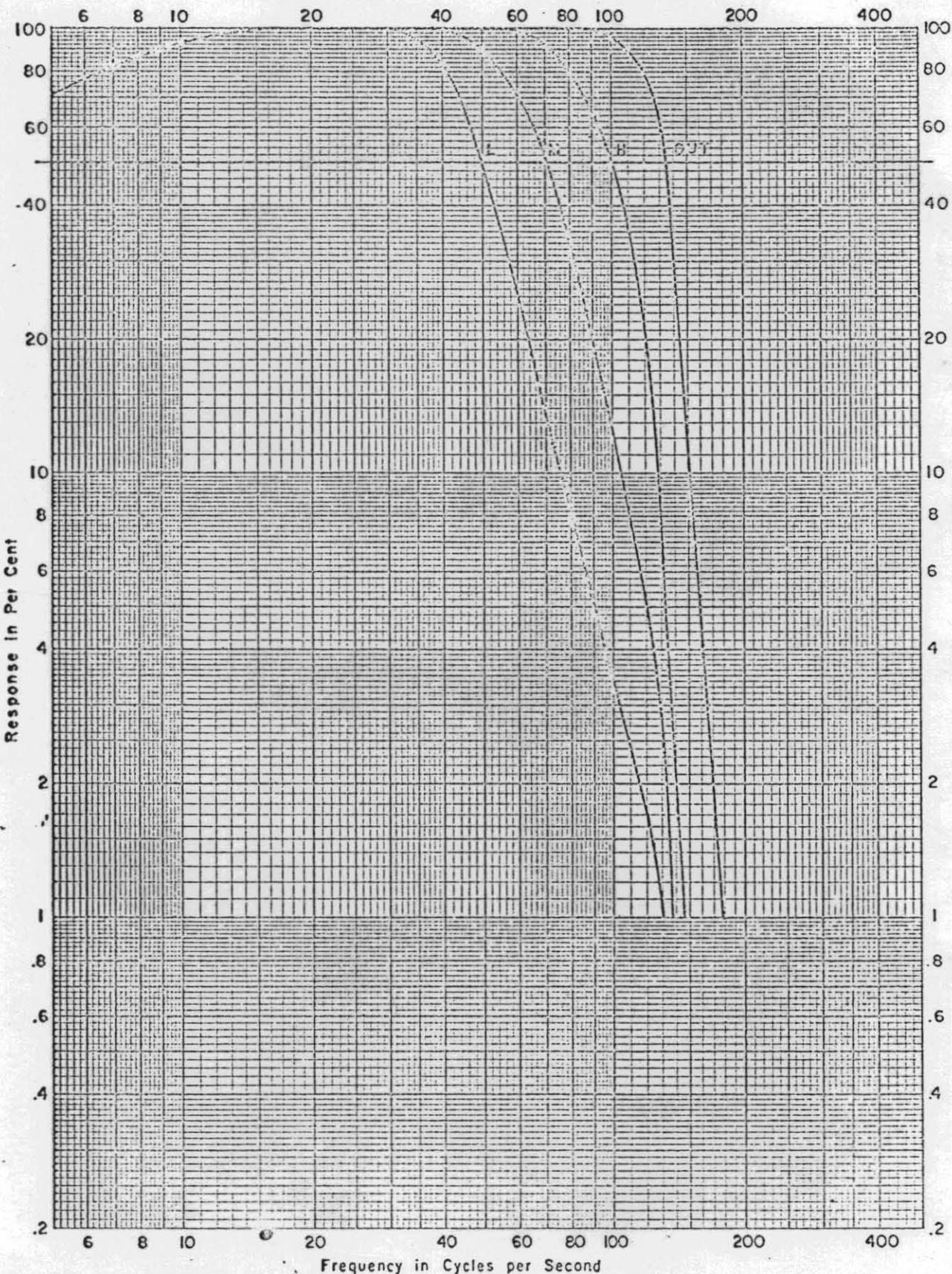
AMPLIFIER ONLY

SERIES DFR-300

LOW CUT FILTER-OUT

HIGH CUT FILTERS

ALIAS FILTER-2MS

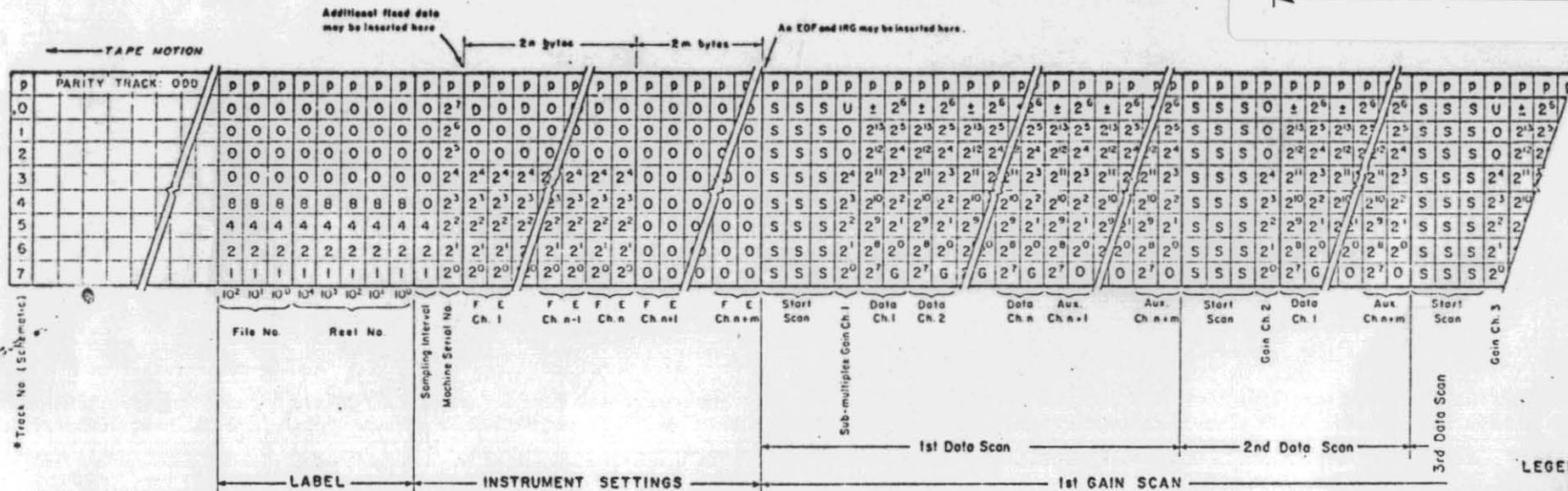


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FIGURE 3.

WESTERN GEOPHYSICAL

9-TRACK DIGITAL RECORDING FORMAT



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

LEGEND

- C = Cyclic Redundance 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
- 2ⁿ = Data Bit

