C83001

T/7P part-1*

FINAL SUBSIDY REPORT

OF

EAST TASMANIA T69B MARINE SEISMIC AND MAGNETIC SURVEY

PREPARED FOR

THE BUREAU OF MINERAL RESOURCES CANBERRA

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

JUNE 1969

AUTHOR: D. I. McEVOY

083002

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ABSTRACT

Esso Exploration and Production Australia Inc., carried out the East Tasmania T69B Marine Seismic and Magnetic Survey between February 7th and February 11th, 1969. 98.24 miles of digitally recorded and processed 12-fold CDP information were shot with Aquapulse in permit area T/7P.

Results of the survey show shallow basement in most of the area with the exception of its eastern edge, which appears to be extensively faulted.

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INTRODUCTION

A. LOCATION

The Survey is located offshore from the east coast of Tasmania in an area bounded by latitudes 41° 00' and 42° 30' south and longitudes 148° 00' and 149° 00' east. This region is within permit area T/7P licensed to Esso Exploration and Production Inc.

B. OBJECT

The object of the survey was to provide reconnaissance control in the area offshore Eastern Tasmania for the assessment of sedimentary thicknesses and structural potential.

C. EXPLORATION HISTORY

The only existing geophysical information in the area is an aeromagnetic survey conducted by Aero Services Limited in 1966 and 1967. This survey covered a total of 9250 miles in T/7P, T/8P and T/11P.

D. REGIONAL GEOLOGY

The eastern continental shelf of Tasmania lies adjacent to extensive areas of Jurassic dolerites and Devonian granites. The aeromagnetic survey results indicate that the Jurassic dolerite terrain on the eastern coast of Tasmania is terminated abruptly by up to the east faulting on and close to the present day coastline. Evidence for this is found onshore on the eastern side of Great Oyster Bay, where a Jurassic-Paleozoic contact may be followed in a north-south trend along the coast.

Thickness of the Paleozoic sequence probably exceeds 28,000ft. in Tasmania, with stratigraphy varying in age from Cambrian to Permian. The section is a series of complexly folded, faulted, metamorphosed and unmetamorphosed sedimentary, extrusive and intrusive igneous rocks. Widespread granitic intrusives occurred during the Tabberabberan Orogeny in Middle Devonian time.

A prolonged period of erosion followed until the deposition of several thousand feet of marine and nonmarine sediments during Permian time.

The sediments are apparently disconformably overlain by nonmarine Triassic clastics. During Lower Jurassic time a vast sheet of dolerite intruded earlier sediments. The Cretaceous onshore in Tasmania is represented only by a syenite stock.

During early Tertiary time nonmarine and marine clastics were deposited in the Bass and Otway Basins to the north. In the Oligocene and Miocene the seas encroached on Tasmania and deposited shoal limestones at isolated coastal localities. Mid-Tertiary basic volcanics locally intruded Tertiary sediments and were extruded on older basement rocks.

FIELD OPERATIONS

A. SEISMIC SURVEY

The energy source used in the East Tasmania T69B Survey is known as Aqualpulse. Four Aquapulse guns in a rectangular array are towed at a depth of 30 feet sub-sea, two on each side of the recording vessel. A mixture of oxygen and propane is injected into the guns and simultaneously fired by an electrical impulse.

The normal operating technique for the programme was to use a 1600 meter cable with a firing rate of three pops every 69.5 meters. In processing the three pops were summed resulting in the equivalent of one shot every 69.5 meters. These data were then processed into a 12-fold C.D.P. presentation.

Shoran radio-positioning system was used for maintaining boat position.

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A detailed report by Western Geophysical Co., on seismic operations is included in the appendix. The radio location operations report by Offshore Navigation Inc., has not yet been received, but will be forwarded under separate cover as soon as possible.

The field production by Western Geophysical Co., under Esso supervision, was as follows:

February 7	50.43 miles recorded
February 11	47.81 miles recorded
Total	98.24 miles recorded

B. MAGNETIC SURVEY

Due to equipment malfunction no magnetic data was recorded on the East Tasmania T69B Survey.

PROCESSING

Digital processing was done under Esso supervision by G.S.I., in Sydney. The digital processes of True Amplitude Recovery, Normal Moveout Correction, twelve fold C.D.P. stack, Time Variant Deconvolution, Time Variant Filter and digital A.G.C., were applied to the data which was finally presented on variable density film negatives. Velocity control for stacking was obtained from T delta T analysis of the recorded data. Eighteen Automated Velocity Scans and writeouts were obtained.

INTERPRETATION

A. METHOD

To assist in the identification of shallow Economic Basement in the area a number of refraction displays from wiggle-trace playback monitors were used to estimate the depth to the Basement refractor.

The method involves the determination of the Basement velocity from the slope of a time-distance plot of the refracted first arrivals displayed on the wiggle-trace records. An average overburden velocity, which depends on the amount of water and sediment overlying basement, is estimated for each determination. By projecting back the time-distance plot of refracted first arrivals to the shot point, the intercept time corresponding to the basement refractor may be obtained. The depth to basement may then be calculated from the formula:

$$Z = \frac{To\ V_1}{2 \cos \theta}, \qquad \theta = \sin^{-1} \frac{V_1}{V_2}$$

Where

Z = depth to basement
V_1 = velocity of overburden
V_2 = velocity of basement
To = intercept time corresponding to the basement refracted arrivals.

The average velocity of the basement in the area was found to be 16,000 ft/sec. with values ranging from 14,300 ft/sec. to 17,200 ft/sec. being obtained.

The reflection horizon which corresponds to this high velocity refractor has been mapped as Economic Basement and is thought to represent Devonian granite which outcrops extensively on nearby onshore Tasmania.

B. DISCUSSION OF MAPS

A time structure contour map with a scale of 1:250,000 was made on Economic Basement and an isochron map with the same scale of total sedimentary thickness

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was made.

Time values are two-way times below sea level with water depth static corrections (figure 2) applied.

ECONOMIC BASEMENT (Plate I)

The Economic Basement structure map shows a gentle eastern regional dip to a maximum depth of 2500 ft. subsea at the edge of the continental shelf. There are a closely spaced series of north-south trending faults beyond the edge of the shelf. A down thrown gross Basement block dips to the west at the eastern end of line B-3. The erosional topographic nature of the shallow Basement surface is evident in many places on the seismic sections.

TOTAL SEDIMENT ISOCHRON (Plate II)

The Total Sediment Isochron shows a general thickening of sediments out to the edge of the continental shelf with Basement dipping to the east. Beyong the shelf the sediments thin towards the faulted margin due to increasing water depth. The exception is a broad thick on lines B-1 and B-2 that was deposited in a Basement depression. Across the faulted region on the eastern end of line B-3 the sedimentary thickness increases to a maximum at shot point 603 and then decreases seaward over the Basement tilted fault block.

CONCLUSIONS AND RECOMMENDATIONS

The East Tasmania T69B Seismic and Magnetic Survey indicated that the permit area is underlain by shallow Basement and is, therefore, extremely unlikely to have any economical potential for hydrocarbons.

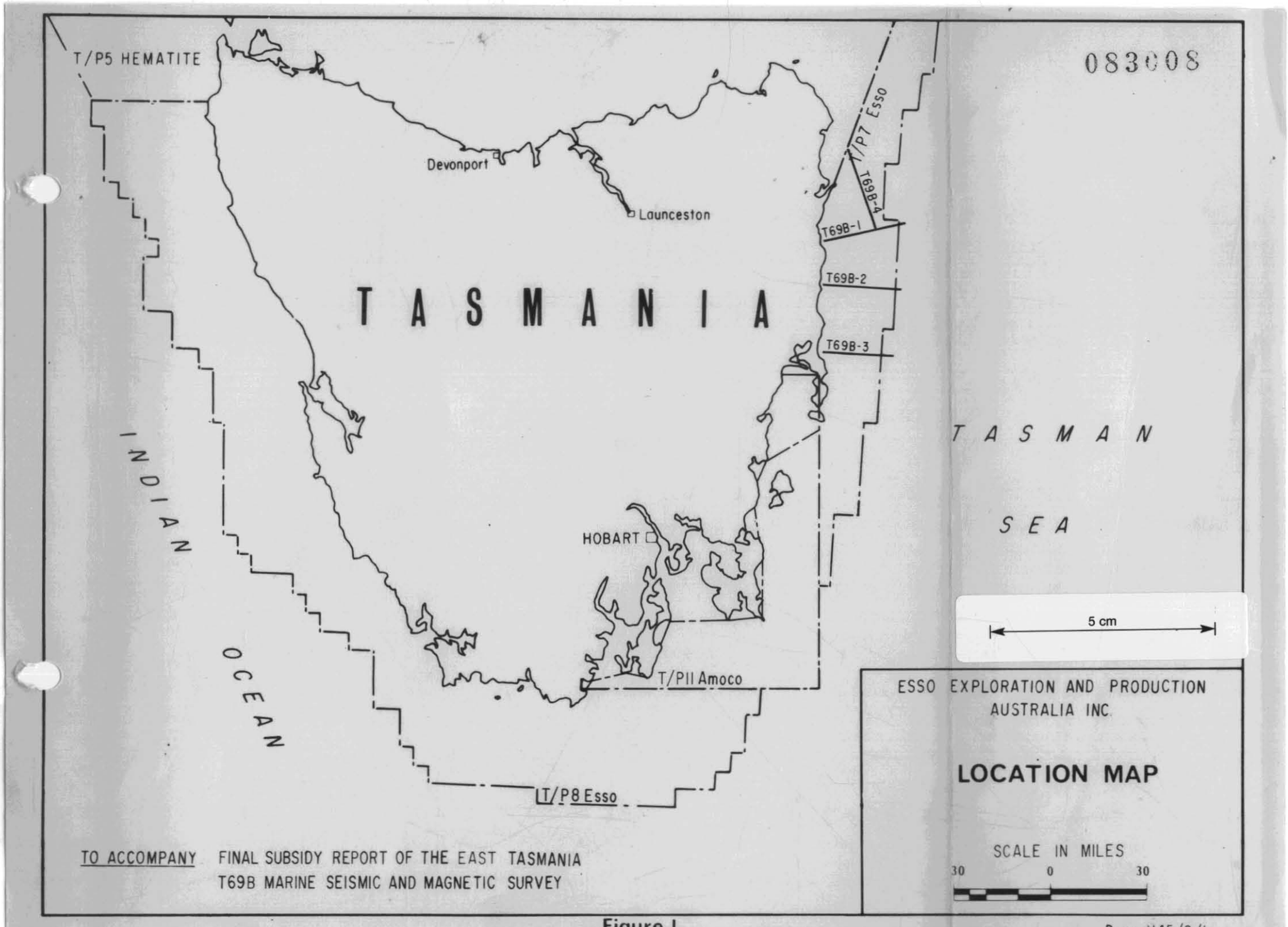


Figure 1

Dwg: 1145/G/1

5 cm

0 ·100 ·200 ·300 ·400 ·500 ·600 ·700 ·800 ·900 1·000 1·100

REFLECTION TIME CORRECTIONS IN SECONDS

WATER DEPTH IN FEET

1000
2000
3000
4000
5000
6000
7000

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

TASMANIA

WATER DEPTH CORRECTIONS

TO ACCOMPANY: FINAL SUBSIDY REPORT OF THE EAST TASMANIA T69B MARINE SEISMIC AND MAGNETIC SURVEY

MAY 1969

FIGURE 2

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Dwg:1145/G/2

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TWO WAY TIME BELOW SEA LEVEL (STATIC CORRECTED FOR TRAVEL TIME IN WATER)

0·0 0·2 0·4 0·6 0·8 1·0 1·2 1·4 1·6 1·8 2·0 2·2 2·4 2·6 2·8 3·0 3·2 3·4 3·6

DEPTH IN FEET BELOW SEA LEVEL

1000 2000 3000 4000 5000 6000 7000 8000 9000 10,000 11,000

MULLET – I

VELOCITY SCANS (T69B)

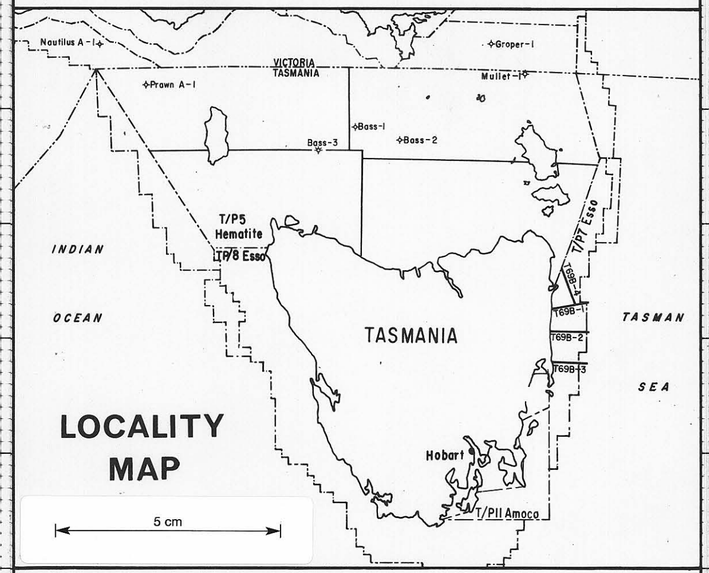
GROPER – I

THESE CURVES APPLY ONLY TO SECTION OVERLYING BASEMENT

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

TASMANIA

TIME DEPTH CURVES



LOCALITY MAP

DATUM: SEA LEVEL
AUTHOR: D. McEVOY
TO ACCOMPANY: FINAL SUBSIDY REPORT OF THE EAST TASMANIA T69B MARINE SEISMIC AND MAGNETIC SURVEY

MAY, 1969

FIG. 3

Dwg. 1145/G/3

T69B Seismic Survey

Seismic Sections

Line	Shot Points
4	1 - 287
1	288 - 580
3	581 - 841
2	842 - 1130

Velocity Scans

Line	Shot Points
4	40, 100, 165, 245
1	300, 350, 400, 465, 525
3	595, 650, 690, 765
2	850, 890, 955, 1000, 1055

083012 APPX B.
T/7P part-I*

FINAL OPERATIONS REPORT

AUSTRALIAN MARINE SEISMIC SURVEY

T69B

EAST COAST TASMANIA

FOR

ESSO STANDARD OIL (AUSTRALIA) LIMITED

BY

WESTERN GEOPHYSICAL COMPANY OF AMERICA

PARTY 64

FEBRUARY 1969

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I. Location Map
II. 5290 foot 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 along the East Coast of Tasmania. Operations commenced on February 5th, 1969 and was completed on February 11th, 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 413-417 New South Head Road, Double Bay, New South Wales, Australia.

B. Base of Operations

Devonport, Tasmania was used as the headquarters base of operations for the East Coast of Tasmania. Good harbour facilities and daily air service was available, and the town provided a good source of supply. Bischeno, Tasmania was set up as a secondary base of operations. A ready supply of fishing vessels were available for runs to the "Western Spruce". Bischeno provided good shelter for transferring personnel and supplies.

C. Weather

The weather was a little bad, but only one day was lost directly due to weather.

D. Surveying Technique

The SHORAN direct ranging method was employed for positioning control. The equipment included track plotter and digital print out system. Three land based stations were utilized. A description of the Shoran system and the fixed base station sites is included in a separate report to be submitted by Offshore Navigation, Incorporated.

E. Chronology

February 5th, 1969 : Arrived in Devonport, Tasmania from West Coast project at 1415 hours. Provisions taken on and departed for East Coast of Tasmania at 1830 hours.

February 6th, 1969 : Underway to prospect. On prospect at 1420 hours but Shoran stations not set. Shoran stations operational at 1800 hours but now too rough to work.

February 7th, 1969 : Started shooting on Line T69B4.

February 9th, 1969 : Waiting on Shoran to complete setting of Base station.

February 10th, 1969 : Stood by for Shoran signals until 2200 hours. First shot point on Line T69B3 at 2330 hours.

February 11th, 1969 : Last shot on prospect at 1520 hours.

III. RECORDING OPERATIONS

A. Survey Vessel: M/V "Western Spruce" - 119 feet steel hulled 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 throughout the survey. Each seismic detector group consisted of 32 crystal geophones in a tapered noise cancelling array, and were 230 feet in length. A 5290 foot cable arrangement was used providing a group centre spacing of 230 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.

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 20lbs. per 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 three pulses per 230 feet, or 68.88 pulses per mile were produced. This pulse density allows certain options in vertical summing and horizontal stacking, such as 4-sum 12-stack or 8-sum 6-stack. Refer to Plate II 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 6 pulses, or 153 yards. 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 Geophysical Services International in Sydney for processing.

V. KEY FIELD PARTY PERSONNEL

A. Esso Standard Oil (Australia) Limited

Name	Position
I. Criss	Client Representative

B. Western Geophysical Company of America

Name	Position
V. Smith	Supervisor
V. Hearon	Operations Manager
K. Dunwoody	Asst. Co-ordinator
P. Cooper	Co-ordinator
J. Berry	Observer
R. Anderton	Gun Captain
A. Shirley	Instrument Supervisor

C. Offshore Navigation, Incorporated

Name	Position
I. Easterbrook	Party Chief
D. Hackenbruck	Mobile Operator
H. Adams	Mobile Operator

VI. STATISTICAL SUMMARY

A. East Coast of Tasmania

Cable length - 5290 feet

Cable length measured from first to last Shoran position.

Constants:

1 interval	- 153.3 yards - .0871 miles
Gun array centre to group 24 centre	- 960 feet
Pop rate	- 3 per 230 feet
Record length	- 5 seconds

Line	Positions	Positions Occupied	Statute Miles
T-69B4	1 - 287	287	24.95
T-69B1	288 - 580	293	25.48
T-69B3	581 - 841	261	22.69
T-69B2	842 - 1130	289	25.13
	TOTAL:	1130	98.25

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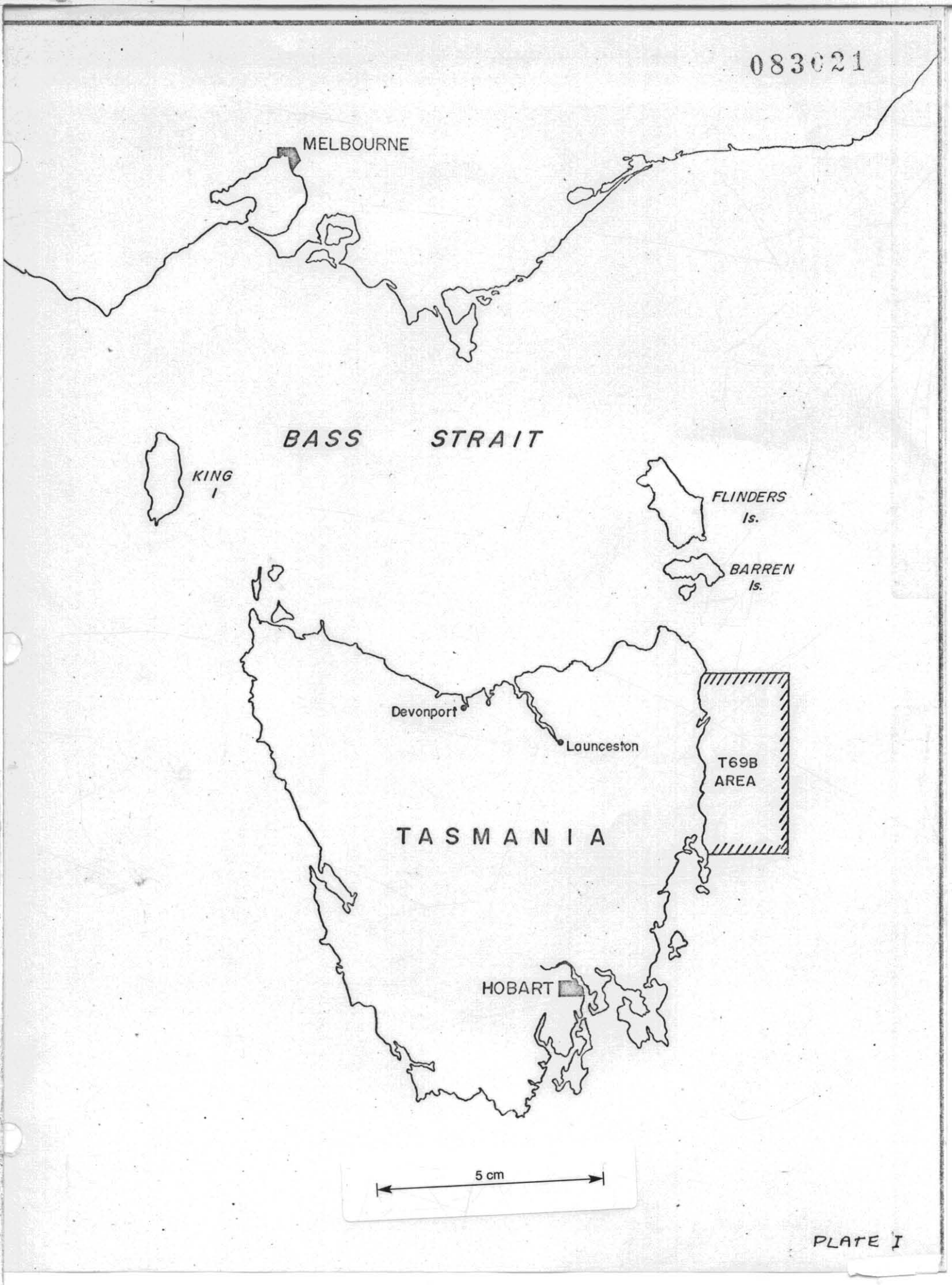
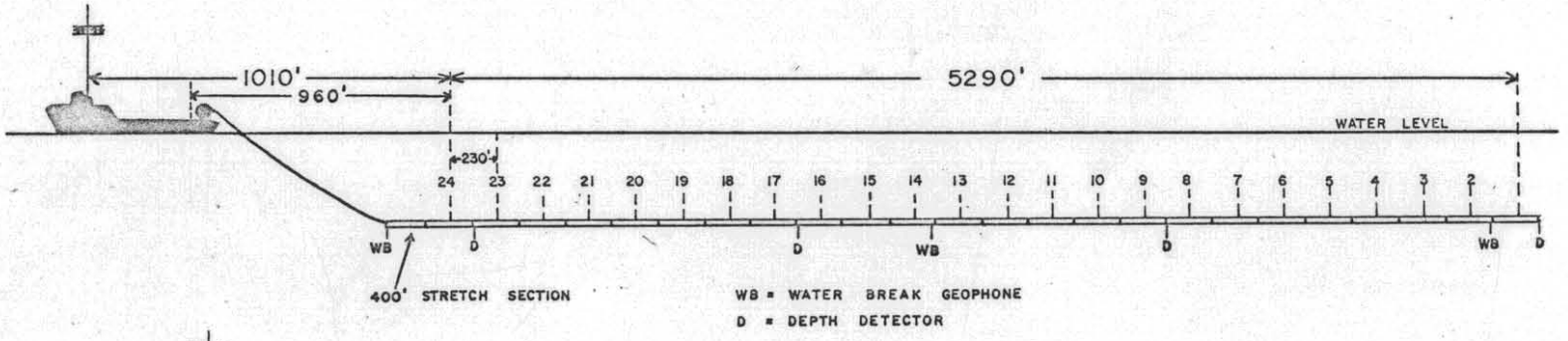
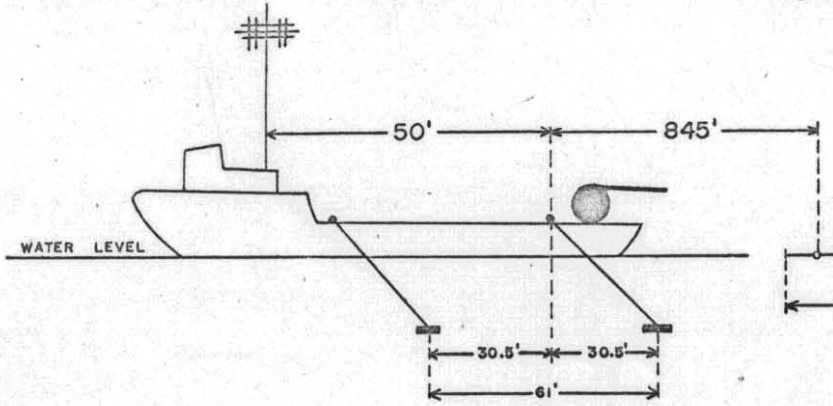


PLATE I

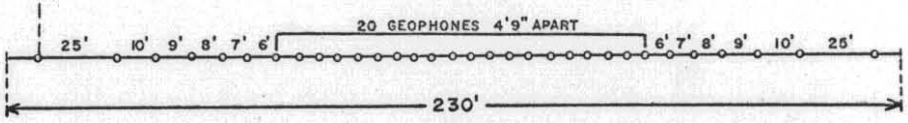
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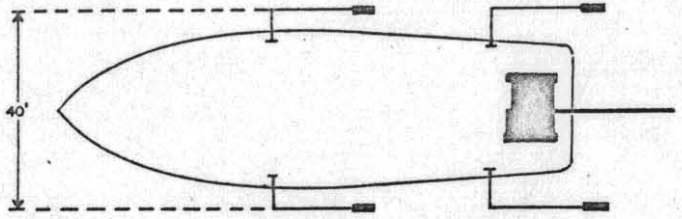
DIAGRAM OF 5290 Ft. STREAMER CABLE

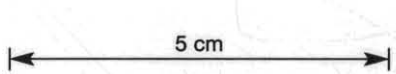




DETAIL OF NOISE CANCELLING ARRAY







THE AQUAPULSE SYSTEM

WESTERN GEOPHYSICAL
DIVISION OF LITTON INDUSTRIES

PLATE II

0830022

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.

083032

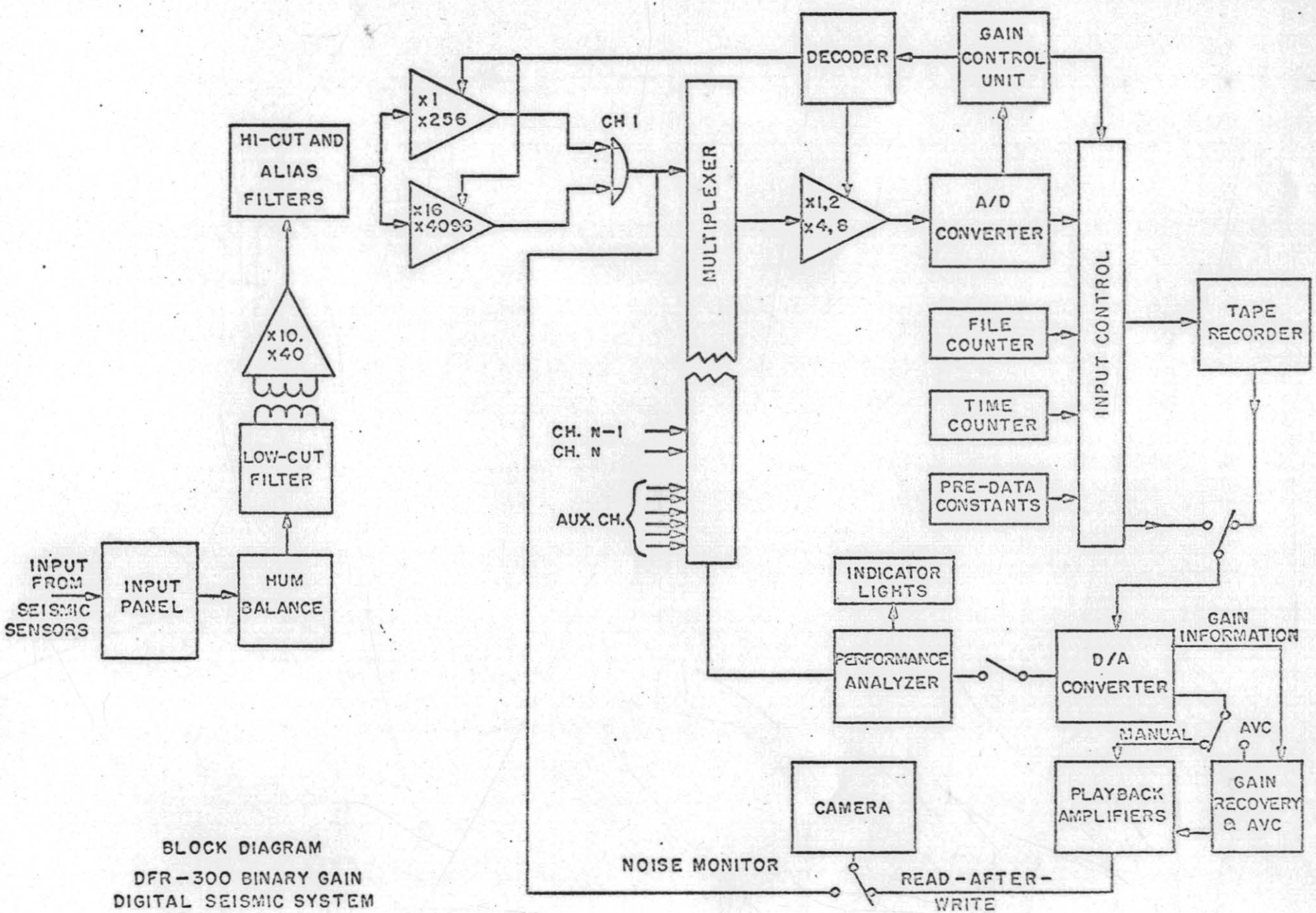


Figure 1

BLOCK DIAGRAM
DFR-300 BINARY GAIN
DIGITAL SEISMIC SYSTEM

WESTERN GEOPHYSICAL

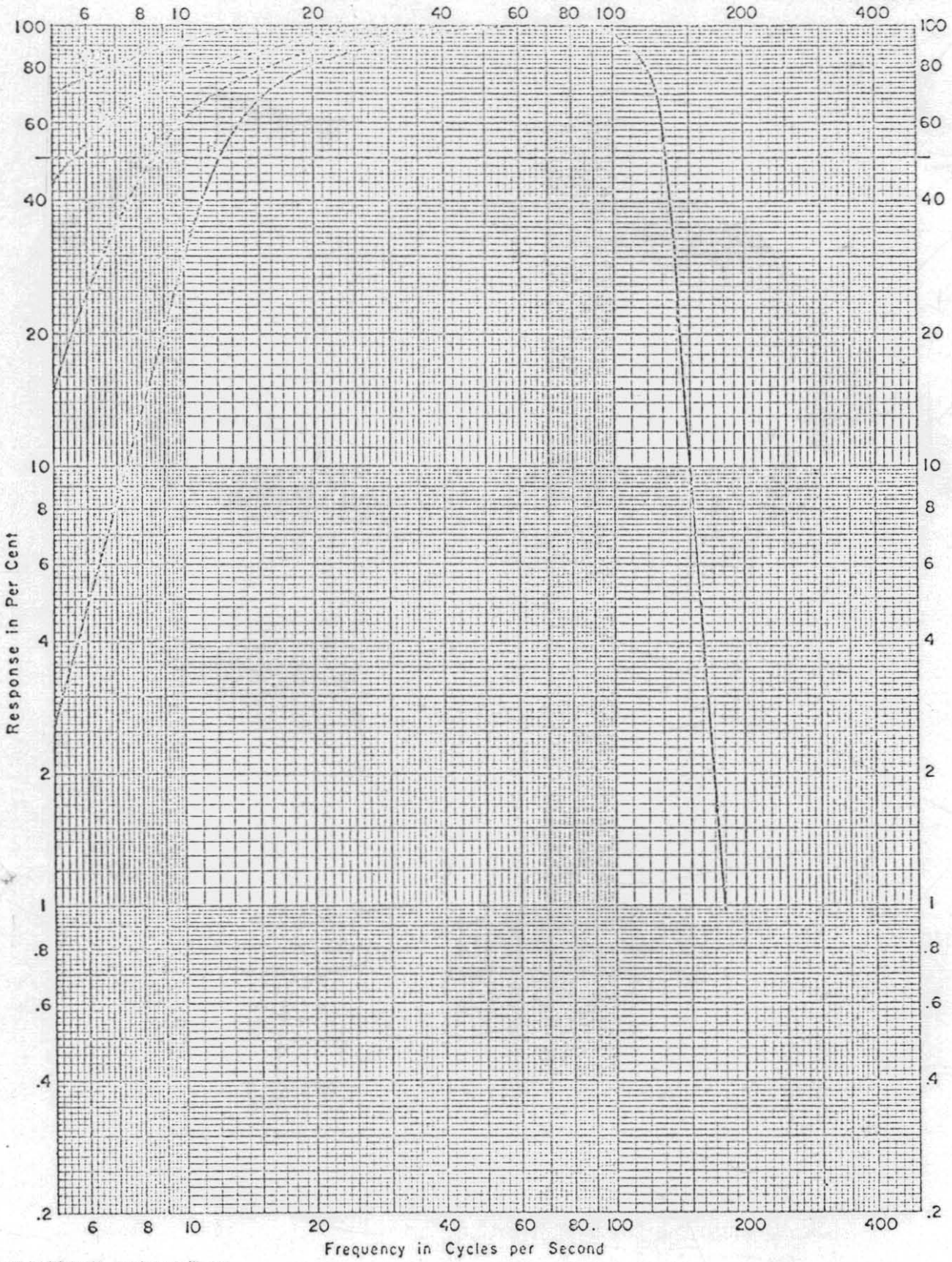
5 cm

AMPLITUDE RESPONSE

083033

SDS BINARY GAIN AMPLIFIER
SERIES DFR-300
LOW CUT FILTERS

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



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WESTERN GEOPHYSICAL

FIGURE 2.

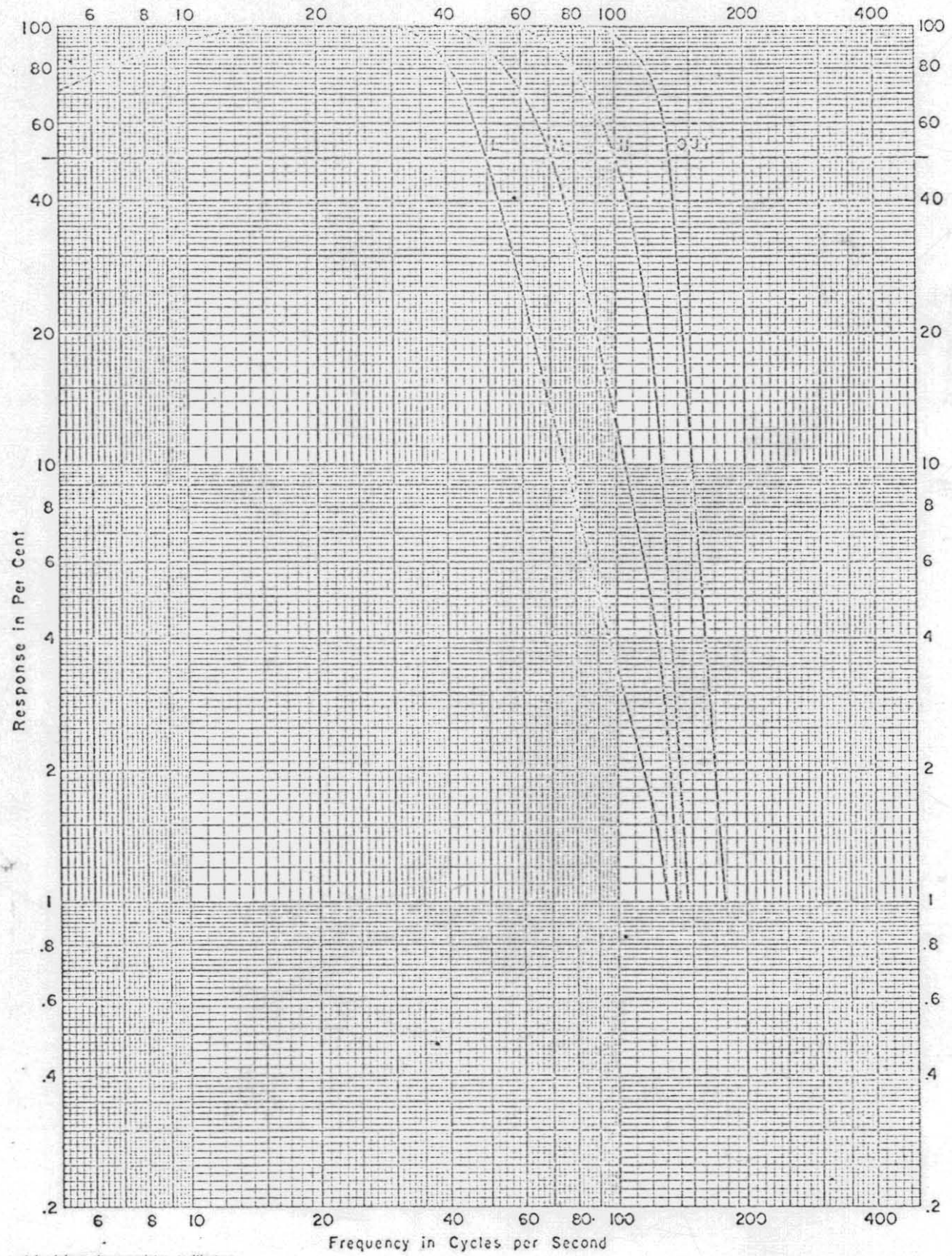
5 cm

AMPLITUDE RESPONSE

083034

SDS BINARY GAIN AMPLIFIER
SERIES DFR-300
HIGH CUT FILTERS

AMPLIFIER ONLY
LOW CUT FILTER – OUT
ALIAS FILTER – 2MS

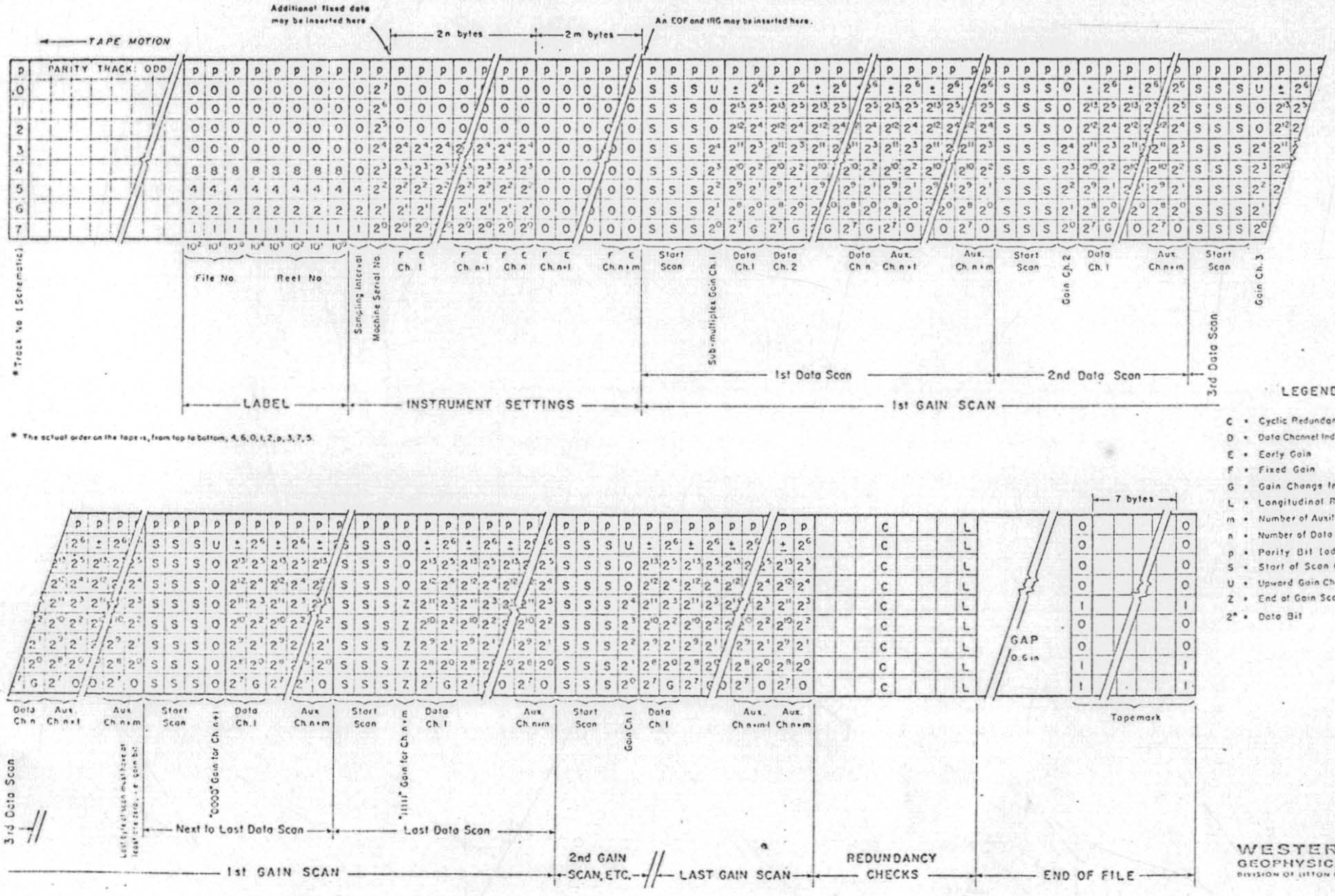


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WESTERN GEOPHYSICAL

FIGURE 3.

9-TRACK DIGITAL RECORDING FORMAT



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^n = Data Bit

WESTERN GEOPHYSICAL
DIVISION OF LITTON INDUSTRIES

083035

FIGURE 4

Appendix C

083036

FINAL REPORT
OFFSHORE NAVIGATION, INC.
PROJECT 305

WESTERN GEOPHYSICAL COMPANY OF AMERICA

TASMAN SEA, TASMANIA

083037

A B S T R A C T

Project 305 was a Shoran-controlled, marine seismic survey for potential mineral deposits in the Tasman Sea off the eastern coast of Tasmania.

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.

083038

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FIGURES

1. Simplified Block diagram of Basic Radio Equipment of a Shoran System
2. Area of uncertainty of position due to error in range measurement
3. Position ambiguity in Circular Range System
4. Relative area of coverage Circular Ranging System

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.

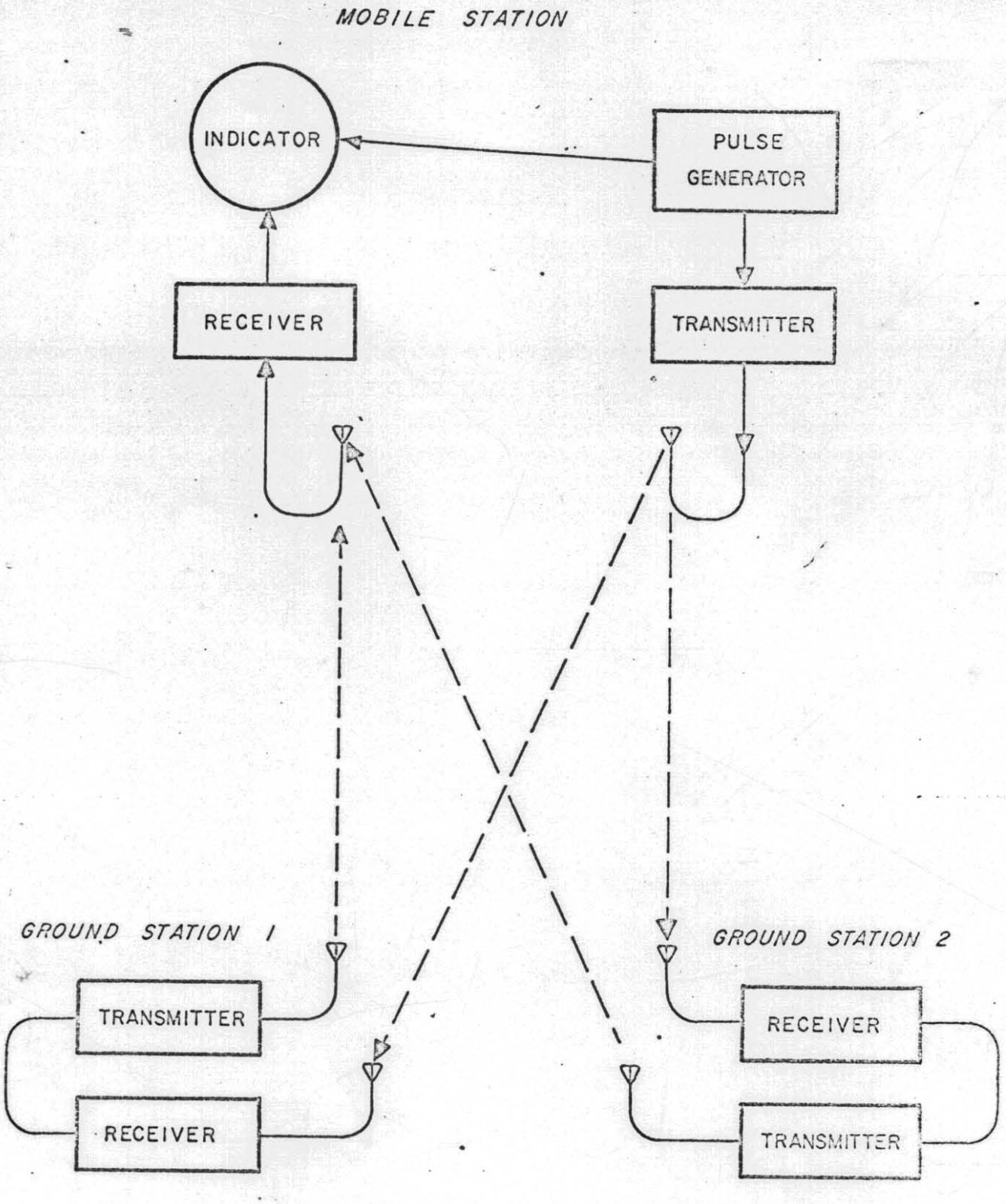


FIGURE 1
SIMPLIFIED BLOCK DIAGRAM OF BASIC RADIO EQUIPMENT OF A SHORAN SYSTEM

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.

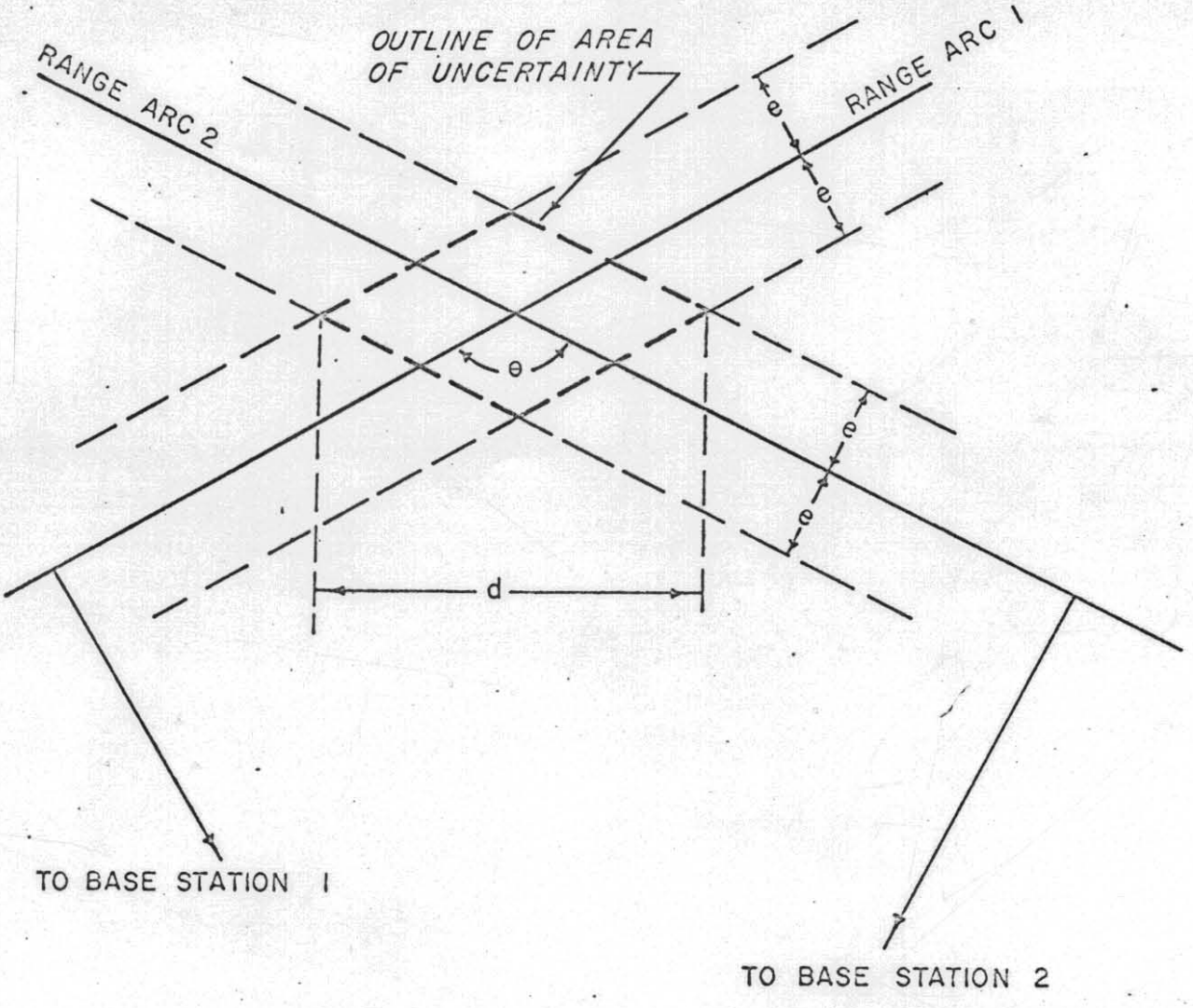
The instrumental accuracy of the Shoran equipment, when properly calibrated, is ± 50-75 feet on a single range. The overall position accuracy is related to the range accuracy by

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

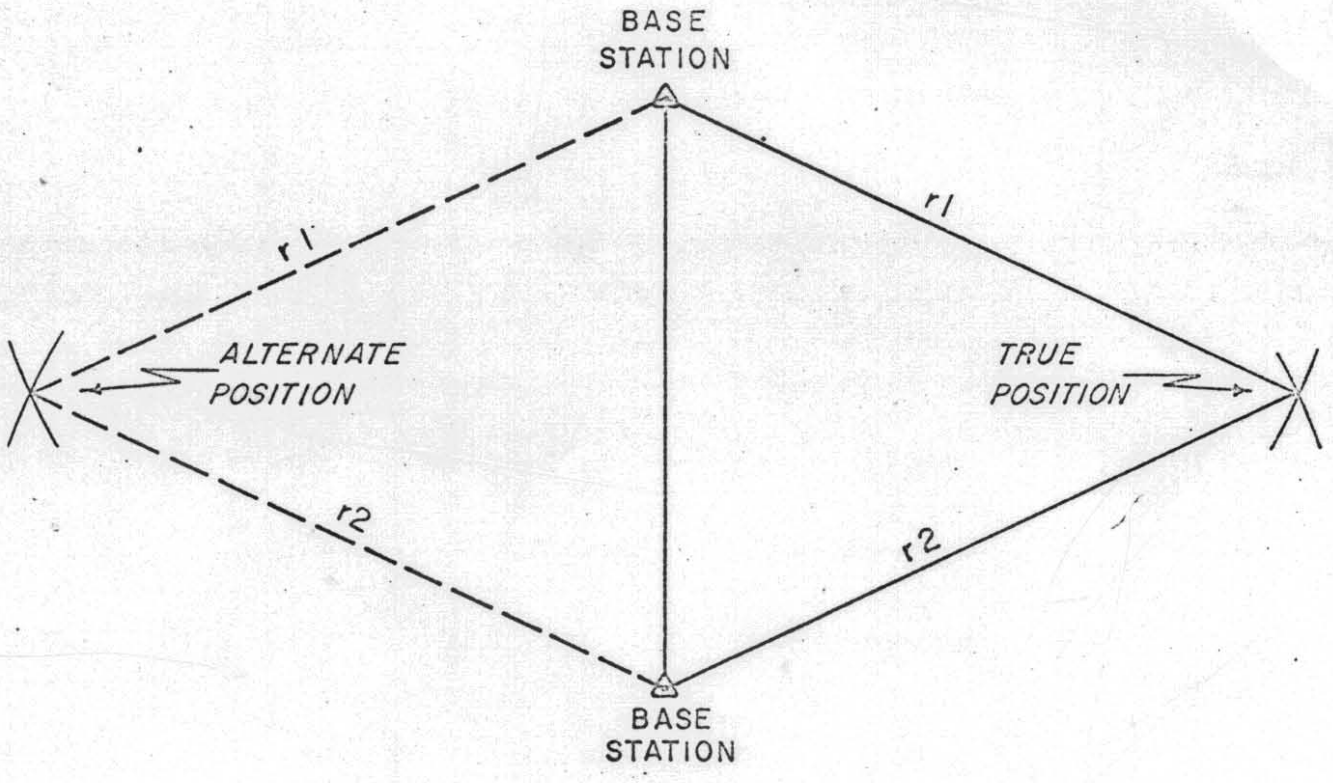
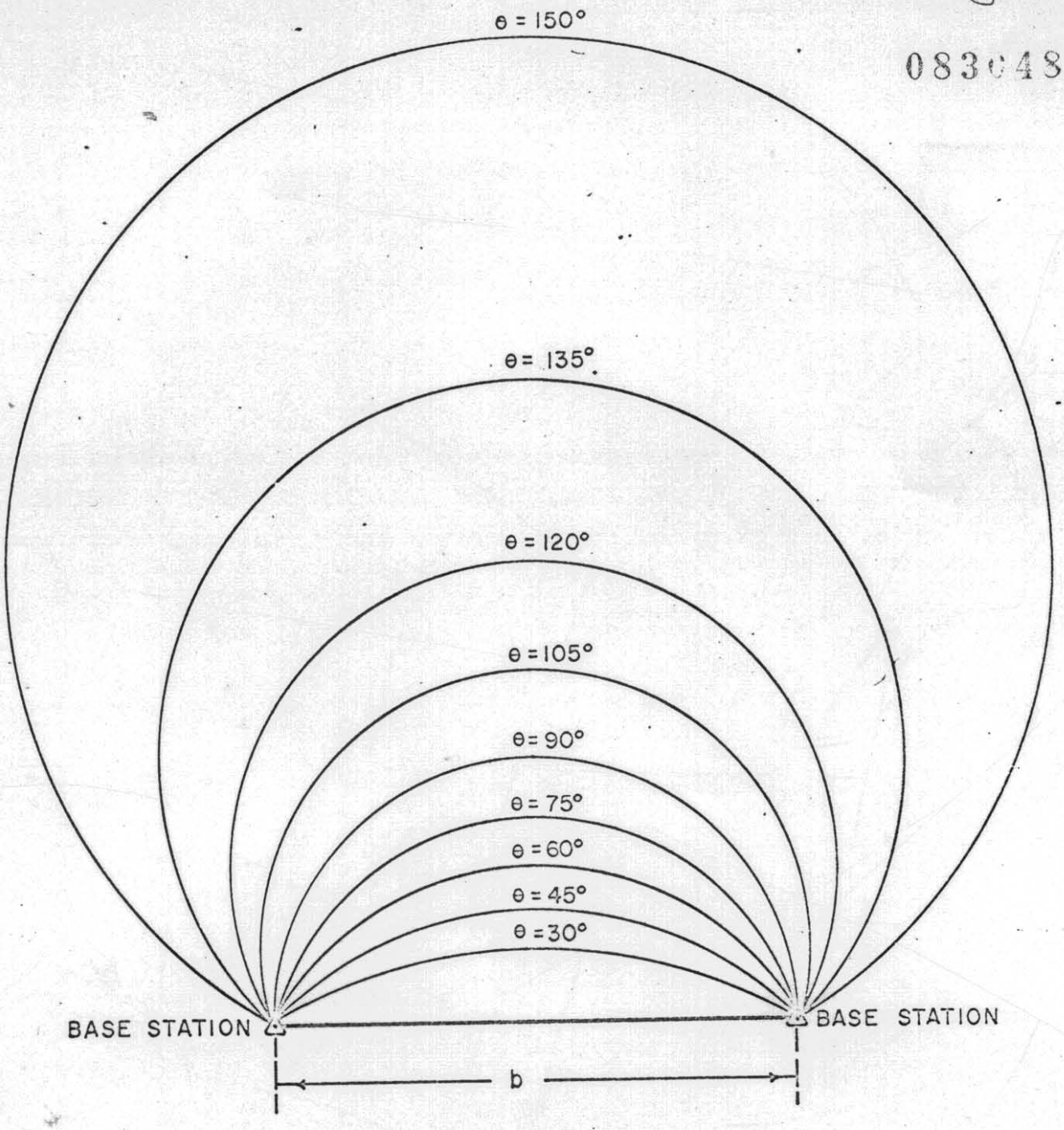


FIGURE 3

POSITION AMBIGUITY IN CIRCULAR RANGE SYSTEM

Figure 4

083048



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

$$r = \frac{b}{2 \text{ SIN. } \theta}$$

WHERE θ IS ANGLE OF INTERSECTION BETWEEN RANGE CIRCLES

5 cm

RELATIVE AREA OF COVERAGE, CIRCULAR RANGING SYSTEM

II. AREA OF OPERATIONS

The area of operations extended approximately 40 miles off the eastern coast of Tasmania from Eddystone Point on the north to Cape Lodi on the south.

The ONI base of operation was located in Devonport, Tasmania. From this office 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 which arrived at Devonport from the west coast of Tasmania on 5 February 1969. Shoran indicating equipment had been installed prior to its departure from the United States.

ONI advance personnel arrived in the area on 6 February 1969 to began installation of initial base stations. The remainder of ONI personnel arrived in the area on 8 February 1969. Installation of base stations was completed on 9 February 1969.

III. FIELD OPERATIONS RECAP (continued)

Actual seismic operations began on 7 February 1969 and continued through 10 February 1969 at which time final readings were observed.

Dismantling of the base stations began on 10 February 1969 and was completed the following day. The ONI base of operation was closed on 13 February 1969. ONI personnel remained in the area for future work under WESTERN's direction.

IV. GENERAL INFORMATION

A. Satisfactory radiotelephone communications between 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. V. C. Smith, a WESTERN representative, on 14 February 1969.

V. COMPUTING AND BASIC CONTROL

Prior to the start of field operations, Engineering Computer Services in Sydney predetermined the Shoran ranges and grid coordinates for each recording boat location to be occupied during the course of the survey.

V. COMPUTING AND BASIC CONTROL (continued)

Coordinates for the three base 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 has been added.

VI. PERSONNEL

Name	Position
Easterbrook, I.	Party Chief
Hackenbruch, D.	Mobile Operator
Owen, G.	Mobile Operator
Binderman, B.	Base Operator
Bienz, W.	Base Operator
Kingsley, B.	Base Operator
Martin, K.	Base Operator

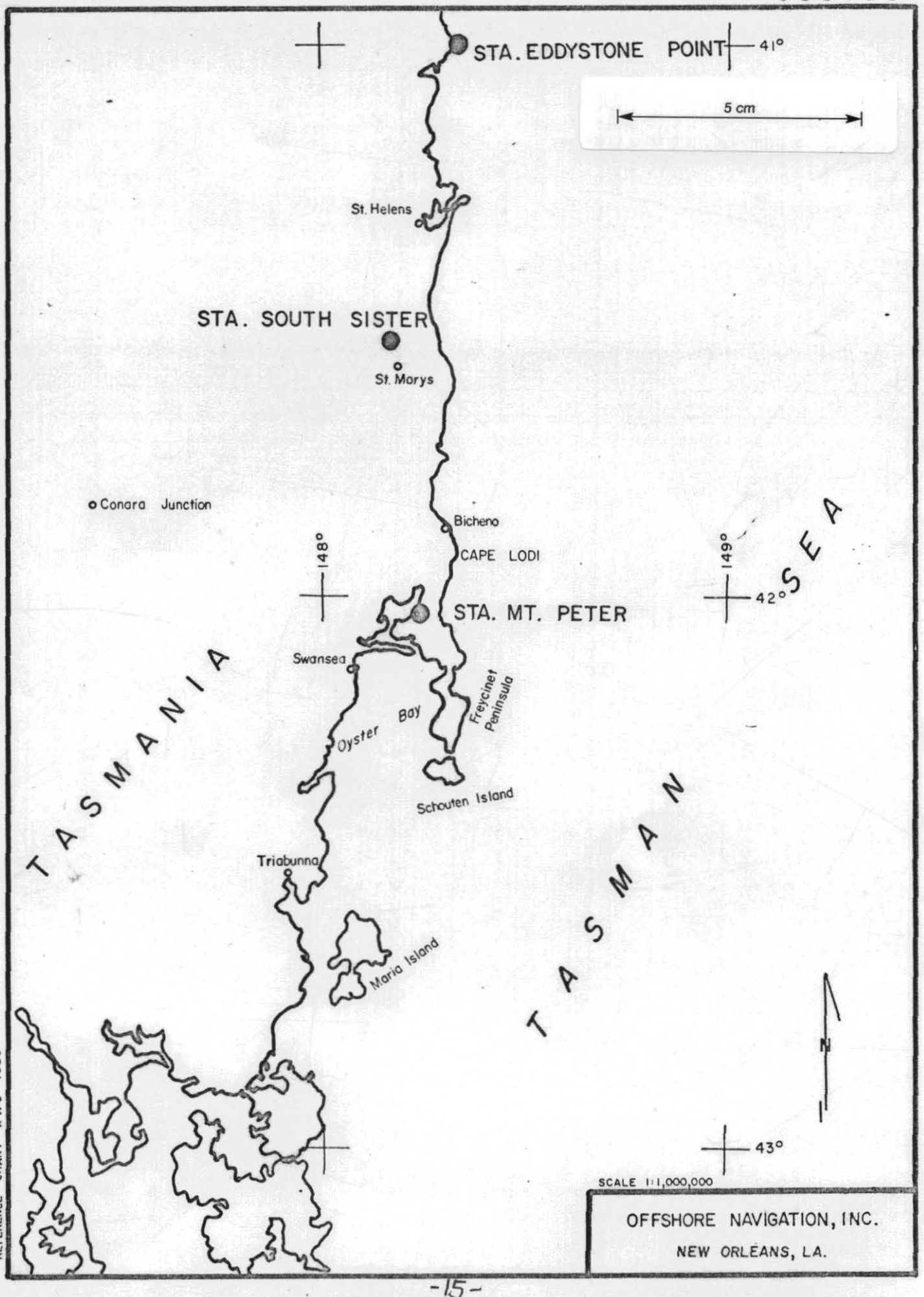
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202 Roma Arcade
413-417 New South Head Road
Double Bay (Sydney) N.S.W. 2028
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STA. EDDYSTONE POINT
41°
5 cm
St. Helens
STA. SOUTH SISTER
St. Marys
Conara Junction
Bicheno
CAPE LODI
148°
149°
42°
STA. MT. PETER
SEA
Swansea
TASMANIA
Oyster Bay
Freycinet Peninsula
Schouten Island
TASMAN
Triabunna
Maria Island
N
43°
SCALE 1:1,000,000
OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.
REFERENCE CHART W A C 1556

SHORAN BASE STATION DESCRIPTIONS AND PLATES

STATION: Eddystone Point

LOCATED: At the Eddystone Point Lighthouse.

ACCESS: Take the road east from Launceston to Derby. Go another 6 miles to the Gladstone turnoff on the left. Take this road into Gladstone to Ansons Bay Road which goes to the Lighthouse.

MARKER: As the Marine Department would not allow the tower to be erected at the Lighthouse, it was offset 350 yards at a bearing of 290° from the lighthouse. At least 30 feet of antenna must be used to clear the sandhills.

GENERAL: The Marine Department in Hobart must be notified before this site can be used.

Water is available at site. Supplies must be carried.

ELEVATION: 40 yards.

SKETCH: See next page.

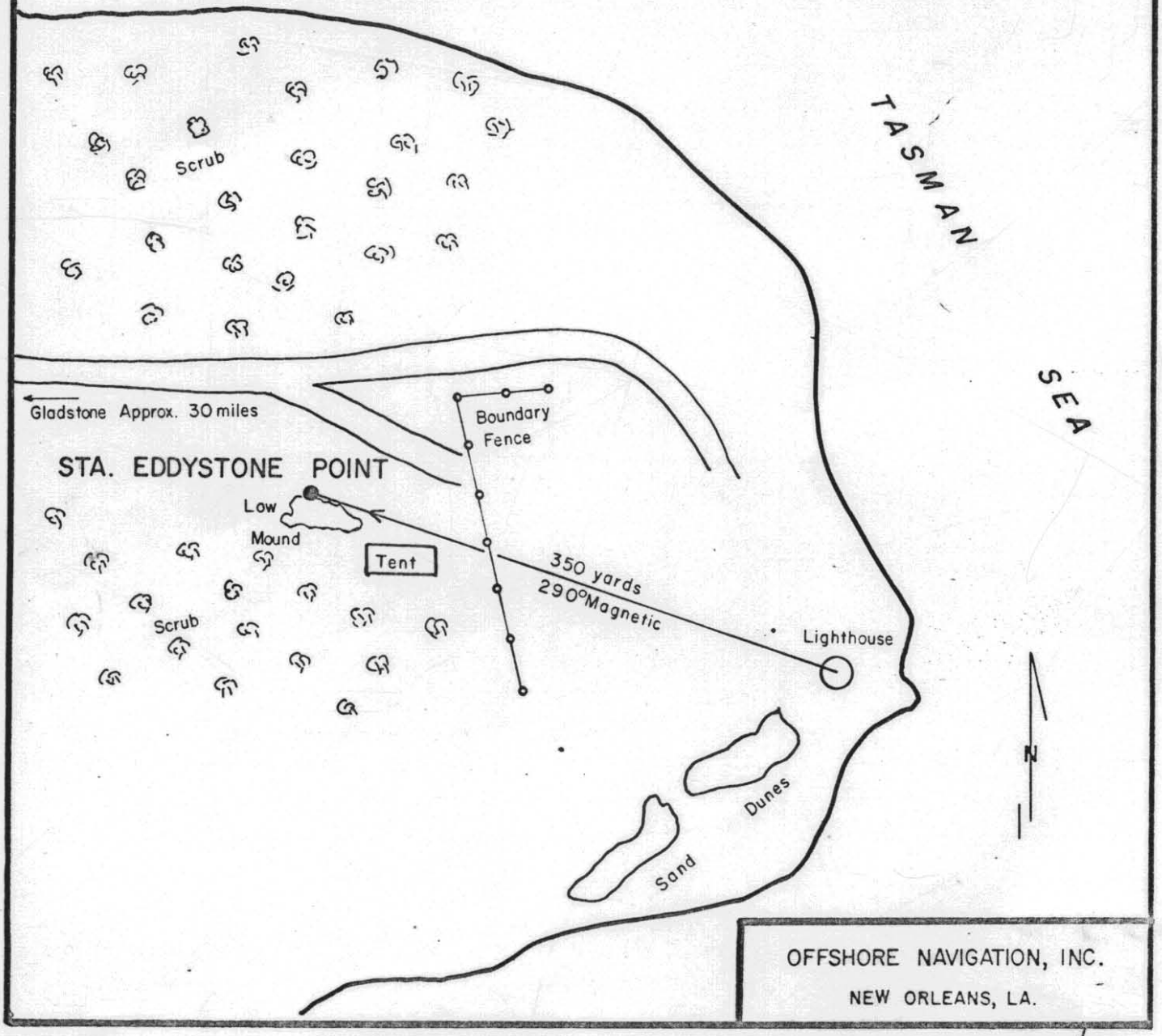
GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID BELT 7, C.M. 146° EAST	
Latitude	Longitude	North	East
40°59'39".01 S	148°20'37".71 E	948,178 yds.	615,696 yds.

STA. EDDYSTONE POINT—AUSTRALIA

LAT.	40° 59' 39".01 S	N	948,178	yards
LONG.	148° 20' 37".71 E	E	615,696	yards
ELEV.	40 yards			

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

5 cm



OFFSHORE NAVIGATION, INC.
NEW ORLEANS, LA.

STATION: South Sister

LOCATED: At the Forestry Lookout hut.

ACCESS: Take main road south from Launceston to Conara Junction. Turn left on Highway 4 to St. Marys. At St. Marys, contact the local Ranger of the Forestry Department for directions and assistance in reaching the site. He will also supply a four-wheel drive vehicle which is needed to reach the site.

MARKER: The antenna was set on the northeast corner of the Forestry Lookout hut. It is not possible to get equipment to this point. Coax was run to foot track leading to hut about 100 feet below, and a tarp was erected over equipment.

GENERAL: The local Ranger of the Forestry Department at St. Marys should be notified in advance.

The tent was erected at the vehicle turning point about 300 yards down the track from the equipment. This is a very difficult position and the more hands available to help set it, the better.

Water and supplies must be carried.

ELEVATION: 922 yards.

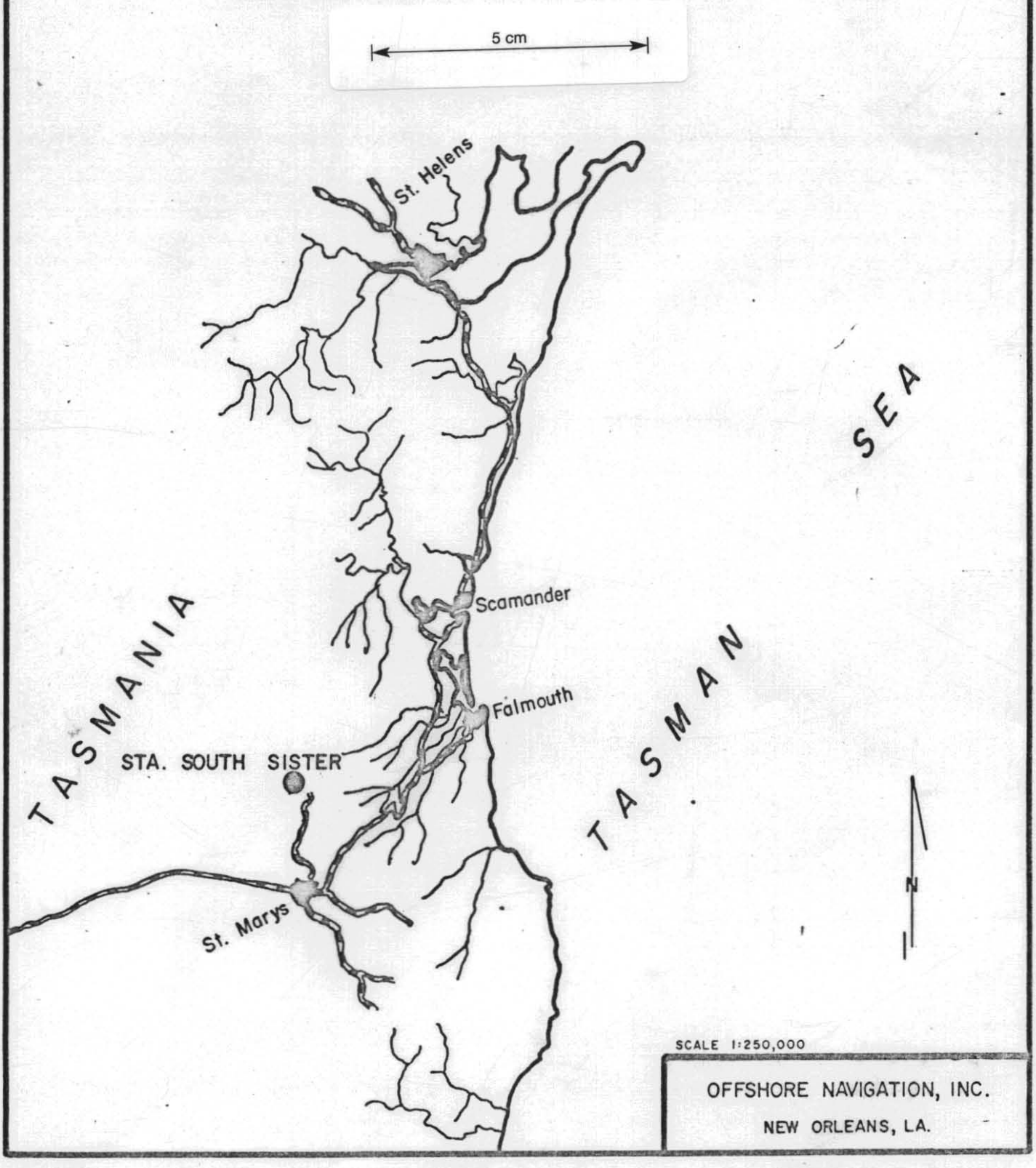
SKETCH: See next page.

GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID BELT 7, C.M. 146° EAST	
Latitude	Longitude	North	East
41°32'08".61 S	148°10'18".80 E	882,806 yds.	598,228 yds.

STA. SOUTH SISTER—AUSTRALIA

LAT.	41° 32' 08".61 S	N	882,806	yards
LONG.	148° 10' 18".80 E	E	598,228	yards
ELEV.	922 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.

STATION: Mount Peter

LOCATED: About 7 miles out of the village of Coles Bay on the second highest point of Mount Peter.

ACCESS: It is a difficult site to reach due to the steep grade of the hill. The equipment can be carried to within about 1/4 mile of the Trig. by crawler tractor. It must then be hand-carried to the Trig.

MARKER: Standard Trig. marker

GENERAL: The owner of the motel at Coles Bay has a tractor available and will assist in erecting station.

Water and supplies must be carried.

ELEVATION: 306 yards.

SKETCH: See next page.

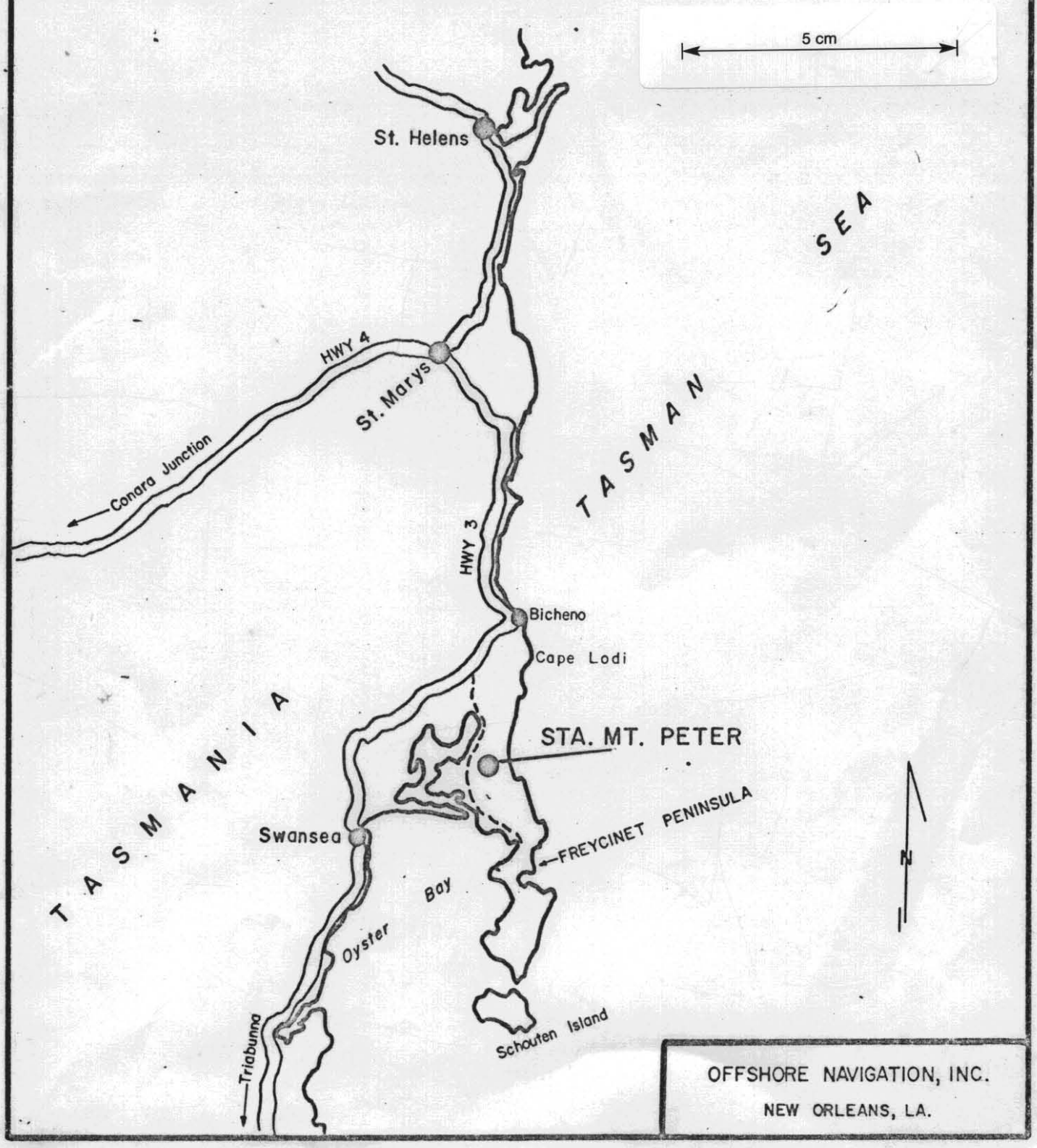
GEOGRAPHICAL COORDINATES		ATM PROJ., CLARKE 1858 SPHEROID BELT 7, C.M. 146° EAST	
Latitude	Longitude	North	East
42°01'56".53 S	148°14'48".47 E	822,300 yds.	603,488 yds.

083059

STA. MT. PETER——AUSTRALIA

LAT.	42° 01' 56"53 S	N	822,300	yards
LONG.	148° 14' 48"47 E	E	603,488	yards
ELEV.	306 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.

146°30' 147° 30' 148° 30' 149°

40°30'

41°

30'

42°

43°

43°45'

450,000y 500,000y 550,000y 600,000y 650,000y 700,000y 750,000y 800,000y 850,000y 900,000y 950,000y 1000,000y 200,000y

RINGAROOMA BAY

ANDERSON BAY

Cape Naturaliste

T/P9 Magellan

T/P6 Hematite

TAMAR RIVER

Launceston

St Helens Pt.

MACLEAN BAY

GREAT OYSTER BAY

Schouten Is.

Maria Is.

T/P7 Esso

MARION BAY

HOBART

DERWENT RIVER

FREDERICK HENRY BAY

STORM BAY

Nubeena Peninsula

North Bruny

South Bruny

PRION BAY

South East Cape

T/P11 Amoco

T/P8 Esso

T A S M A N I A

0.200 0.250 0.300 0.350 0.400 0.450 0.500 0.550 0.600 0.650 0.700 0.800 0.900 1.000 1.100 1.200 1.300 1.400 1.500 1.600 1.700 1.800 1.900 2.000 2.100 2.200 2.300 2.400 2.500 2.600

U D

MAP INDEX



LEGEND

- ·230 — Seismic shot point
- △ — Velocity scan
- U / D — Fault, 'D' downthrown side
- —0.050— — Structure contour in seconds
- — Petroleum Tenement Boundary
- Igneous intrusion, reflector not pierced

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

TASMANIA

EASTERN PORTION

STRUCTURE MAP ON ECONOMIC BASEMENT

5 cm

083c60

CONTOUR INTERVAL: 0.050 AND 0.100 SECONDS

DATUM: SEA LEVEL

Scale 1:250,000

4 0 4 8 12

MILES

AUTHOR: D I McEVOY

DRAFTED BY: M.F.WEETMAN

TO ACCOMPANY: FINAL SUBSIDY REPORT OF THE EAST TASMANIA T 69 B MARINE SEISMIC AND MAGNETIC SURVEY

DATE MAY, 1969

SHEET 2

PLATE I

T/7P part-I*

OR-072

Dwg: 1145/G/4

146°30' 147° 30' 148° 30' 149°

40°30' 41° 42° 43° 43°45'

450,000y 500,000y 550,000y 600,000y 650,000y 700,000y 750,000y 800,000y 850,000y 900,000y 950,000y 1000,000y

RINGAROOMA BAY

ANDERSON BAY

Cape Naturaliste

T/P9 Magellan

T/P6 Hematite

TAMAR RIVER

Launceston

St. Helens Pt.

MACLEAN BAY

Long Blockage

GREAT OYSTER BAY

Schouten Is.

Maria Is.

MARION BAY

HOBART

DERWENT RIVER

FREDERICK HENRY BAY

STORM BAY

Nubeena Peninsula

North Bruny

South Bruny

PRION BAY

South East Cape

T/P11 Amoco

T/P7 Esso

T/P8 Esso

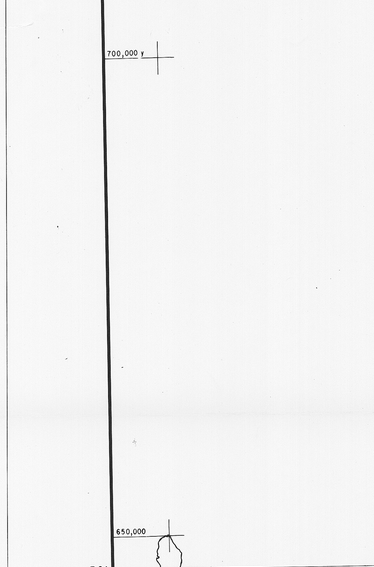
T A S M A N I A

0.200 0.250 0.300 0.350 0.400 0.450 0.500 0.550 0.600 0.650 0.700 0.750 0.800 0.850 0.900 0.950 1.000 1.050 1.100 1.150 1.200 1.250 1.300 1.350 1.400 1.450 1.500

U D

B-1 B-2 B-3

MAP INDEX



LEGEND

- ∘230 — Seismic shot point
- △ — Velocity scan
- U / D — Fault, 'D' downthrown side
- —0.050— — Structure contour in seconds
- —·— — Petroleum Tenement Boundary
- Igneous intrusion, reflector not pierced

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

TASMANIA

EASTERN PORTION

ISOCHRON MAP OF TOTAL SEDIMENTARY THICKNESS (SEA FLOOR – BASEMENT)

5 cm

083061

CONTOUR INTERVAL: 0.050 AND 0.100 SECONDS DATUM: SEA LEVEL

Scale 1:250,000

4 0 4 8 12

MILES

AUTHOR: D I McEVOY DRAFTED BY: M.F. WEETMAN

TO ACCOMPANY: FINAL SUBSIDY REPORT OF THE EAST TASMANIA T 69 B MARINE SEISMIC AND MAGNETIC SURVEY DATE MAY, 1969

SHEET 2 PLATE II

T/7P part-1*

OR-072

Dwg: 1145/6/5

146° 30' 147° 30' 148° 30' 149°

40° 30'

41°

42°

43°

43° 45'

450,000y 500,000y 550,000y 600,000y 650,000y 700,000y 750,000y 800,000y 850,000y 900,000y 950,000y 1000,000y 200,000y

RINGAROOMA BAY

ANDERSON BAY

Cape Naturaliste

T/P9 Magellan

T/P6 Hematite

TAMAR RIVER

Launceston

St.Helens Pt.

MACLEAN BAY

GREAT OYSTER BAY

Schouten Is.

Maria Is.

T/P7 Esso

MARION BAY

HOBART

DERWENT RIVER

FREDERICK HENRY BAY

STORM BAY

Nubeena Peninsula

North Bruny

South Bruny

PRION BAY

T/P11 Amoco

South East Cape

T/P8 Esso

TASMANIA

100 200 300 400 500 1000 2000 3000 4000

MAP INDEX



LEGEND

- ∘230 — Seismic shot point
- △ — Velocity scan
- U / D — Fault, 'D' downthrown side
- —0.060— — Structure contour in seconds
- — Petroleum Tenement Boundary
- Igneous intrusion, reflector not pierced

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

TASMANIA

EASTERN PORTION

WATER DEPTH MAP

5 cm

083062

CONTOUR INTERVAL: 100 FEET AND 1000 FEET

DATUM: SEA LEVEL

Scale 1: 250,000

4 0 4 8 12

MILES

AUTHOR: D I McEVOY

DRAFTED BY: M.F. WEETMAN

TO ACCOMPANY: FINAL SUBSIDY REPORT OF THE EAST TASMANIA T 69 B MARINE SEISMIC AND MAGNETIC SURVEY

DATE MAY, 1969

SHEET 2

PLATE III

T/7P part-1*

OR-072

Dwg: 1145/6/6

146° 30' 147° 30' 148° 30' 149°

40° 30'

41°

42°

43°

43° 45'

450,000 E 500,000 E 550,000 E 600,000 E 650,000 E 700,000 E

1000,000 y 950,000 y 900,000 y 850,000 y 800,000 y 750,000 y 700,000 y 650,000 y

T A S M A N I A

RINGAROOMA BAY

ANDERSON BAY

Cape Naturaliste

T/P9 Magellan

T/P6 Hematite

TAMAR RIVER

Launceston

St. Helens Pt.

MACLEAN BAY

GREAT OYSTER BAY

Schouten Is.

Maria Is.

T/P7 Esso

MARION BAY

HOBART

DERWENT RIVER

FREDERICK HENRY BAY

STORM BAY

Nubeena Peninsula

North Bruny

South Bruny

PRION BAY

T/P11 Amoco

South East Cape

T/P8 Esso

MAP INDEX



LEGEND

•230 Seismic shot point

ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

TASMANIA

EASTERN PORTION

SHOT POINT MAP

083063

5 cm

Scale 1: 250,000

4 0 4 8 12

MILES

AUTHOR: D I McEVOY DRAFTED BY:

TO ACCOMPANY: FINAL SUBSIDY REPORT OF THE EAST TASMANIA T69B MARINE SEISMIC AND MAGNETIC SURVEY DATE MAY, 1969

SHEET 2 PLATE IV

T/7P part-1*

OR-012

Dwg: 1145/G/7