

091001

Report EP-44811

MARINE GEOPHYSICAL SURVEY OFFSHORE AUSTRALIA
CONDUCTED WITH m.v. PETREL
FROM 19 Dec. 1972 TO 18 APRIL 1973

prepared for:

Shell Development(Australia) pty Ltd.

EP/12

June 1973

Shell Internationale Petroleum Maatschappij B.V. - The Hague
Exploration and Production

OR-087



091002

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KEY WORDS

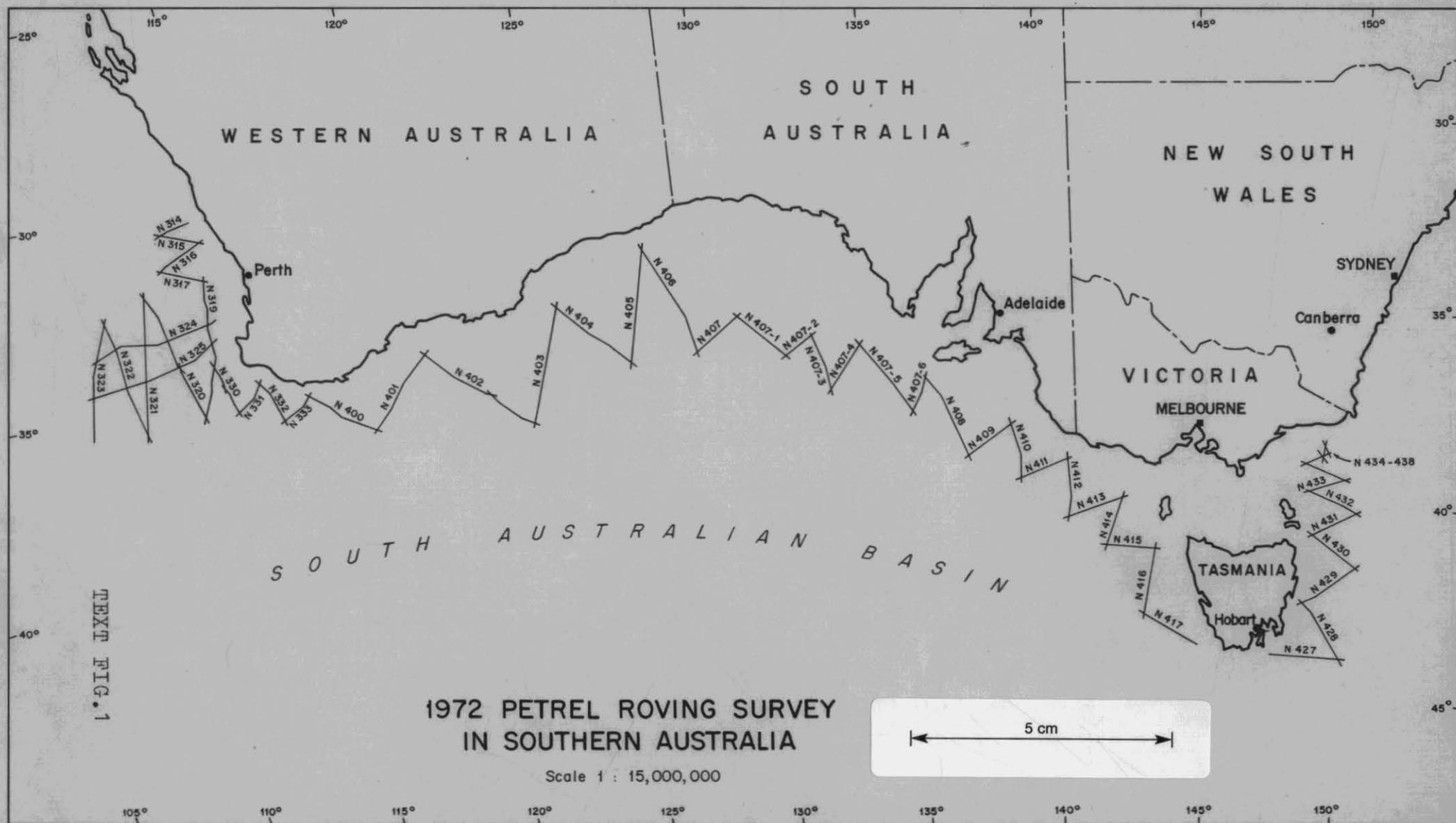
Geophysical Survey; Government; Australia; "PETREL";
Equipment; S.S.(M)L.

Text Figures

- I Key map
- II Plan drawing m.v. PETREL
- III Cable diagram

Appendices

- D-1 Data and Equipment on m.v. "PETREL"
- D-2 Data on surveyed lines and lengths in km
- D-3 Data on DFS III 24 channel format
- D-4 Data on DFS III amplitude response
- D-5 Data on DFS III field tests
- D-6 Data on airgun array



MARINE GEOPHYSICAL SURVEY OFFSHORE AUSTRALIAConducted with m.v. PetrelFrom 19 Dec. 1972 to 18 April 1973I. GENERAL INFORMATIONA. Report Coverage and Duration of Operation

This report covers lines N314-1 through N325, N330 through N333, N400 through N417 and N427 through N438 shot during the period of 19 Dec. 1972 to 18 April 1973. A total of 10904 km of line were observed.

B. Location of Survey

The survey was located offshore West- and South Australia and Tasmania between Geraldton and Cape Howe, as shown on Text figure I.

C. Base of Operations

The survey was directed and supervised from SIPM Central Offices in The Hague. The m.v. Petrel, with which the survey was conducted, was equipped by SIPM in cooperation with Koninklijke Shell Exploratie en Productie Laboratorium Rijswijk for worldwide roving geophysical work and was originally operated by SIPM. Since 1971 the vessel has been operated by Seismograph Service (Marine) Ltd., London, under a long range contract with SIPM.

D. Purpose of Survey

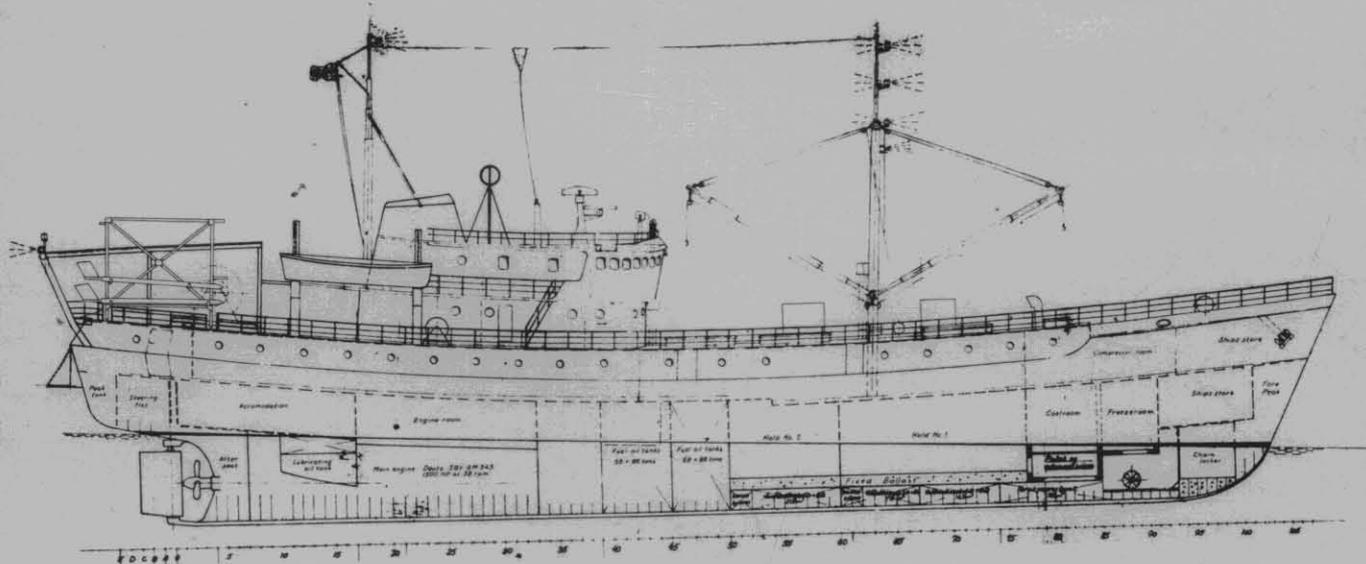
The objective of the survey was to ^arequire basic data for a regional geological evaluation of the area.

E. Operational Problems

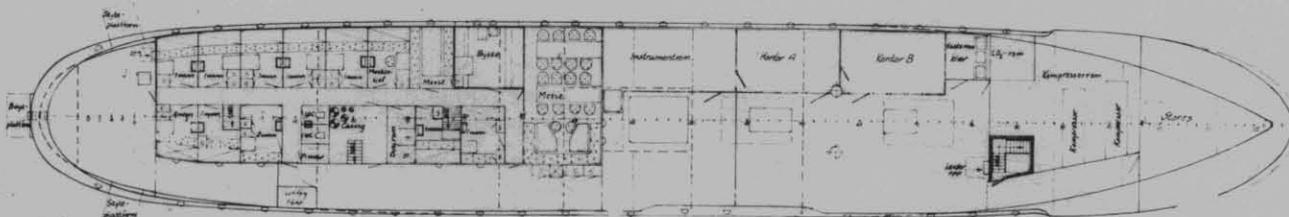
28 December m.v. Petrel entered the port of Geraldton and had to wait for the necessary work-permit from the Australian Government till 18 January. This resulted in very high standby costs in Geraldton and in a serious delay in arrival time for the Tasmania programme by which time the weather was deteriorating rapidly and down-time building up tremendously. In order still to survey some lines near Tasmania the programme was changed. Because of the weather a large part of the programme had to be postponed for an indefinite period and the boat left for the next assignment before completion.

F. On Board Supervision

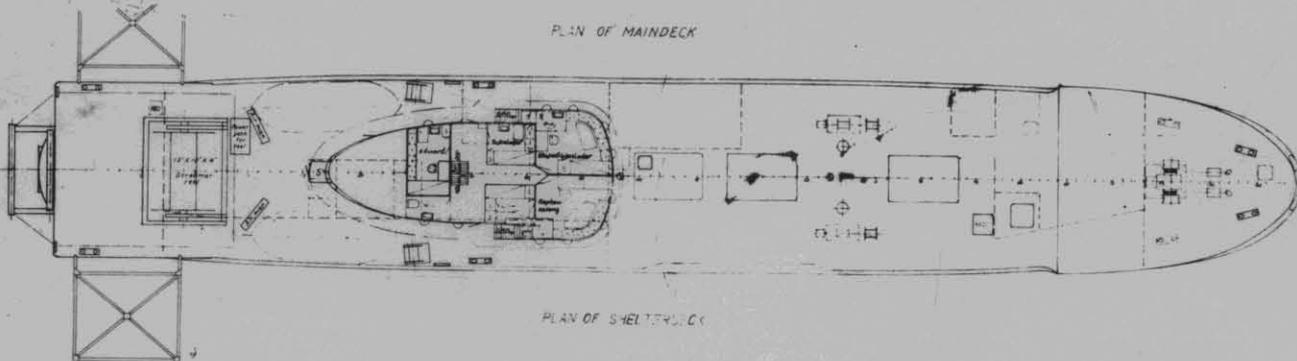
Geophysicists from SIPM the Hague and from Shell Development (Australia) Ltd. Melbourne took turns as on board Shell representatives to witness the operations of the contractor, S.S.(M.)L.



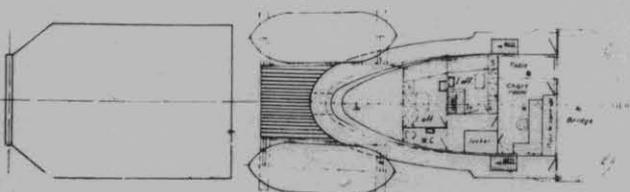
PLAN UNDER MAINDECK



PLAN OF MAINDECK



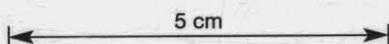
PLAN OF SHELTERDECK



PLAN OF BRIDGEDECK

PRINCIPAL DIMENSIONS

L.O.A	58.2 m	194' 0"
L.P.P	53.5	175' 0"
B. moulded	9.15	30' 0"
D	4.88	16' 0"



TEXT FIG.2

LAY OUT M.V. PETREL

II. OPERATIONS

A. Survey vessel PETREL

The m.v. PETREL, a Norwegian trawler, was rebuilt for single boat geophysical operations worldwide by SIPM in cooperation with Koninklijke Shell Exploratie en Productie Laboratorium, Rijswijk, The Netherlands.

The PETREL is 58.2 metres in length, has a beam of 9.15 metres, a draught of approximately 4.88 metres and a gross tonnage of 867.72 tons. Her variable pitch propeller is powered by a 1500 HP Deutz marine diesel and three generators of approximately 160 KW each supply the necessary electrical power. Her bow propeller is driven by a Schottel 160 BHP unit.

In addition to all the normal marine and life-saving apparatus, the vessel is equipped with radar, fathometers, radio telephony, gyro compass and a satellite navigation system integrated with a Doppler Sonar navigation system.

Accommodation is provided for a nautical and geophysical crew of 32 men. A plan drawing is shown in Text Fig. II. Appendix D-1 lists vessel data and equipment.

B. Positioning

1. System

The satellite navigation system was used for primary positioning with dead reckoning time-cycle control between satellite fixes. Generally the water was too deep to allow Doppler Sonar ground speed control.

The satellite navigation system consists of a receiver and a digital computer. The system uses the information transmitted by a passing satellite to calculate the position of the vessel with an accuracy of approximately 150 metres. Normally a satellite pass is available about every two hours, allowing night and day operation without loss of positioning accuracy.

2. Equipment

The positioning equipment used on board the vessel was as follows:

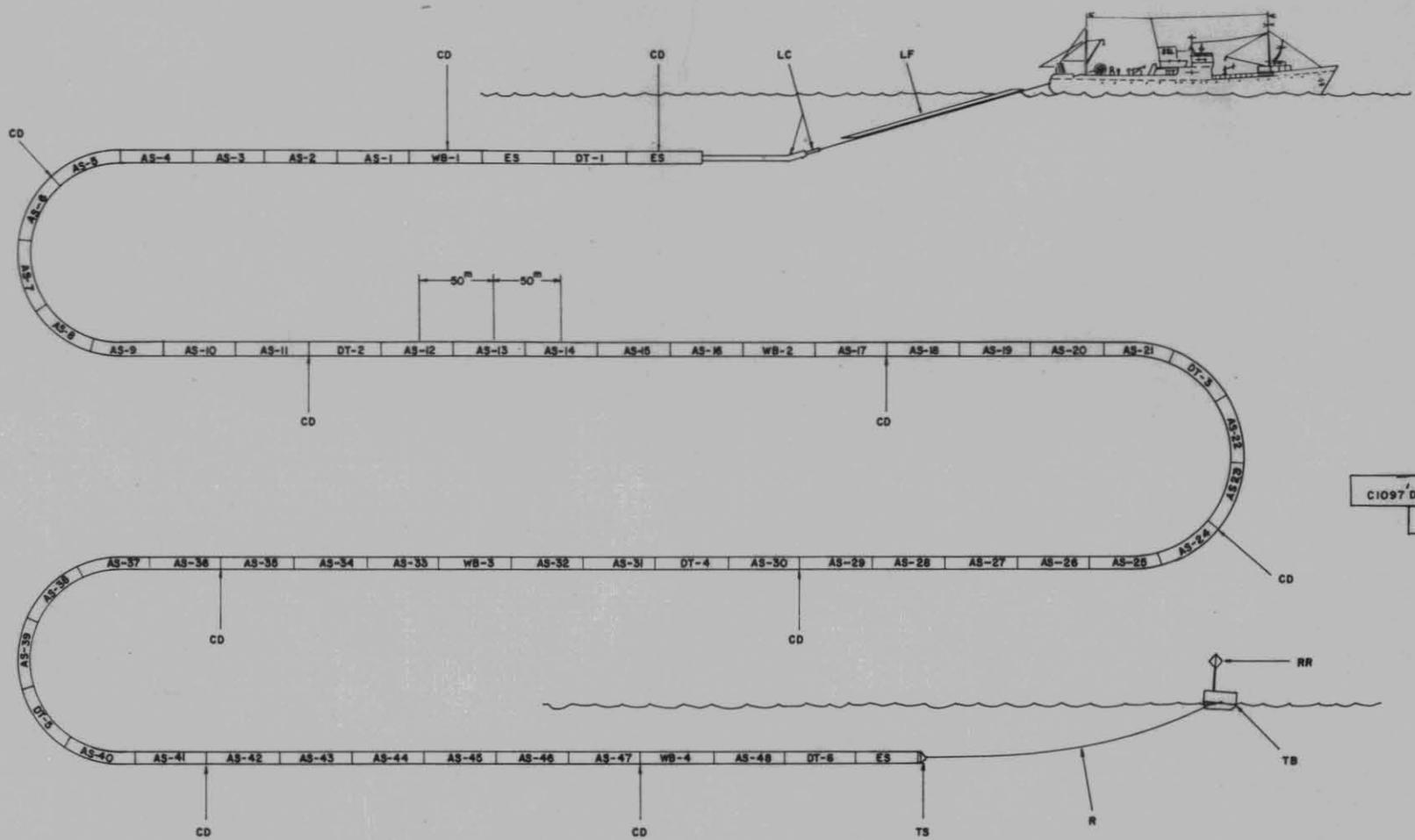
- A. I.T.T. Satellite navigation receiver system model 5001
- B. PDP8-1 Computer
- C. Marquardt Doppler Sonar system model 2015A.

3. Maps

The final line location maps were plotted on board the ship and sent to SIPM Central Offices in The Hague, together with all data concerned.

5 cm

CABLE DIAGRAM "M.V. Petrel"



C1097 DMZ

LEGEND	
LF	LEAD IN CABLE FAIRING
LC	LEAD IN CABLE
CD	CABLE DEPTH CONTROLLER
ES	ELASTIC ISOLATOR SECTION
WB	WATER BREAK TRANSDUCER
AS	ACTIVE SECTION
DT	DEPTH TRANSDUCER
YS	TAIL SWIVEL
TB	TAIL BUOY
R	POLYPROPYLENE ROPE (0-375)
RR	RADAR REFLECTOR

NOTE... FOR 2400 METERS 48 CHANNEL CONFIGURATION SECTIONS AS-1 TO AS-48 USED
 - - - - - 24 - - - - - AS-1, AS-3, AS-5 - - - - - AS-47 -
 - 1600 - 32 - - - - - AS-1 TO AS-32 - -
 - 1200 - 24 - - - - - AS-1 TO AS-24 -

DRAWN FROM BR '071'38 BR '3041 SEISMIC ENG. CO., DALLAS

DRAWN		SEISMOGRAPH SERVICE LIMITED	
DATE		LONDON	ENGLAND
CHECKED		FOR CONTRACT No.	
APPROVED		DRAWING No.	
DATE		C1097 DMZ	
DESCRIPTION		SEISMIC ENGINEERING CO.	

TEXT FIG. III
G. 61302

091009

C. Geophysical Equipment

1. Energy source

A system consisting of two airgun racks carrying a total of 17 tuned airguns of different sizes with a total capacity of 1090 cubic inches was used. During the operation the racks with guns on both sides of the vessel were towed at a depth of 10 metres. The guns were fired simultaneously at a pre-determined time from a programming console, with a cycle time regularly adjusted to the speed of the vessel with respect to the ground.

See Text Figure II for positions of airgun racks and Appendix D-6 for airgun array.

For this survey the air pressure used was 136 atmospheres. Every 50 metres i.e. approximately every 15 seconds, the guns were fired and a recording was taken.

2. Detector cable

A 2,400 metre neutrally buoyant oil-filled cable, manufactured by Seismic Engineering Company with "Multidyne" type acceleration canceling hydrophones, was used during the survey. The cable consisted of 24 groups of 50-metre active sections, each containing 30 hydrophones spread over 45 metres and each group separated by 50-metre dead sections to provide an effective 100-metre detector interval.

The cable was trimmed and balanced to tow at a depth of 15 metres at a ship's speed of 6 knots.

The cable-depth controllers were distributed over the length of the cable and set to maintain this depth.

Six depth transducers were equally spaced along the cable to allow monitoring of the streamer depth at all times during operations. A water-break detector, located at the head of Group I and recording direct arrivals through the water from the energy source, was used to check on cable-to-gun distance.

The distance from the centre of the gun array to the centre of detector Group I was 388 metres and the distance from the centre of the gun array to the satellite receiver antenna was 16 metres.

See Text Figure III for cable diagram.

3. Recording

The recording equipment consisted of:

- a. 24-channel Texas Instruments seismic Digital Field System III with Binary Gain recording amplifiers and 8 auxiliary channels.

- 4 -

- b. Two T.I. digital tape transports with $\frac{1}{2}$ " tape and 9-track SEG "A" EPR format.
- c. Variable area cross-section camera (SSL VAX A MkII)
- d. 64-trace squiggle electrostatic monitor camera (Shell Dev. Co.)
- e. VARIAN Proton Magnetometer
- f. Bell Aerosystems Gravimeter
- g. 4-channel Shell QLR-140 analogue seismic amplifier system.

The DFS III recording amplifiers used an 8 Hz low-cut filter with a slope of 18 dB/octave and a 62 Hz high-cut filter with a slope of 72 dB/octave.

The digital tape recorders were able to operate in both record and playback modes. Sampling time was 4 milliseconds.

Water bottom travel time between shot, sea bottom and Group I detector is counted and displayed on the programmer. As water depth increased and water bottom travel time exceeded 1 second, accurate time delays (multiples of 1-second intervals) were introduced by the observer via the programmer between shot and start of data record time in order to conserve digital tape.

In conjunction with the 24-channel data acquisition, a ship-board section was made with the VAX camera, utilising data from detector Groups I and II routed through QLR analogue amplifiers with filters set at low cut 10 Hz and high cut 65 Hz with slopes of 12 dB/octave. The time delay used in the digital system was also applied in this system to the VAX cam start.

A Simrad Scientific Echosounder was used to record water depths, its maximum range being 2,000 metres.

During the whole survey a VARIAN Proton magnetometer was towed. This instrument measured once every minute the absolute intensity of the earth's magnetic field. Values could be observed directly on a digital counter and were recorded on a strip-chart pen recorder as well as on the magnetometer system digital tape. The sensitivity was $\pm \frac{1}{2}$ gamma.

Readings of gravity were also recorded during the whole survey. The gravimeter, mounted on a stabilised platform, provided gravity information at 1-second intervals. This information was transferred to a PEC digital tape recorder together with other supporting data. The system, which included a PDP8 computer, was able to filter the gravity data and dump out the Eötvös corrected results on a teletype recorder at 1-minute intervals.

Seismic gravity and magnetic information was thus readily available for shipboard correlation, together with water-depth readings.

D. Shipboard quality control

Quality control on board ship is the responsibility of the Party Chief. Tests were carried out regularly to verify the performance of the airguns and the recording systems. Daily tests were performed to check instrument levels, streamer cable noise levels and the synchronising of the airguns.

For data on DFS III and instrument field tests, see Appendices D-3, D-4 and D-5.

E. Field Data

Record quality was fair to good and no problems occurred with noisy, weak or dead streamer cable traces. Streamer cable noise was low and of the order of 1 microbar r.m.s. equivalent. In the Tasmania part of the survey, with weather conditions deteriorating, cable noise reached 3 microbar but was still acceptable.

All recorded data were shipped to SIPM Central Office in The Hague.

Appendix D-2 lists basic data for each line.

VESSEL

M.V. PETREL

Owner : E.J. Pettersen, Tromsø, Norway
 Registration : Tromsø, Norway LNZQ
 Classification : Norske Veritas (1A1) Worldwide Trade
 Length : Overall - 194 feet (58.2 metres)
 : Between perpendiculars - 175 feet (53.3 metres)
 Beam : 30 feet (9.15 metres)
 Draught : 16 feet (4.88 metres)
 Gross tonnage : 867.72 tons
 Nett tonnage : 354.26 tons
 Fuel capacity : 160 tons
 Freshwater capacity : 104 tons
 Speed : 13 knots

Machinery:

Main engine

: 1500 HP Deutz SBV/8M/545 380 rpm
 bridge controlled, driving single
 variable pitch propellor.
 Hydraulic take off for Schottel
 Bow Thruster of 160 HP bridge
 controlled.

Auxiliaries

: One 352 HP Deutz SBF/8M/716 diesel
 driving one 250 KVA AVK 3 phase 50 Hz
 220 volt generator.
 One 332 HP Deutz BF/8M/716 diesel
 driving one 190 KVA Stanford MX23S
 3 phase 50 Hz 220 volt generator.
 One 315 HP Deutz 6M/716 diesel
 driving one 175 KVA Stanford C45
 3 phase 50 Hz 220 volt generator.
 One electrical starting compressor.
 Five power take offs at front main
 engine for hydraulic pumps.
 One evaporator Allas AGU-1. 2½ tons/
 24 hours.
 One airconditioning unit 28 HP
 78,000 Kcal/hour.
 One Schottel Bow Propulsion unit
 160 BHP

Navigation Equipment

ITT Satellite Navigation system. Model 5001
 Marquardt Sonar Doppler system 2015A
 PDP-8-1 (12K) Computer interfaced to Sat.Nav.
 1 RM316 Decca Radar (48 miles)
 1 2C Kelvin Hughes Radar (50 miles)
 1 SR2 Simrad Asdic
 1 EK38B Simrad Scientific Echo Sounder (5100 metres)
 1 ES2C Simrad Echo Sounder (300 fathoms)
 1 LC-1 Furuno LORAN Receiver
 1 DM2 Koden Direction Finder
 1 SAL Water speed Electric Log
 1 Standard III Anschutz Gyro Compass and Autopilot
 1 TA3 Simrad 100 watt R.T. with RA2 Simrad Receiver
 1 Van der Heern VHF Transceiver
 1 JAX AR21 Facsimile Weather Recorder

Hold Space

General store hold space approximately 500 cu.metres
 Smoke detector by Norske Sprinkler Company, Oslo.

Winches and Windlass

Mast with two booms and two 4 ton hydraulic winches,
 hydraulic windlass.

Safety Equipment

Life saving and fire fighting equipment to Rules
 and Regulations Norske Skipskontrollen.

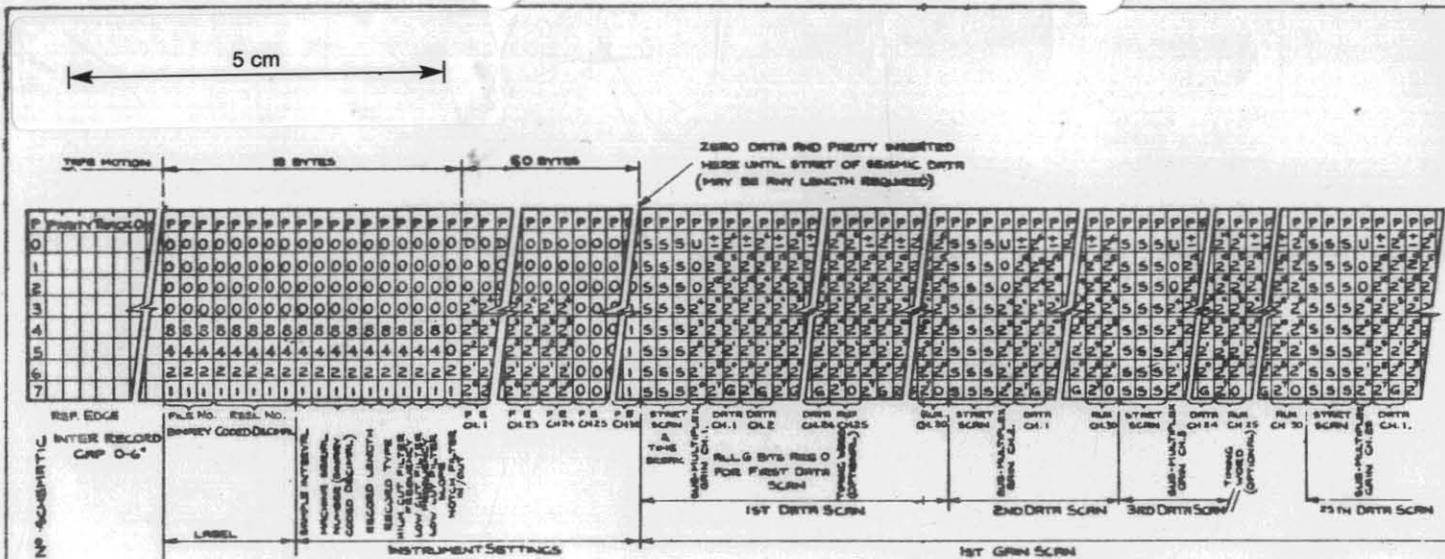
Accommodation

32 berths in 20 single and 6 double cabins plus
 hospital, fully airconditioned.

DATA ON SURVEYED LINES AND LENGTH IN KM

<u>Line</u>	<u>SP.</u>	<u>Km</u>
N314-1	10-1370	67
N315	10-2200	117
N316	10-1952	101
N317	10-2180	112
N319	10-5658	280
N319-I	10-3000	156
N320	10-5413	267
N320-I	10-3285	149
N321	10-9035	461
N322	10-7555	383
N323	10-7570	385
N324	10-2130	109
N324-1	10-4975	274
N325	10-8535	437
N330	10-1500	74
N330-1	10-1850	79
N331	10-1400	74
N331-1	10- 862	39
N332	10-2720	132
N333	10-1975	100
N400	10-5125	251
N401	10-6505	318
N402	10-5000	247
N402-1	10-3450	169
N403	10-5144	253
N403-1	10-2755	121
N404	10-4220	211
N404-1	10-1590	81
N405	10-4465	228
N405-1	10-2920	142
N406	10-7410	377
N407	10-3270	175
N407-1	10-4656	225
N407-2	10-2630	137
N407-3	10-3710	183
N407-4	10-6760	193
N407-5	10-4720	244
N407-6	10-2740	134
N408	10-4530	226
N409	10-3580	178
N410	10-3460	168
N411	10-3500	179
N412	10-3520	180
N413	10-3740	192
N414	10-3020	155
N415	10-2970	152
N416	10-3620	175
N417	10-3470	178
N427	10-4090	206
N428	10-3742	187
N428-1	10- 910	34
N429	10-3810	205
N430	10-3800	194
N431	10-3250	165
N432	10-3720	188
N433	10-2790	137
N434	10-3050	151
N435	10-1300	65
N436	10- 710	37
N437	10- 930	47
N438	10- 420	20

TOTAL 10904 Km



CLIENT SHELL INTERNATIONAL PETROLEUM
 MAATSCHAPPIJ NV
 PARTY 576

LEGEND

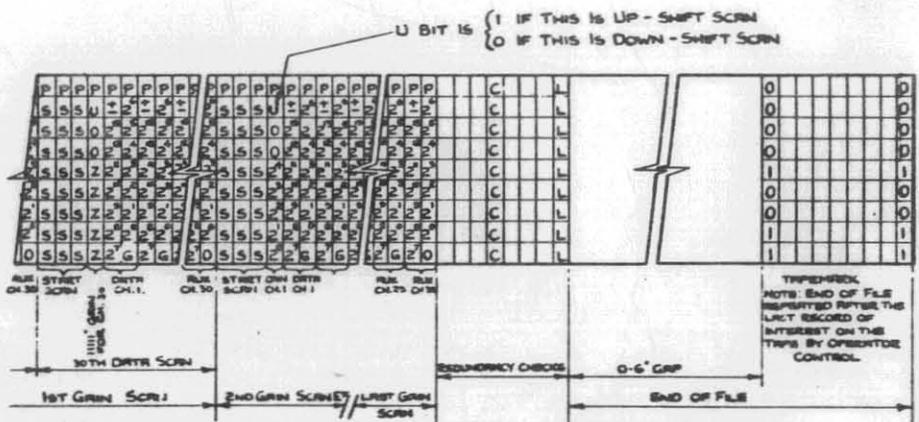
C	CYCLIC REDUNDANCY CHECK SEE ISM TECH REPORT TR 00118 JUNE 1968
D	DATA CHANNEL INDICATOR 1 FOR ALL SEISMIC DATA CHANNELS
E	EARLY GAIN - INITIAL WEIGHTING SSC SETTING SEISMIC DATA CHANNELS
F	FIXED GAIN - BINARY EXPONENT OF ALL GAIN NOT INCLUDED IN VARIABLE SSC PORTION OF AMPLIFIER
G	GAIN CHANGE INDICATION. 1 ONLY IF THE GAIN FOR THIS CHANNEL CHANGED SINCE ITS PRECEDING SAMPLE
L	LONGITUDINAL REDUNDANCY CHECK SAME AS REP C ABOVE
P	PARTY BIT ODD 1 IF EVEN NUMBER OF DATA BITS IN THE BYTE
S	START OF SCAN CODE - ALWAYS IS
U	UPWARD GAIN CHANGE INDICATOR 1 IF UPWARD GAIN SHIFTS PERMITTED 0 IF DOWNWARD
Z	END OF GAIN SCAN - ALWAYS IS
2 ⁿ	DATA BITS
2 ⁿ	2 ⁿ REPRESENTS 0.25 MV
+	SIGN BIT
-	0'S PLUS 1'S MINUS

FILTER CODES

HIGH CUT FREQUENCY	LOW CUT FREQUENCY	LOW CUT SLOPE
1 = 240 CPS	1 = 37 CPS	1 = 0UT
2 = 125 CPS	2 = 18 CPS	2 = 18 DB/OCTAVE
4 = 62 CPS	4 = 12 CPS	4 = 36 DB/OCTAVE
8 = 31 CPS	8 = 6 CPS	8 = 54 DB/OCTAVE
		8 = SPARE (0 RECORDED)

AUXILIARY CHANNEL DESIGNATIONS

CH	FUNCTION
25	TIMING WORD
26	NOT USED
27	NOT USED
28	U.M.
29	T.S.
30	NOT USED



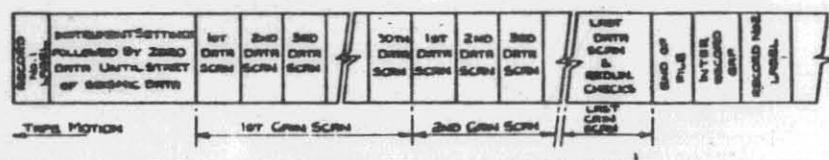
- RECORD TYPE**
- 1 = DATA RECORD
 - 2 = TEST RECORD
 - 4 = SPWRE (0 RECORDED)
 - 8 = SPWRE (0 RECORDED)

RECORD LENGTH
 RECORDED IF AUTOMATIC RECORD LENGTH OF 1 TO 15 SECONDS
 IS SELECTED BY OPERATOR. ALL 0'S RECORDED IF MANUAL
 STOP IS SELECTED.

- NOTCH FILTER**
- 1 = NOTCH FILTER IN
 - 2 = NOTCH FILTER OUT

THE ACTUAL ORDER ON THE TAPE IS FROM
 TOP TO BOTTOM 4,6,0,1,2,3,7,5 (OXIDE UP)
 SEE ISM 2400 MAGNETIC TAPE UNITS MANUAL
 ORIGINAL EQUIPMENT MANUFACTURER'S INFORMATION
 FILE NO. 5.360-19 FORM R22-6862-2

NOTE 3. THE 'U' BIT IS WRITTEN EVERY
 15TH DATA SCAN REGARDLESS OF
 EDGE RATE, WHICH IS CONTROLLED
 BY INHIBITING WRITING OF 'C' BITS

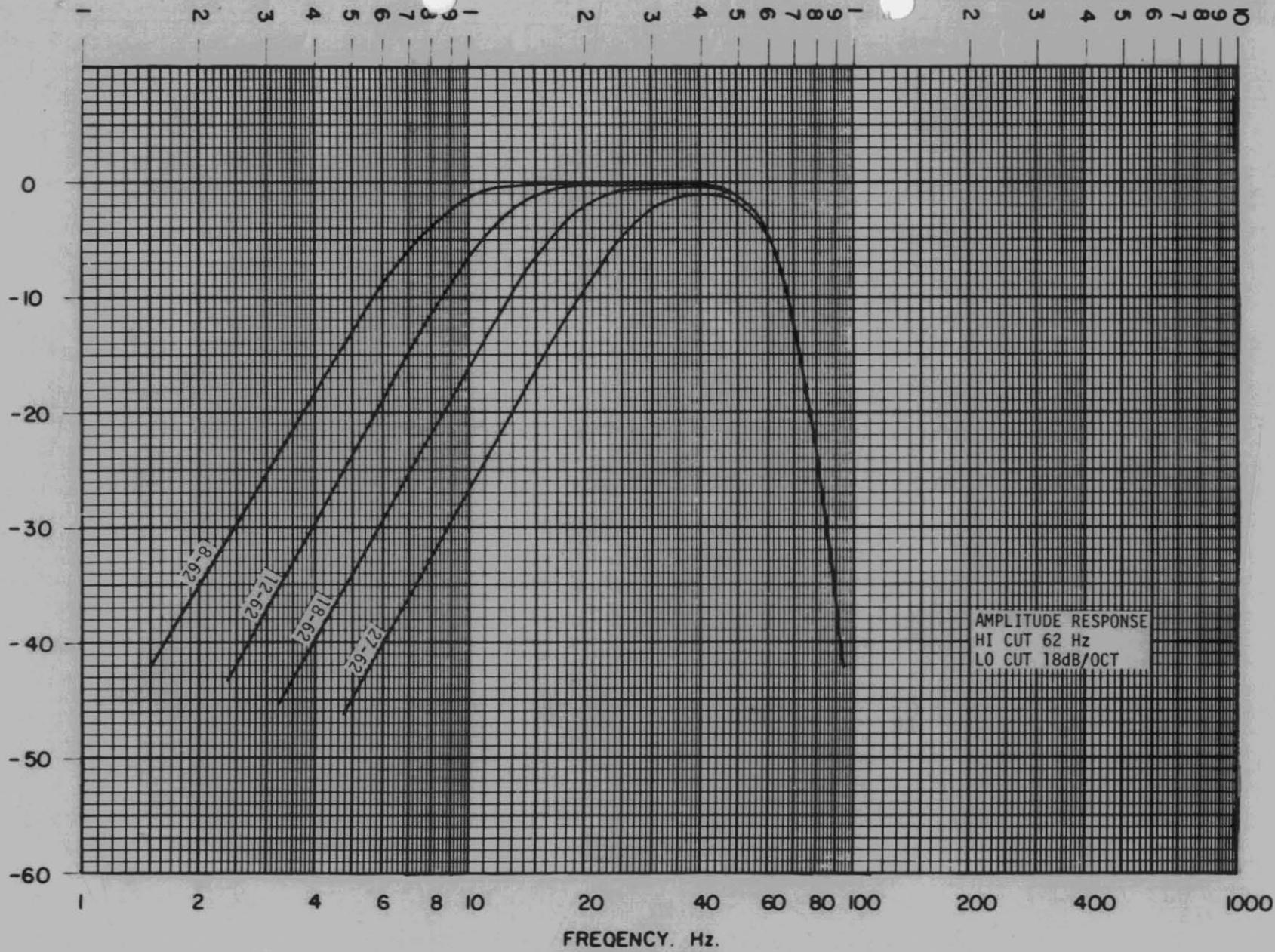


C	20-10-71	ALX. CH. INFORM. LAYOUT REVISED
B		
A		

DISTRIBUTION

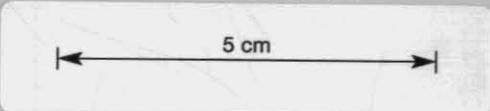
DIVISION	7 COPIES
PARTY	2
INST. SUPP.	1
FILED	1

Seismograph Services Limited
 LONDON ENGLAND
 DATE 1.7.69
 WAVE DFS III 24 CHANNEL
 SCALE
 FORMAT
 CHECKED APPROVED
 DRAWN DC 34/18M



AMPLITUDE RESPONSE, 18 dB / Oct., 62 Hz.

DFS III



091017

INSTRUMENT TESTS
TO BE MADE
BY LAND AND MARINE CREWS
USING DIGITAL RECORDING.

INSTRUMENT TESTS to be made by LAND and MARINE CREWS
using DIGITAL RECORDING.

Daily Tests

1. System noise with signal calibration
2. Frequency response, cross feed and distortion
- 2a. Short dynamic range check
3. Recording polarity
- 3a. Vibrator similarity
4. Cable noise with signal calibration
5. Production filter pulse test

Weekly Tests

6. Tape system dynamic range
- 6a. Full dynamic range determination (D.R.D.)
7. Skew check
- 7a. Pulse pairing check
8. System cross feed check
9. Analogue summing check
- 9a. Visual C.R.C.

Monthly Tests Records and Test Tapes to be submitted to Holwood for evaluation before the 10th of each month.

10. Time break accuracy check
11. Digital format checks
12. A/D Converter balance check (no record or tape required)
13. P.G.U. or G.A.G.C. Calibration check
- 13a. Binary Gain accuracy BIGACI check
14. Digitizer linearity, ANLIN check
15. G-bit analysis check
16. Loop summing check
17. Filter duplication check

Those tests from the above list which are appropriate to the particular equipment and the type of operation, should be made. For example, a marine crew using a DFS-III equipment will do 1, 2, 2a, 3 (Marine), 4, 5, 6a, 7, 7a, 8, 9a, 10, 11, 13a, 14 and 15.

Monthly test records should include those Daily and Weekly tests not included in the Monthly Test schedule, with the exception, in the case of the DFS-III, of Test 2a which is covered by Test 6a.

Test procedures for particular equipments are given in detail in the appropriate schedule.

NB. Before attempting to run any tests, the equipment must be properly set up, i.e. Chopper Zeros must be checked, gains properly trimmed, comparators zeroed, etc.

Before making any test recording on a production tape, the Observer must ensure that the record will be identified as a TEST RECORD when it is processed in the computer.

In the DFS III this is done by setting the RECORD switch to CAL.

Where no provision is made in the format for distinguishing between test and data records, for example, Leach and Leach-Globe, particular care must be taken in writing the Observer's report to ensure that test recordings are clearly identified.

- d) Playback as (c) Check that noise spikes do not exceed one bit in amplitude. Look for coherent noise and other irregularities.

The four 1 second paper records should be identified and filed.

Test No. 3 Recording Polarity

Each crew will receive a polarity test tape recorded with a series of trace sequential, full scale, positive going pulses, which will be repeated throughout the length of the tape.

Marine Crews

1. A mandatory Daily Test will be made in the following manner:
 - a) Playout the polarity test tape to the U.V. camera to show at least one complete sequence of 24 (or 48) pulses. The test tape must then be removed from the recorder.
 - b) Apply a d.c. source (sufficient to drive the A/D converter to full scale) at Test Points 2 and 3 on the Series Shunt Switch card in the Converter Multiplexer Module such as to cause all Data Display Lamps, except the sign bit, to light. This indicates positive full scale.

A record must be run as the d.c. is applied to register the direction of galvanometer deflection.

- c) Make a recording while simulating a pressure increment on one or more geophones. In the case of variable reluctance geophones, this can be done by pushing a diaphragm with a sliver of wood, such as a match stick. In the case of streamer type cables, it has been found possible in practice to apply a pressure increment to one or more geophone stations by giving the cable or cable drum (with the cable wound on it) a sharp blow.
2. The U.V. records made from the test tape, the d.c. input pulse, and the simulated pressure increment, must all show first arrivals of the same polarity. The three U.V. records produced each day must be identified and preserved for submission to Holwood at the end of the sortie.

3. Both the d.c. input pulse and the pressure increment must be recorded on tape. During a sortie this should be the production tape, with proper identification of the test recording. At the start of sorties, or when the cable or any part of the signal routing has been changed, both tests must be recorded on a separate reel which should be submitted to Holwood for verification.

When sections of a streamer cable are replaced, it is the responsibility of the observer in charge to ensure that correct polarity is maintained.

4. The Company convention is that a positive pressure at the geophone is recorded as a positive number on the digital tape. The direction of galvanometer deflection is for the Client's decision. Where no decision is given by the Client, the first breaks will be upward going.

Land Crews.

1. A mandatory Daily Test will be made in the following manner:

- a) Playout the polarity test tape to the camera to show at least one complete sequence of 24 (04 48) pulses. The test tape must then be removed from the recorder.
- b) Apply a d.c. source (sufficient to drive the A/D converter to full scale) at Test Points 2 and 3 on the Series Shunt Switch card in the Converter Multiplexer Module such as to cause all Data Display Lamps, except the sign bit, to light. This indicates positive full scale.

A record must be run as the d.c. is applied to register the direction of galvanometer deflection.

- c) Bury a detonator under a near geophone and record its first arrival.

2. Test tape, input pulse and first arrival polarity must all be the same. The three paper records produced each day must be identified and preserved for submission to Holwood with the regular monthly instrument test records.

3. Both the d.c. pulse and the detonator under geophone test should be recorded on the production tape, with proper identification of the test recording. Polarity tests should also be made at the start of operations in a new area, and after any

change has been made which could affect recording polarity, e.g. the introduction of new cables, geophones, input panel, stacking box, or any part of the signal cabling. Such special polarity tests should be recorded on a separate tape which should be wound on to a small diameter spool and submitted with proper record identification to Holwood for computer verification.

4. In terms of cable and input circuit polarity, an upward movement of the geophone produces a positive going voltage at the red (wide) Mueller clip, the red take-outs go to the A, C, E, etc. pins at the cable plug.

5. The Company convention is that an upward movement of the geophone is recorded as a positive number on the digital tape. The direction of galvanometer deflection is for the Client's decision.

Test No. 4 (Marine Crews) Cable Noise with signal calibration

Take a cable noise record feeding one channel (isolated from the geophone cable) with a 16uV signal for calibration purposes. Operate the normal time cycle system and make the record at the normal shooting speed.

Test No. 5 Production Filter Pulse Test

- a) Set operate/parallel switches to Parallel
- b) Set oscillator control to Pulse
- c) Set Signal Level to OFF
- d) Set system to CAL
- e) Check that all filter controls are set as for production
- f) Set record time to One Second
- g) Push Start button

This test should be made on the production tape with proper identification on the Observer's report. The paper record should show exact duplication of the pulse on all traces.

The maximum amplifier gain that can be used depends upon the filter, and gain constant settings as shown by the table below:

MAXIMUM GAIN

Filter	Gain Constant			
	36	30	24	18
248	30 dB	36 dB	42 dB	48 dB
124	36 dB	42 dB	48 dB	54 dB
62	42 dB	48 dB	54 dB	60 dB
31	48 dB	54 dB	60 dB	66 dB

Test No. 6a Full Dynamic Range

- a) Set Operate/Parallel switch to Parallel
- b) Set Gain Mode to Manual and Manual Gain to 6dB
- c) Set Record length to 1 second
- d) Set Meter Function switch to output
- e) Set Channel Select and DC Voltage switch to OFF
- f) Set Oscillator frequency to 12Hz
- g) Set LO CUT Filters to OUT
- h) Set Record Type to Cal.

Make nine recordings as specified in the table shown over-leaf.

Record	Gain	Test Signal		True Signal	dB Below Full Scale
		Range	Level		
1	6	X1	16 mV	16 mV	3
2	6	X1	4 mV	4 mV	15
3	6	X1	1 mV	1 mV	27
4	6	X1	256 uV	256 uV	39
5	6	X1	64 uV	64 uV	51
6	6	X1	16 uV	16 uV	63
7	6	X1	4 uV	4 uV	75
8	6	X2	1 uV	2 uV	81
9	6	X1	0	Noise	-

The level of the test signal required to fill a given number of bits will depend upon the Gain Constant setting of the amplifier. If this is other than 36 dB for which the above table is compiled, the test signal level must be modified according to the following table :

Gain Constant	Test Signal Control Change	
	Range	Level
30 dB	Change X1 to X2	No change
	Change X2 to X4	No change
24 dB	Change X1 to X4	No change
	Change X2 to X8	No change
18 dB	Change X1 to X8	No change
	Change X2 to X4	4 times as large

Either Amplifier or Direct playbacks of the D.R.D. records may be made. Direct playbacks are preferred since amplified playbacks will add amplifier noise. Some integrations may provide insufficient range of galvanometer adjustment for direct playback at the lower signal levels, in this case APB's are acceptable.

The gain schedules for the two types of playback are as follows:

Amplifier Playback

Record	Amplifier Gain				Bit Slide dB
	Gain Constant				
	36 dB	30 dB	24 dB	18 dB	
1	12	18	24	30	0
2	24	30	36	42	0
3	36	42	48	54	0
4	36	42	48	54	12
5	36	42	48	54	24
6	36	42	48	54	36
7	48	54	60	66	36
8	54	60	66	72	36
9	54	60	66	72	36

Direct Playback

Record	Bit Slide	Galvo Level Initially set to same Level as on Record. Increase above this by the Number of dB given.
1	0	0
2	0	12
3	12	12
4	24	12
5	36	12
6	48	12
7	60	12
8	60	18
9	60	18

All playbacks with the exception of record 9 should have the same amplitude.

Records 1 to 5 should show the oscillator signal free of noise.

Noise should be just noticeable on record 6.

On record 7 the noise will be prominent.

The signal on record 8 should be equal to or greater than the noise.

If the peak to peak amplitude of the noise on record 9 is not greater than the peak to peak amplitude of signal on records 1 to 5, the system is within its specifications.

Test No. 7 Skew Check

Mount IBM master "all ones" tape on tape transport.

Remove Read Amplifier Translator board 1 from the Read/Write module and mount extender card.

Connect one input of the oscilloscope to the Parity Track output J8 and synchronise to this. Connect the other oscilloscope input to all other Read Amplifier Translator outputs in turn, noting the lag or lead of pulse with respect to the parity track. The relationship between tracks and R.A.T. pin numbers is given in the table below:

Bit	Track	R.A.T. No.	Output pin
P	4	1	J.8
0	7	1	X.20
1	6	1	L.32
2	5	2	J.8
3	3	2	X.20
4	9	2	L.32
5	1	3	J.8
6	8	3	X.20
7	2	3	L.32

Mount a scratch pad tape and record all ones. Check the lag or lead at the same points on the R.A.T. boards as for the IBM master "all ones" tape. The total record skew is obtained by subtracting the former from the latter.

This test should be made with the tape deck running in both forward and reverse directions.

If the total skew exceeds 3 μ S across all nine tracks proceed as described in Section 5 of the Read/Write Module Manual.

Skew figures are to be submitted with the monthly instrument test records.

Test No. 7a Pulse Pairing Check

Install the Write amplifier, WA, and the Read Amplifier Translator, R.A.T., for corresponding tracks, on extender cards. Mount a scratch pad tape on machine, select record length MANUAL, and RECORD ONES. (MODE SWITCH at TEST and TEST SWITCH at WRITE ONES).

Set oscilloscope to INTERNAL TRIGGER and 1 V/cm sensitivity. Using a X1 probe, connect to one of the R.A.T. output pins, J8, X20 or L32, and commence recording.

Adjust the oscilloscope time base until three pulses of the R.A.T. output are visible on the screen, then switch the multiplier to X5 and position the trace so that the middle pulse occupies the centre of the screen. Adjust the appropriate potentiometer on the W.A. card for minimum jitter of the pulse. R16 adjusts J8 output; R17 adjusts X20 and R18 adjusts L32. Repeat the adjustment for all tracks.

Track No. 8 System Crossfeed Check

Connect the input switching box to the amplifier inputs.

Set :

Mode switch to Record.

Gain Mode switch to Manual

Manual switch to 12 dB

Data Display switches to Positive only and Select Word

Read Only switch to Normal

Feed in a 12 Hz signal from an external oscillator of sufficient amplitude to drive the digitiser to full scale.

Switch out each input in turn at the same time selecting that particular channel for display on the data display lights.

With the Read Only switch in the Normal position the Word Select switches give channel No. 1 on switch position 02 etc.

The amplitude of the crossfed signal is then read on the display lights.

Correct crossfeed isolation should show only the .5 mV and .25 mV lights on.

Make 2 files (Record length 2s, Filter OUT-Alias) as follows :

File No. 982. Settings as above. Odd channels switched out, even channels full scale.

File No. 983. Similar to 982, but with even channels switched out and odd channels full scale.

Make a DPB of each file, with (a) 0 dB bit slide, (b) 60 dB bit slide.

Test No. 9a Visual C.R.C.

The C.R.C. character is displayed on the row of DATA DISPLAY lights to verify that the header is being written correctly and that gain ranging is correct.

The C.R.C. character will be unique to each equipment since the contract number (which is written into the header in place of the machine number) is taken into account. During lab testing in Holwood the correct C.R.C. displays will be established for each test and noted in the equipment manuals.

It should be noted that the visual C.R.C. does not include the parity bit and thus if the C.R.C. character contains an even number of ones causing a one to be written in the parity track, it will not be the same as the C.R.C. character on the format test slide.

Procedure

The C.R.C. switch which is the centre switch on the Data Hold Card is set to ON.

The switch settings required for the DOWN RANGING test are as follows :

- | | | |
|-----|---|------------------------------------|
| 1. | File number | 000 (to write 001) |
| 2. | Reel number | 99999 |
| 3. | High cut filters | 62 (include S.R.S.) |
| 4. | Low cut filters | 12 |
| 5. | Low cut filters slope | OUT |
| 6. | Notch filters | OUT |
| 7. | Record type | CAL |
| 8. | Record length | 1 second |
| 9. | Trip delay | zero (all switches down) |
| 10. | Gain constant | 30 (remember to re-set after test) |
| 11. | Initial gain | 90 |
| 12. | Programme card | 0007(48 ch) or 0010(24 ch.) |
| 13. | Data all ones switch | ON (Located in Format Module) |
| 14. | Release rate | FAST |
| 15. | Final gain | 90 |
| 16. | Switch tape deck to high speed if format slide is required. | |

(With the C.R.C. and ALL ONES switches ON, full scale positive is applied to the converter interface card, causing all amplifiers to down range fully)

Press the ERASE, OVERRIDE, and START switches in that order to produce a 1 second record. Search, and playback this record with the DATA HOLD switch set to ON to obtain the C.R.C. display.

Compare the DATA LIGHT display with that established for the particular equipment.

For the UP RANGING TEST change the INITIAL GAIN settings from 90 to 0, set the ALL ONES switch to off and the ALL ZEROS switch to ON and repeat the sequence.

(With the C.R.C. and ALL ZEROS switches ON, the zero condition is applied to the converter interface card causing all amplifiers to up-range fully).

Again compare the DATA LIGHT display with that established for the particular equipment.

Note that the C.R.C. switch may remain ON throughout, but the DATA HOLD switch must only be set to ON during playback.

Test No. 10 Time Break Accuracy Test.

Make up a detonator link by taping one turn of 26 SWG enamelled wire round the body of a detonator. Arrange to display the interruption of a current through the 26 SWG wire on a galvanometer trace. Connect the detonator to the firing line in the normal manner and go through a normal firing cycle recording the time break and the rupture of the detonator link on the same piece of paper. There should be less than 1 ms error between the time break and the rupture of the wire.

Test No. 11 Digital Format Checks

Instal a new digital tape on the tape transport. Set format switch to "Single Frame" on the Data Hold Card.

Set:-

- | | | |
|--|--------------|----------------|
| 1. File No. | 110 | (to write 111) |
| 2. Reel No. | 99999 | |
| 3. Sample Rate (Programme Card) | 4 ms | |
| 4. Contract No. or Machine Serial No. | As required | |
| 5. Record length | 1 second | |
| 6. Record type (Record Switch) | Data | |
| 7. H/C Filter | 124 Hz | |
| 8. L/C Filter (frequency) | 12 Hz | |
| 9. L/C Filter (slope) | 36 dB/octave | |
| 10. Notch Filer | Out | |
| 11. Fixed Gain (Gain Constant. On each Amplifier Module) | 30 dB | |
| 12. Early Gain (Initial) Channels | 1 - 4 24 dB | |
| | 5 - 8 30 dB | |
| | 9 -12 36 dB | |
| | 13 -16 42 dB | |
| | 17 -20 48 dB | |
| | 21 -24 54 dB | |

Continue this sequence for 48 channel systems

13. Data "all one's" (switch under lid of Format Module)
14. Tape Transport 80 ips (switch under lid of Read/Write Module)

Press :-

- 1). Override
- 2). Stop
- 3). Start

IN THAT ORDER and hold until tape starts.

Cut out the section of tape with the format check written on it and repeat above with Data all "0's". Produce a 35 m/m slide for each format check as described in the attached section "Processing of Format Checks", (TP2:45) and compare the CRC byte with the standard tests made in Holwood.

Test No. 12 A/D Converter Balance

Set the Mode switch to Test and the Test switch to Conv. Cal. Remove the series shunt switch board from the Conv/Multiplexer module and mount on an extender board. In the case of 48 channel equipments the series shunt switch must also be removed from the Aux./Multiplexer module.

Feed a voltage of precisely 4092.00 mV to Test Points 2 and 3 of the series shunt switch via a twisted pair of wires shunted at the board by a 250 uF capacitor observing the correct polarity. The voltage source should be the Power Designs model 2005, or similar, monitored by a Fluke Differential Voltmeter.

The display lights on the Format Module should read this voltage. The sign bit and all data bit lamps below 4 mV will be off and all others should be on for positive on T.P.3.

Locate the Record Reference card R1 and identify the four potentiometers R31, R43, R36 and R47 which can be adjusted without removing the board.

R31 is for the negative adjustment.

R36 is the reference Zener Diode adjustment which should not normally be touched.

R43 is for coarse positive adjustment.

R47 is for fine positive adjustment.

R43 should be used to bring the lights to very near the correct value, the final adjustment should then be made with R47.

This completes the positive calibration.

Reverse the d.c. connections to TP2 and TP3, adjust R31 until the lamps read correctly. The sign bit 2 mV, 1 mV, 0.5 mV and 0.25 mV lamps should be on, and all other lamps off.

Reverse the d.c. connection and re-check the positive adjustment and then return to the negative adjustment. Continue until no further improvement can be made.

Systems with a read-after-write facility have a second reference card R2, the D/A converter reference card. Plug this card into the extender board in place of R1 and repeat the calibration. Return cards to their original positions.

Test No. 13a Binary Gain Accuracy BIGACI

1. Parallel amplifier inputs.
2. Set trip delay to zero.
3. Set mode switch to calibrate.
4. Select manual gain.
5. LO CUT filter-Out.
6. Meter function-Output.

7. Meter range - 2.
8. Feed in a signal using internal oscillator at 12 Hz via the attenuator. Find signal level that just gives overdrive and reduce by 6 dBs. Eliminate as much 50 Hz pick-up as possible.
9. Make the following series of 1 second recordings, and RAW paper records. VAR amplitudes should be set just below clipping. Examine the paper records for amplitude irregularities and distortion before shipping both tape and records for evaluation.

Record Number	Manual Gain Setting	Signal Input
951	90	Just below clipping
952	84	Retain setting
953	78	Retain setting
954	72	Retain setting
955	72	Increase to just below clipping
956	66	Retain setting
957	60	Retain setting
958	54	Retain setting
959	54	Increase to just below clipping
960	48	Retain setting
961	42	Retain setting
962	36	Retain setting
963	36	Increase to just below clipping
964	30	Retain setting
965	24	Retain setting
966	18	Retain setting

<u>Record Number</u>	<u>Manual Gain Setting</u>	<u>Signal Input</u>
967	18	Increase to just below clipping
968	12	Retain setting
969	6	Retain setting
970	0	Retain setting
971	0	Retain setting
972	0	Retain setting
973	0	Retain setting
974	0	Retain setting

Test No. 14 Digitizer Linearity ANLIN Check

1. Remove series shunt switch card from Conv./Multiplexer and fit on extender card.
Remove series shunt switch card from Aux./Multiplexer of 48 channel system.
2. Input d.c. from Power Designs Model 2005, or similar, to Test Points 2 and 3. Shunt with 250 uF capacitor and monitor voltage with Fluke differential voltmeter.
3. Set the trip delay to zero.
4. Check that comparator offset is zero.
5. Mode switch to Record and Record switch to Direct Channel.
6. Run 1 second records using the record numbers and voltages given in the following table :-

TP/2:21

records for computer analysis.

"1" representing on, "0" off.

Test No. 15 G-bit Analysis Check.

Record No. 980

1. Parallel inputs
2. Input signal zero
3. Early gain zero
4. Final gain 90 dB
5. Trip time zero
6. Record length 6 seconds
7. Gain mode OPERATE

Record No. 981

1. Parallel inputs
2. Input signal 36 Hz, 16 mV x 8
3. Early gain 90 dB
4. Final gain 90 dB
5. Trip time zero
6. Record length 6 seconds
7. Gain mode OPERATE

This tape should be submitted with the Monthly Test records for computer analysis.

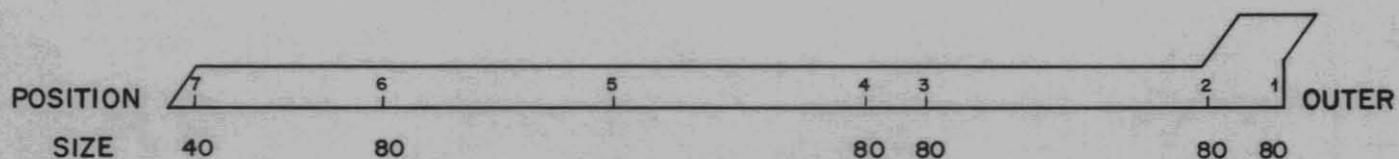
Test No. 17 Filter duplication check

Repeat Test No. 5 using the filter settings given in the table below and producing R.A.W. paper records for submission to Holwood.

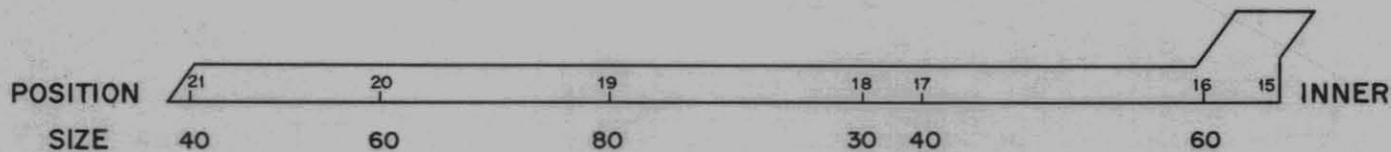
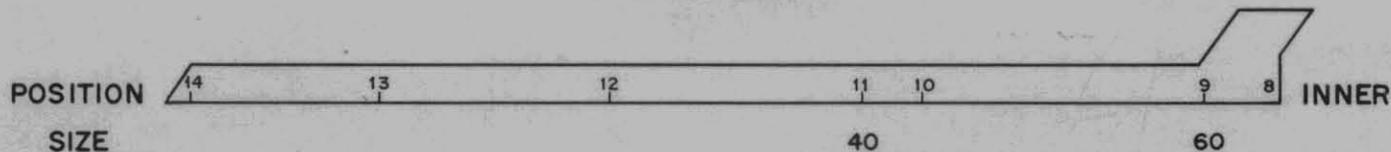
Only high-cut filter settings lower than that which is correct for the sampling rate in use are required.

	LOW-CUT	SLOPE	HIGH-CUT
a	8	18	as for
b	12	18	sample rate
c	18	18	in use
d	27	18	
e	8	36	
f	12	36	
g	18	36	
h	27	36	
i		OUT	as many records
j		OUT	as may be required
k		OUT	to check all lower
l		OUT	settings

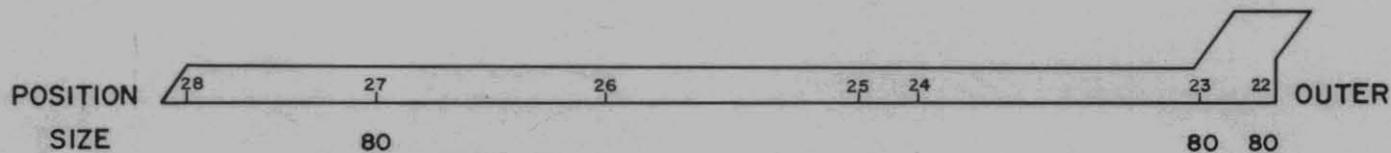
AIR GUN ARRAY M.V. Petrel



STARBOARD

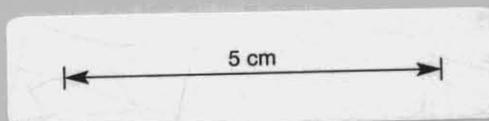


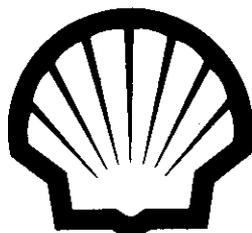
PORT



Scale : 2,5 cm = 1 m

TOTAL SIZE 1090 cu. in.





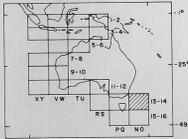
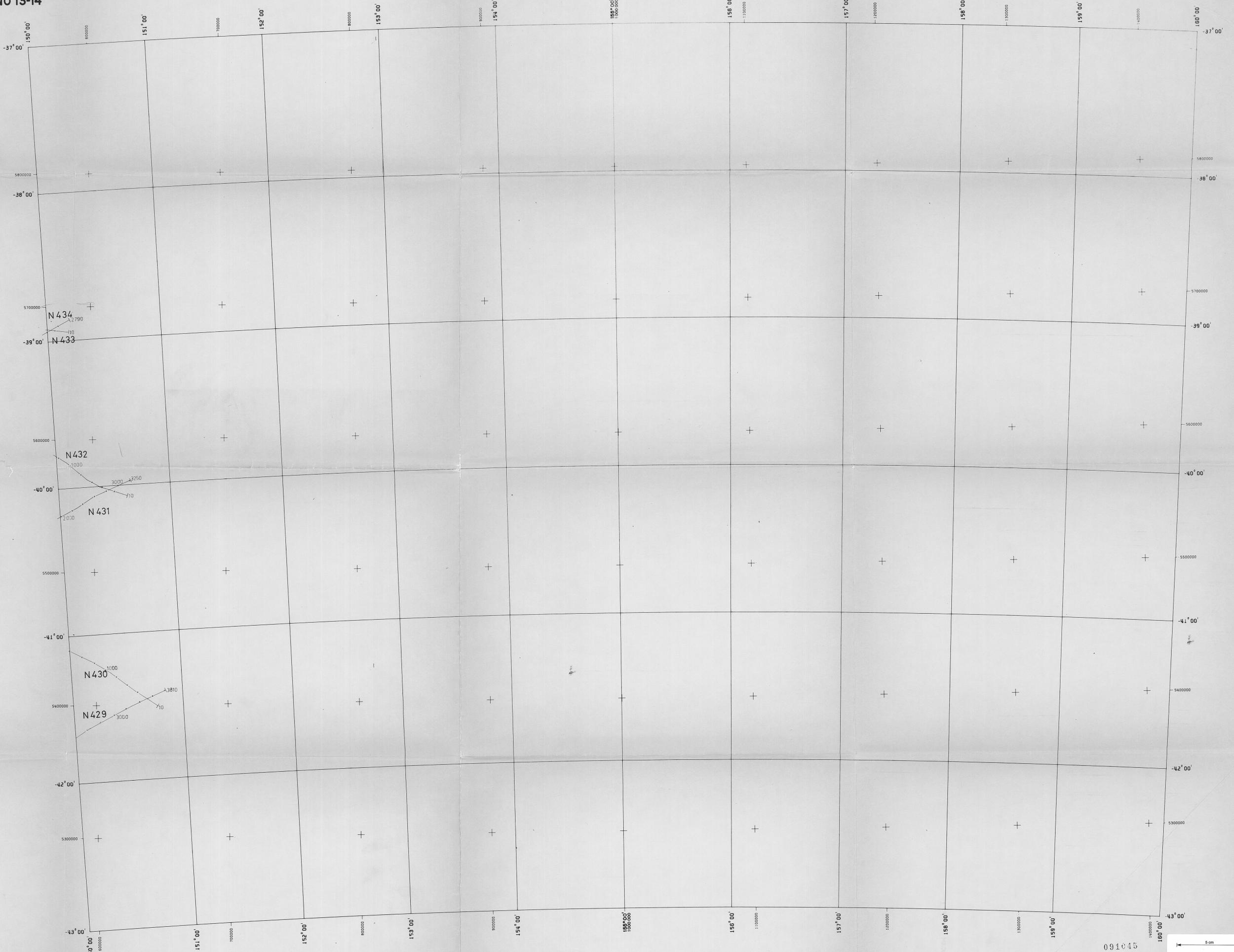
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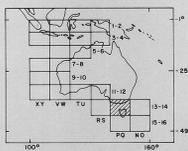
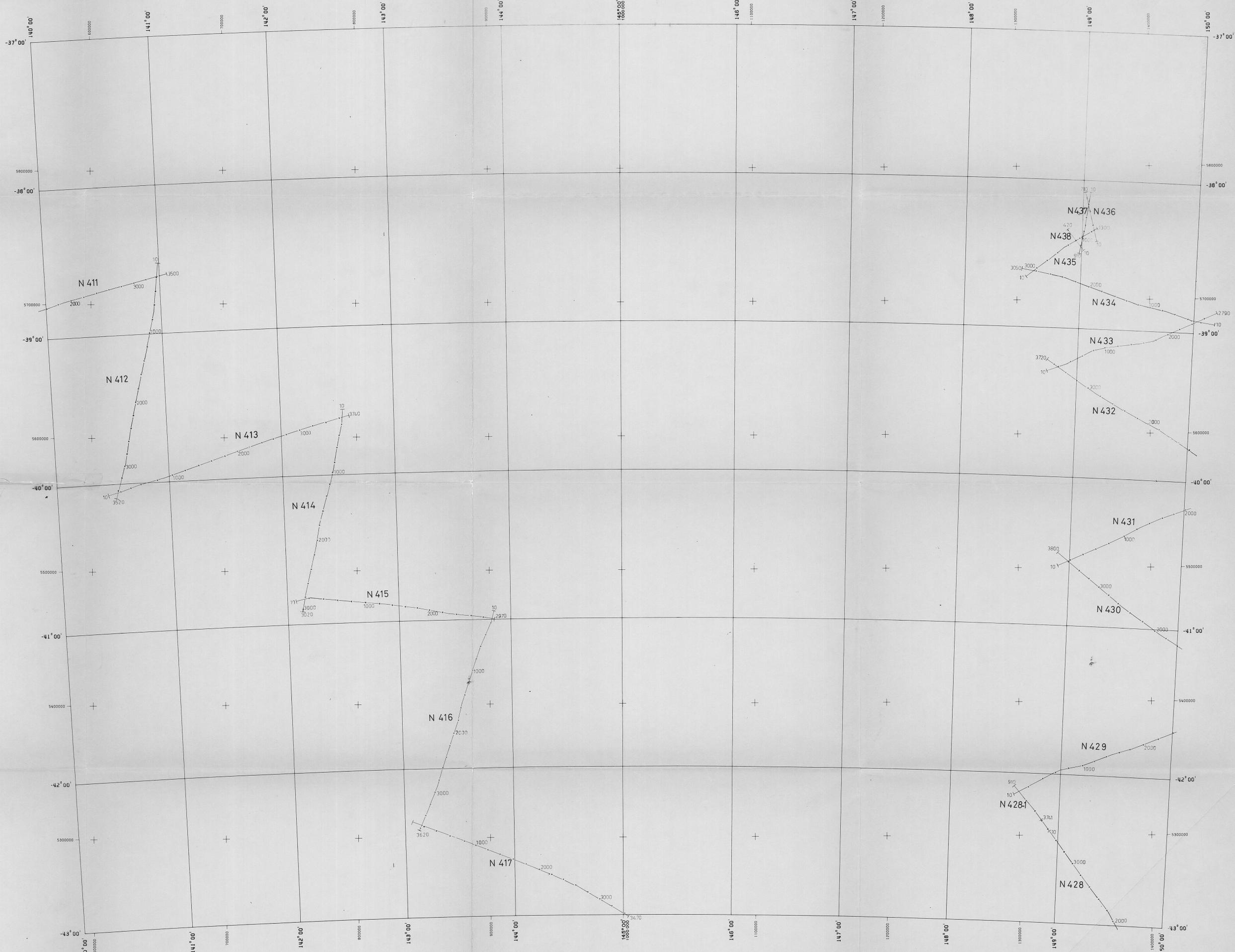


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THE HAGUE	EXPLORATION & PRODUCTION
AUSTRALIAN PROGRAMME	
SHEET NO 13-14	
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Author:	Exec:
Report No.:	Draw. No. <i>5-73</i>
	<i>02087</i>

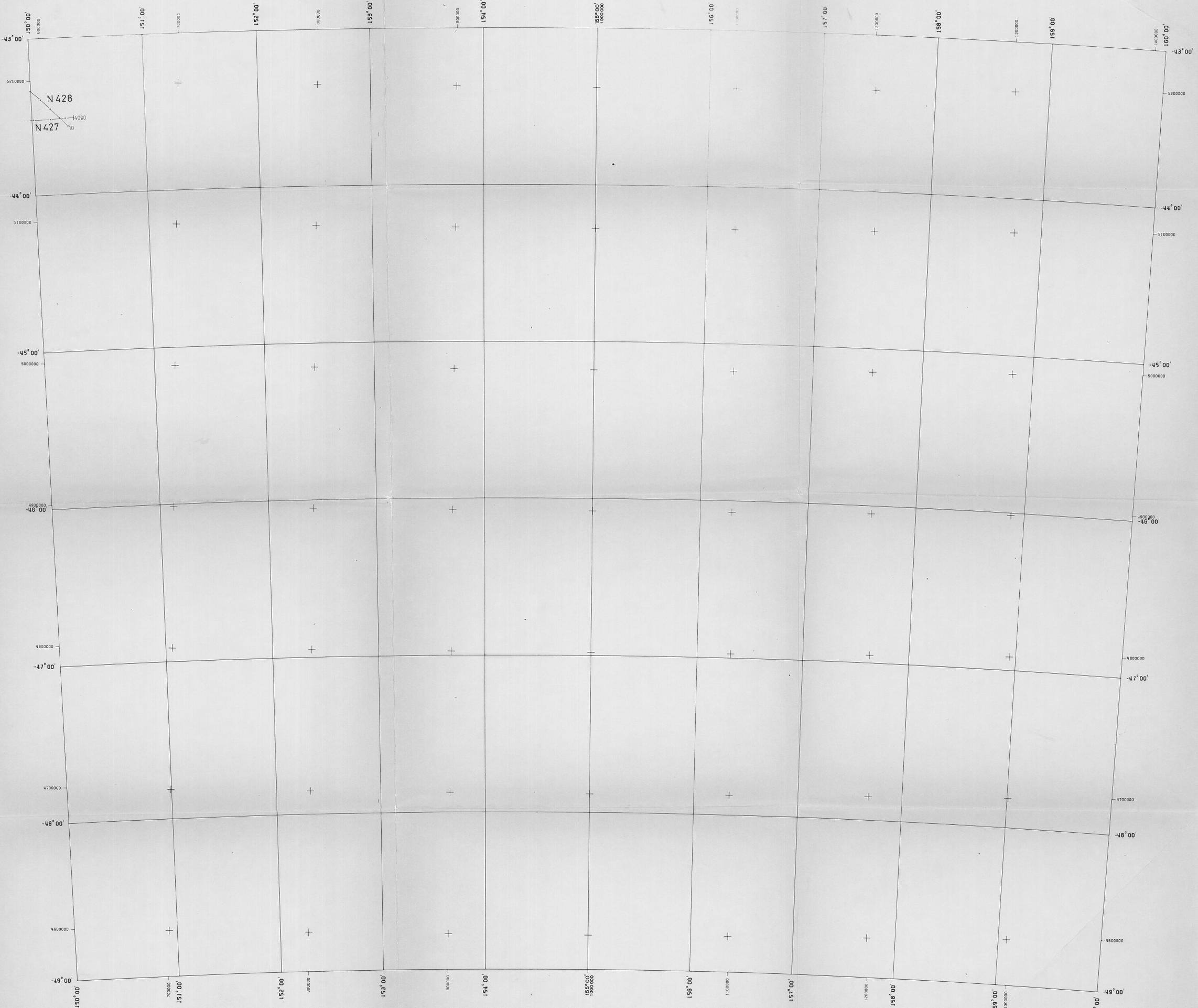


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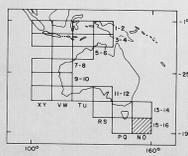
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THE HAGUE EXPLORATION & PRODUCTION		
AUSTRALIAN PROGRAMME		
SHEET PQ 13-14		
Scale 1:1,000,000		
Author:	Encl:	Date: 4-5-73
Report No.:	Draw. No.:	CR 687



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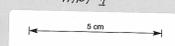


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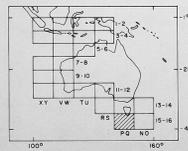
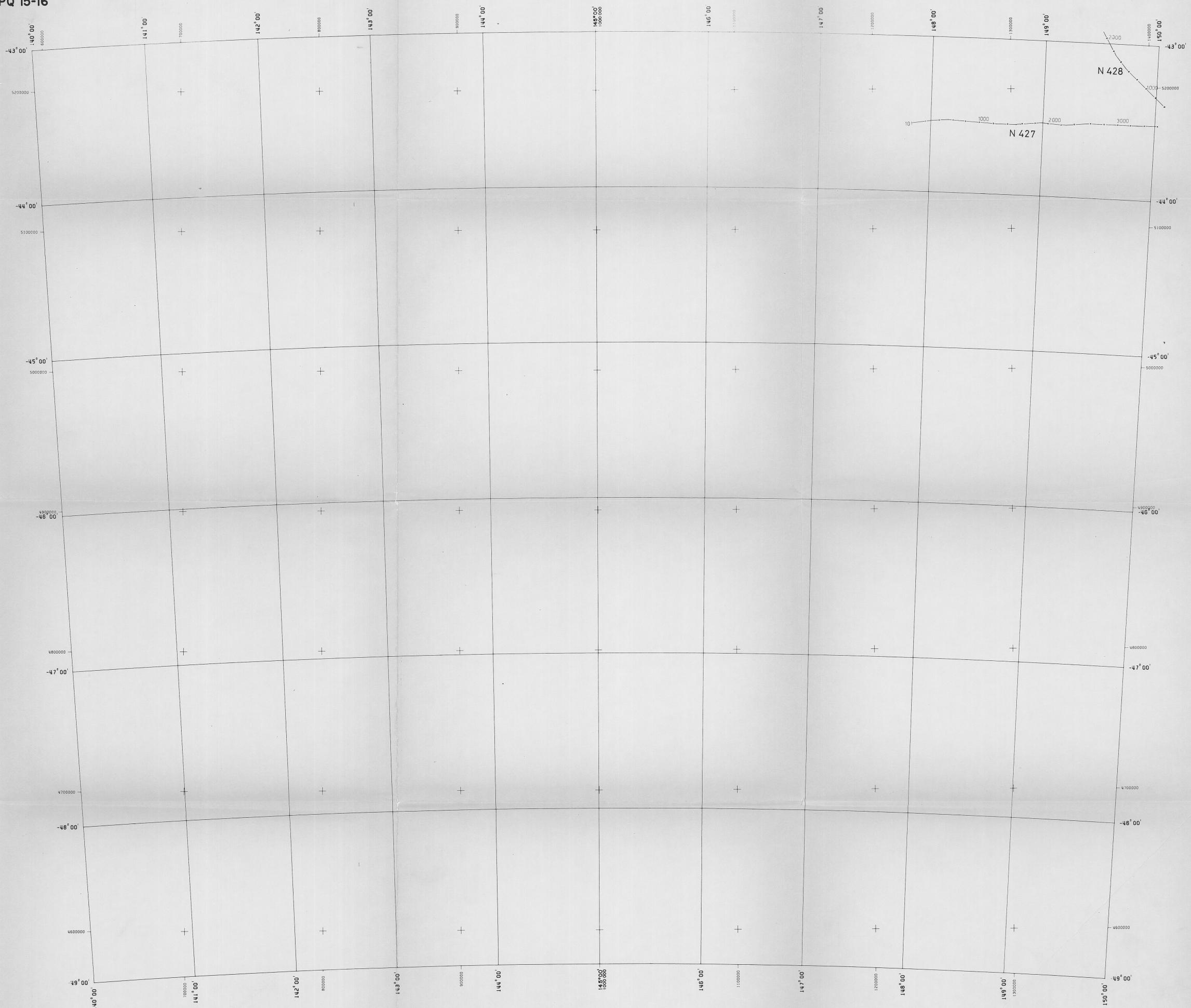
SHELL-1972 PETROL ROVING
SURVEY
PART 1



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AUSTRALIAN PROGRAM	
SHEET NO 15-16	
Scale 1:1,000,000	
Author:	Encl: Data: 4-5-73
Report No.:	Draw. No. 6/20/73

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T.M. PROJECTION C.M. 145°
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SHEW 1912 - PETREL ROVING
SURVEY PART I



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AUSTRALIAN PROGRAMME	
SHEET PQ 15-16	
Scale 1:1,000,000	
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Report No.:	Draw. No. 500/15/1

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