DEPARTMENT OF
MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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Record 1973/116

PROGRAM FOR EAST PAPUA CRUSTAL SURVEY

OCTOBER - NOVEMBER 1973

by

D.M. Finlayson

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CONTENTS

SUMMARY

This Record is a handbook of survey operations prepared for participants in the BMR East Papua Crustal Survey, October-November 1973.

PARTICIPATING ORGANIZATIONS

Commonwealth of Australia

Bureau of Mineral Resources, Geology and Geophysics, P.O. Box 378, Canberra City - A.C.T., 2601.

BMR Geophysical Observatory, Port Moresby

Survey Branch, Department of Services and Property, Canberra.

P.N.G. Administration

Lands Branch, Department of the Chief Officer and Developmental Administration, Port Moresby

Marine Division, Department of Transport, Port Moresby

Radio Branch, Department of Posts and Telegraphs, Port Moresby

PNG Geological Survey, Department of Lands, Surveys and Mines, Port Moresby and Rabaul.

Universities and Institutes of Technology

Research School of Earth Sciences, Australian National University, Canberra.

Department of Geology and Mineralogy, University of Queensland, Brisbane.

School of Geology, University of Melbourne.

Preston Institute of Technology.

Warrnambool Institute of Advanced Education.

Hawaii Institute of Geophysics, Honolulu, U.S.A.

1. INTRODUCTION

The geophysical and geological background information for the East Papua Crustal Survey has already been described by Finlayson (1971). BMR has been coordinating the planning of the survey since 1970 and the purpose of this Record is to document the final survey design, organization, and scheduling for those participating in the survey. The Record is a handbook of survey operations and as such is essential reading for all personnel involved in these operations.

1.1 Survey Objectives

The survey seeks to investigate the gross tectonic boundaries in the region of the central Papuan peninsula using seismic refraction and gravity methods. This will involve the study of velocity and velocity boundaries at least to depths of the order of 40 km and the determination of velocity and boundary gradients at such depths. The tectonic features of the area which single it out for study are:

1. The boundary between the Solomon Sea and Australian plates along the Owen Stanley Fault system with the ophiolite suite of rocks on the Solomon Sea plate contrasting distinctly with the Owen Stanley Metamorphic Belt.

2. The possible distinct crustal differences on the Solomon Sea and Coral Sea side of Owen Stanley Fault system.

3. The nature of the emplacement of the Papuan Ultramafic Belt.

4. The relatively minor seismic activity along this plate boundary.

5. The active volcanism in the Mount Lamington and Mount Victoria regions.

6. The gravity changes recorded across the plate boundary.

1.2 Survey Design

The major survey effort will go into shooting the pattern of seismic shots shown on the accompanying map (Plate 1) and recording at the temporary and permanent seismic stations also shown on that map. The shot pattern is designed to give two traverses across the Papuan Peninsula and traverses along the NE and SW coasts. This should provide seismic refraction data both within tectonic provinces and across their major boundaries.

The shots have been confined to approximately linear patterns to distances of 300 km from the central Port Moresby-Popondetta survey area. This should minimize the number of simplifying assumptions made in any delay time interpretation, but the spacial distributions of shots and recording stations should not exclude a time-term approach to the interpretation.

There will be about 59 shots of 1028 kg at 40 km spacing which it is hoped will be recorded throughout the survey area. About 54 smaller shots of 181 kg fired along the coastal traverses will provide useful data at distances up to 100 km.

The recording network of stations will be kept substantially unchanged throughout the four-week shooting period. This is desirable so that a substantial number of recordings can be made with the station delay-time factors kept constant while those for the shot-points are varied. There will be a short period after about two weeks' shooting when a few stations will be moved. It is also planned to move personnel at the same time.

1.3 Survey Headquarters

A survey headquarters will be set up in Port Moresby for the duration of the survey and will be staffed during all field operations. The address of the office is (Fig. 1):

East Papua Crustal Survey (EPCS)
Queenscliffe Street,
KOROBOSEA, PNG

Telephone 56439

Note that this is not a mailing address; all mail should be addressed to the Boroko P.O. box number given in Chapter 5.1. The headquarters will be in radio communication with all parties from a transceiver installed in the building.

The overall party leader for the survey is Mr D.M. Finlayson and assisting him at headquarters will be Dr J.P. Webb (University of Qld) and Mr J.A. Sommerville (BMR Party clerk). At least one of these three persons should be at headquarters during all survey operations.

Because the survey area will be divided topographically by the Owen Stanley Ranges, a subsidiary headquarters will be established in Popondetta. The address and telephone number of this office will be available at a later date. It will be equipped with a base station transceiver also and will be in telephone contact with Port Moresby Headquarters.

2. SHIPBORNE OPERATIONS

The officer in charge of shipborne operations is Mr P.E. Mann. Other personnel on board the shooting vessel, apart from the crew, will be the Survey Branch navigator, the SHORAN operator, a geophysicist, and a shooter (Mr R. Cherry). The shooting vessel will be the L/C Sir Alan which is of landing barge type construction. BMR will be installing four marine cabins on the deck to house equipment and personnel. Ship fitting-out and trials are expected to take two weeks.

2.1 Seismic Shooting Traverses

The locations of the shooting traverses and the shooting vessel route are shown in Plate 1. 59 large shots (1028 kg) and about 54 smaller shots (181 kg) are planned. All shooting will be outside reef areas in at least 100 m of water. Shots will be fired as close to 5 minutes past the hour as possible, and shooting will only take place during the hours 07.00 to 18.00 EST inclusive. It is hoped to fire 3 large shots per day and there will be a minimum of 3 hours' ship steaming between large-shot sites. Small shots will be fired at the intervening hours where indicated on the map.

Once shooting commences, it will be conducted on a continuous basis except where indicated on the shooting schedule (Table 1) when there will be brief harbour calls for supplies, personnel changes, and fuel.

Shot numbers will be allotted (1, 2.....n) in chronological firing order irrespective of the size of the shot.

2.2 Ship Navigation

The shooting vessel will be equipped with normal navigation aids such as magnetic compass, radar, and echo sounding. In addition, under contract with Navigation Aust. Pty Ltd of Perth, it will be fitted with a VHF/UHF SHORAN navigation system with three onshore base stations. The shot position fixing will be the responsibility of the Survey Branch navigator in cooperation with the SHORAN operator on board the shooting vessel. The desired accuracy of navigation is 0.1 km. The positions of the SHORAN base stations are indicated in Plate 1. Under certain conditions it may be necessary to resort to navigation by radar, Hydrodist and land fixes in areas close inshore. The proposed shot positions and shore stations are listed in Table 2 (Note that the shot numbers may well be changed as shooting operations dictate; see para 2.1).

2.3 Shooting Procedures

The explosive being used on the survey is Du Pont WW packed in 66-2/3 lb cylinders. There will be two standard shot sizes, the larger shots being 34 cans (1028 kg) and the smaller shots being 6 cans (181 kg).

The larger shots will be assembled on a wooden tray sitting on top of a roller platform. The assembly will be fixed with steel banding and a net. The shot will be fired by primer, primacord and safety fuse lit before the whole is rolled over the side of the ship. The fuse burning time will be approximately 5 minutes.

The larger shots will be suspended in the water at 100 m depth by a rope attached from the containing net to a surface buoy. Shot timing will be achieved by means of a sonobuoy near the suspension buoy transmitting to the shooting vessel which will be about a kilometre away. This sonobuoy signal will be recorded on a "Visigraph" recorder along with a crystal clock time code, VNG radio time signals, and a hydrophone signal from alongside the ship.

The smaller shots will consist of 6 cylinders banded together and fired with primer and safety fuse (90 sec. burning time). These shots will not be suspended and a sonobuoy will not be used for timing since better than 0.1 second timing accuracy can be achieved at the shorter shot-to-ship distances which can be tolerated. Otherwise the timing system will be the same as for the large shots.

2.4 Subsidiary Shipborne Operations

The shooting ship will be equipped with a 7 kilojoule sparker profiling system to provide continuous sub-bottom information and water depths and may also operate a proton-precession magnetometer towed behind the vessel. This profiling equipment will only be run during periods when no shooting operations are taking place and when it is possible to achieve a few hours of continuous operation.

3. SEISMIC RECORDING OPERATIONS

3.1 Site Information and Surveying

An information file has been compiled for every recording site to be used during the survey. This file will be available to the geophysicists who establish recording stations and it is essential that it be studied prior to arriving at a site so that local contacts and topography can be assessed.

In most cases some local official or resident has been informed of the survey operations and will be expecting you. All these prior arrangements have been made to save time in the establishment of recording stations.

During April and May 1973, Amalgamated Decca Surveys Pty Ltd in cooperation with Survey Branch officers conducted a positioning survey at each site and the locations of their marker pegs (long steel spike driven into ground) are described in the site files. The positions of these markers are knownto an accuracy of 0.1 km and the relation of the seismometers to the markers must be measured by the geophysicist who establishes the station. This will be done using a compass and measuring tape. Every care must be taken in mak ng the measurements; distances and compass bearings should be made in both directions, i.e. working both from the survey marker to the seismometer and in the reverse direction. Both sets of readings shall be reported. Geophysicists are expected to exercise their own judgment in choosing the seismometer locations but it is requested that these be within 1.0 km of the survey marker.

3.2 Recording Equipment and Personnel

The basic network of recording stations will be established using 35 sets of temporary recording equipment and 4 permanent recording stations. These, together with a brief equipment description are listed below.

Organization		Description	Number of sets
BMR	:	Vert. Willmore, P.I. f.m. tape recorder, automatically switched 1/4 hr. every hour	6
"	:	Vert. Willmore, Akai f.m. tape recorder, automatically switched 1/4 hr. every hour	13
ANU	:	Vert. Willmore, Sony a.m. slow-speed tape recorder, 24-hour operation	9
Univ. of Qld.	:	Vert. Hall Sears, Teac f.m. tape recorder manually switched	2
Univ. of Melb.	:	Manually switched	3
Rabaul Obs.	:	Vert. Willmore, Kinemetrics visual recorder, 24-hour operation	1

Rabaul Obs.	:	Observatories at Esa Ala and Lamington	2
Pt Moresby Obs.	:	Observatories at Port Moresby and Lae	2
H.I.G.	:	Three-geophone L spread, tape recorder, manually switched.	1
			39

The personnel who will be concerned with the establishment of the seismic recording network and its operation throughout the shooting period are listed below

Organization	Personnel	Total
BMR	J.B. Connelly, B.J. Drummond, C. Collins, P. Ryan, I. Ripper, J. Petkovic, N. Parker, B. Carr.	8
ANU	J. Cleary, K. Muirhead (first 3 weeks only)	2
Univ. of Melb.	J. Russell, G. Gibson	2
Univ. of Qld.	J.P. Webb, J.M.W. Rynn, P. Furness	3
Rabaul Obs.	V. Dent or C. McKee	1
H.I.G.	A.S. Furumoto, Mr R. Boyles, Mr Ichenose, Mr Mitiguy	4
		20

Table 3 contains details of the personnel coding used in all mobilization schedules in this Report.

The above personnel will be responsible for setting-up and operating the recording equipment which their organization provides but may also be asked to service other equipment according to requirements.

The recording network personnel will have the support of H.Q. staff at all times and, for at least the setting-up period, will have the assistance of staff from helicopter gravity survey duties, patrol officers of the PNG Administration, and geophysical assistants from the Port Moresby Observatory and PNG Geological Survey.

Two recording stations will be established on Cape York Peninsula by BMR Observatory Group Canberra and University of Queensland. These stations will be at Coen and Iron Range.

3.3 Equipment and Personnel Location during Shooting Operations

The equipment to be installed at sites and the location of personnel during the shooting operations are contained in Table 4. Also contained in this table are the radio call signs for the communications network.

3.4 Siting of Recording Equipment, Seismometers and Aerials

All recording sites have been inspected and recommendations for housing the equipment are contained in the site files. However, the final decision on location of the equipment is the responsibility of the geophysicist. As explained in chapter 3.1 it should be within 1.0 km of the survey marker and surveyed with reference to the marker.

The surface vegetation and soil cover at most sites preclude the siting of the seismometer on rock. In many instances, tall timber is adjacent to the sites, in other cases the sites are near fast-flowing rivers or near the sea coast. Thus microseismic noise may prevent a very high amplifier gain being achieved.

Where hard rock seismometer sites are not available, the best compromise is to locate the site near the village but not in it and thus exclude as much cultural noise as possible due to people, animals, and vehicles moving. It is desirable to "dig in" the seismometer and get through the loose surface soil.

At some sites it will be possible to run a cable from the seismometer to a permanent building which can be used to house the recording equipment. If this is not possible then a shelter will have to be built with the flysheets provided. Aerials for radio time signals and radio communication will have to be erected.

A period of 24 hours has been allowed for the setting up at each recording site and thus every effort should be made to make the installation as robust as possible. Strong construction methods can be achieved with local materials and in this respect it should be possible to enlist the help of local villagers. Particular attention should be paid to waterproofing, drainage, discouraging local livestock (cattle and pigs), burying ground cables, and discouraging local children.

3.5 PNG District Administration, Local Assistance, and Hire of Local Labour

The success of a survey of this nature depends largely on the cooperation and assistance of the PNG Administration, local village councillors, mission staff, and plantation owners. Therefore great importance must be placed on "public relations" and in this respect all local protocols must be observed. Thus on arrival at sites it will be necessary for the geophysicist to contact the relevant official, whether he be D.C., A.D.C., patrol officer, village councillor or village policeman, teacher, pastor, etc., and explain what you are doing and that it is connected with previous visits by helicopters in February and April/May.

Most local officials will have been told of your coming but sometimes there are breakdowns in communication and therefore the geophysicist will have to do the "public relations" job himself. In all cases when going into a site for the first time the geophysicist will be accompanied by an officer from the PNG Administration who is familar with the language and local employment conditions.

The names of local contacts are contained in the relevant site files. Where this contact is a full-time paid official of the PNG Administration he will not be paid for his assistance. However, where other local assistance is sought in setting up equipment or shelters this will be paid for on the spot by the geophysicist at rates determined by the Administration Officer from funds provided for this purpose. The rates may seem small by Australian standards but in no instance should they be exceeded.

Where recording equipment is being left to operate automatically it will be necessary to make arrangements for watchkeeping duties.

These will be unpaid in instances where local PNG officials are concerned but at village level an arrangement will have to be made with the village councillor, to pay someone to discourage interference with the equipment. Specific instructions will be given to the person about how often he should inspect the site, when the next visit will be, what and when he will be paid, reporting any damage to village councillor, policeman or Administration official. Village social structure is normally well disciplined and equipment will probably be safer at remote villages than nearer the larger towns provided all protocols are observed.

4. MOBILIZATION OF EQUIPMENT AND PERSONNEL

As indicated in chapter 3.3 the survey recording operations have been divided into three sectors (green, blue, and red) for logistic reasons. Personnel and equipment will, generally speaking, be working within one sector at least for the initial network establishment period. The sectors are delineated geographically in Plate 1.

The proposed survey schedule is set out in Table 1. The target date for day D is 15 October.

4.1 Equipment Listing

Equipment for the survey will be available from the D.C.A. Warehouse, Elanese Road, (Fig. 1), and should be returned there at the end of the survey.

Equipment required for each recording station (Unmanned)

Site file

Complete recording equipment, clock, time-signal receiver, tapes, aerials, and power supply

Seismometer and cables

Equipment log sheets (to be distributed by BMR)

Flysheet

Plastic sheeting

Twine (1 ball)

Poles for flysheet and aerials (to be cut on site)

Equipment required for each manned recording station (in addition to that above)

Transceiver (25-W Codan) complete with aerial wire

Car battery for above (12 V)

Battery charger for above (if no charging facilities available at site)

Replacement power supplies for recording equipment

Replacement tapes for recorder

Tools for servicing recording equipment

Timber cutting and digging equipment (borrowed at site)

Equipment required for establishing an unmanned station

Equipment servicing tools

Shovel

Bush knife

Bush saw

Mattock

Measuring Tape (50 metres)

Compass (Prismatic)

For overnight stay:

Camp stretcher (1 per person)

Blankets (2 per person) or sleeping bag

Stove (L.P. gas)

Gas bottle, (4½ lb)

Gas light (complete with spare mantles)

Matches

Food and water

First Aid Kit

Transceiver complete with dry battery pack

Mosquito net (1 per person)

Torch and batteries

Crockery and cutlery (pro rata)

At most sites it will be possible to use local village rest houses or Administration accommodation for overnight shelter.

4.2 Personal Equipment

It is difficult to make any definite suggestions about personal equipment to be taken on the survey. It is probably sufficient to remind participants that the normal town recreations may not be available in Port Moresby, and at other sites may be wholly absent.

Equipment

Clothing

Toilet requisites

Torch and batteries

Driving licence

Anti-malarial prophylactic

Optional:

Reading material

Writing material

Camera and film

Radio (with short waveband)

Sports or hobby equipment

4.3 Transport - Road Vehicles, Aircraft, Helicopter

Road Vehicles

Road vehicles will be hired on a full-time basis at Port Moresby and Popondetta. Additional vehicle requirement during busy periods will be met by D.C.A. and Dept of Public Works (trucks) and local hire vehicles (Avis, Hertz, Budget).

Vehicle arrangements at other recording sites are included in the file for each site.

Aircraft

Fixed-wing aircraft requirements will be met by use of a D.C.A. Period Contract. The contractors are Macair (Port Moresby, Popondetta, Lae) and Ansett (Port Moresby). Aircraft schedules will be booked by H.Q. staff and a flight log will be kept for each sortie. Survey personnel should check aircraft schedules at H.Q. on the morning of the flight (or the previous afternoon).

Helicopter

Helicopter requirements will be met using a BMR Period Contact. The contractors are Helitrans Australia Pty Ltd and BMR will have a Bell 206B Jetranger on hire for the duration of the survey. When not engaged in seismic recording station establishment or servicing, it will be engaged on regional gravity survey work (see chapter 7). Flight schedules for the helicopter should be arranged with H.Q. Port Moresby or Popondetta and flight logs reported to H.Q. Port Moresby.

4.4 Movements Schedule, Recording Network Establishment

4.4.1 Green Sector

Personnel: Drummond (BMR 3), Rynn (Qld 2)

Dent (RAB), (PNG 1)

Equipment: 5 BMR sets, 1 Qld set, 1 RAB set.

DAY D-7

Personnel Location; POM 4

Aircraft (B.N. Islander):

Route: POM - DAUGO IS - POM

Load: BMR 3, RAB, 1 BMR Set
DAUGO IS: Drop BMR 3, RAB, 1 BMR Set

Vehicle:

Route: POM - KWIKILA

Load: QLD 2, PNG 1, 1 QLD Set

Green Sector (continued)

Aircraft (B.N. Islander):

Route: Ex-Woitape - DAUGO IS - POM (see BLUE Sector Schedule)

Load: Nil Ex-Woitape

DAUGO IS: P/U BMR 3, RAB

DAY D-6

Personnel location: POM 2, KWIKILA 2

Vehicle

Route: POM - Mt Lawes - POM

Load: BMR 3, RAB, 1 BMR Set

Vehicle KWIKILA - POM

Load: QLD 2, PNG 1

DAY D-5

Personnel location: POM 4

Vehicle

Route: POM - OWERS CORNER

Load: BMR 3, QLD 2, PNG 1, 2 BMR Sets

DAY D-4

Personnel location: POM 1, OWERS CORNER 3

Vehicle

Route: OWERS CORNER - SIRINUMU DAM - POM

Load: BMR 3, QLD 2, PNG 1, 1 BMR Set

DAY D-3

Personnel Location: POM 4

Vehicle

Green Sector (continued)

Route: POM - KWIKILA

Load: QLD 2

Aircraft (B.N. Islander)

Route: Pom - Kupiano - Cape Rodney - Pom

Load: BMR 3, RAB, PNG 1, 1 RAB Set, 1 BMR Set

Kupiano; Drop RAB, 1 RAB Set

Cape Rodney; Drop BMR 3, PNG 1, 1 BMR Set

DAY D-2

Personnel Location: Kupiano 1, Cape Rodney 2, Kwikila 1

Aircraft (B.N. Islander)

Route: Pom - Cape Rodney - Pom

Load: Nil Ex-Pom

Cape Rodney; P/U BMR 3, PNG 1:BMR 3 embarks on shooting vessel Sir Alan.

4.4.2 BLUE SECTOR

Personnel: Connelly (BMR 2), Petkovic (BMR 7), Ryan (BMR 5), (PNG 2), (PNG 3), (PNG 4), Carr (BMR 6), Gibson (MELB 2), Parker (BMR 16).

Equipment: 9 BMR sets, 2 Melb sets.

DAY D-7

Personnel location: Pom 9

Aircraft (B.N. Islander)

Route: Pom - Aroa - Yule Is - Pom

Load: BMR 2, BMR 7, PNG 2, PNG 3, 3 BMR sets

Aroa; drop BMR 2, PNG 2, 1 BMR set

Yule Is; drop BMR 7, PNG 3, 2 BMR sets

Blue Sector (continued)

Aircraft (B.N. Islander)

Route: Pom - Woitape - Daugo Is - Pom

Load: Melb 2, 1 BMR set,

Woitape; drop Melb 2, 1 BMR set

Daugo Is; P/U BMR 3, RAB

DAY D-6

Personnel location: Aroa 2, Yule Is 2, Woitape 1, Pom 4

Aircraft (B.N. Islander)

Route: Pom - Aroa - Bereina - Yule Is - Malalaua - Kerema - Woitape - Pom

Load: BMR 16, 2 BMR sets, 1 Melb set

Aroa; P/U BMR 2, PNG 2

Bereina; drop BMR 2, PNG 2, 2 BMR sets

Yule Is; P/U BMR 7, PNG 3, 1 BMR set

Malalaua; drop BMR 7, PNG 3, 1 BMR set

Kerema; drop BMR 16, 1 Melb set

Woitape; P/U Melb 2

DAY D-5

Personnel location: Bereina 2, Malalaua 2, Kerema 1, Pom 4

Aircraft (B.N. Islander)

Route: Pom - Tapini - Garaina - Malalaua - Pom

Load: BMR 5, PNG 4, Melb 2, 2 BMR sets, 1 Melb set

Tapini; drop BMR 5, PNG 4, 2 BMR sets

Garaina; drop Melb 2, 1 Melb set

Malalaua; P/U BMR 7, PNG 3

Blue Sector (continued)

Vehicle

Route: Bereina - Kubuna - Bereina

Load: BMR 2, PNG 2, 1 BMR set

DAY D-4

Personnel location: Tapini 2, Garaina 1, Kerema 1, Bereina 2, Pom 3

Aircraft (B.N. Islander)

Route: Pom - Efogi - Pom

Load: BMR 7, PNG 3, 1 BMR set

Efogi; drop BMR 7, PNG 3, 1 BMR set

Aircraft (B.N. Islander)

Route: Pom - Tapini - Guari - Bereina - Pom

Load: Nil Ex-Pom

Tapina; P/U BMR 5, PNG 4, 1 BMR set

Guari; drop BMR 5, PNG 4, 1 BMR set

Bereina; P/U BMR 2, PNG 2

DAY D-3

Personnel location: Guari 2, Garaina 1, Kerema 1, Efogi 2, Pom 3

Aircraft (B.N. Islander)

Route: Pom - Efogi - Woitape - Pom

Load: Nil Ex-Pom

Efogi; P/U BMR 7, PNG 3

Woitape; drop BMR 7, PNG 3

Blue Sector (continued)

DAY D-2

Personnel location: Guari 2, Garaina 1, Kerema 1, Woitape 2, Pom 3

Aircraft (B.N. Islander)

Route: Pom - Guari - Woitape - Pom

Load: Nil Ex-Pom

Guari; P/U BMR 5, PNG 4

Woitape: P/U BMR 7, PNG 3

4.4.3 RED SECTOR

Personnel: Ripper (BMR 8), Collins (BMR 4), Cleary (ANU 1) Muirhead (ANU 2), Russell (MELB 1), Furumoto (HIG 1), Broyles (HIG 2), Furness (QLD 3), (PNG 5), (PNG 6)

Equipment: 5 BMR sets, 9 ANU sets, 1 Melb sets, 1 HIG set, 1 QLD set.

DAY D-8

Personnel location: Pom 10

Aircraft (DC 3)

Route: Pom - Pop - Pom

Load: Whole Red Sector Party and equipment offload at Pop

Helicopter (B206B)

Route: Pom - Pop

DAY D-7

Personnel location: Pop 10

Helicopter

Route: Pop - Musa - Pop

Red Sector (continued)

Load: ANU 1, Melb 1, 1 ANU set

Musa: drop ANU 1, Melb 1, 1 ANU set

Route: Pop - Namudei - Pop

Load: ANU 2, PNG 5, 1 ANU set

Namudei; drop ANU 2, PNG 5, 1 ANU set

Aircraft (C206)

Route: Pop - Morobe - Pop

Load: Helicopter fuel

Vehicle

Route: Pop - Oro - Pop

Load: BMR 4, QLD 3, 1 BMR set

DAY D-6

Personnel location: Musa 2, Namudei 2, Pop 6

Helicopter

Route: Pop - Namudei - Afore - Musa - Pop

Load: 1 ANU set

Namudei; P/U ANU 2, PNG 5

Afore; drop ANU 2, PNG 5, 1 ANU set

Musa; P/U ANU 1, Melb 1

Route: Pop - Tetebedi - Pop

Load: ANU 1, PNG 6, 1 ANU set

Tetebedi; drop ANU 1, PNG 6, 1 ANU set

Red Sector (continued)

Vehicle

Route: Pop - Killerton - Pop

Load: HIG 1, HIG 2, BMR 8, 1 HIG set

DAY D-5

Personnel location: Pop 6, Afore 2, Tetebedi 2

Helicopter

Route: Pop - Afore - Tetebedi - Pop

Load: Nil Ex-Pop

Afore: P/U ANU 2, PNG 5

Tetebedi: P/U ANU 1, PNG 6

Route: Pop - Karukaru - Pop

Load: ANU 1, BMR 8, 1 ANU set

Karukaru; drop ANU 1, BMR 8, 1 ANU set

Vehicle

Route: Pop - Gorari - Kokoda

Load: BMR 4, PNG 6, 2 BMR sets

Gorari: Set up 1 BMR set

DAY D-4

Personnel location: Pop 4, Karukaru 2, Kokoda 2, Cape Ward Hunt 2

Helicopter

Route: Pop - Ioma - Cape Ward Hunt - Pop

Load: HIG 1, HIG 2, 1 BMR set

Ioma; drop HIG 1, HIG 2, 1 BMR set

Cape Ward Hunt: P/U ANU 2, PNG 5

Red Sector (continued)

Route: Pop - Karunkaru - Pop

Load: Nil Ex-Pop

Karukaru; P/U ANU 1, BMR 8

Aircraft (C206)

Route: Pop - Tufi - Pop

Load: QLD 3, 1 QLD set

Tufi; drop QLD 3, 1 QLD set

Route: Pop - Morobe - Pop

Load: MELB 1, 1 Melb set, 3 ANU sets

Morobe: drop Melb 1, 1 Melb set, 3 ANU sets

Vehicle

Route: Kokoda - Pop

Load: BMR 4, PNG 6

DAY D-3

Personnel location: Pop 6, Tufi 1, Ioma 2, Morobe 1

Aircraft (C206)

Route: Pop - Morobe - Pop

Load: Helicopter fuel

Route: Pop - Ioma - Pop

Load: BMR 4

Ioma: P/U HIG 1, HIG 2 after equipment check by BMR 4

Helicopter

Route: Pop - Morobe - Lake Trist - Morobe

Load: ANU 1, ANU 2, PNG 5, PNG 6

Morobe; P/U 1 ANU set, drop ANU 1, PNG 5

Lake Trist; drop ANU 2, PNG 6, 1 ANU set

Red Sector (continued)

Route: Morobe - Salamaua - Lae

Load: ANU 1, PNG 5, 2 ANU sets

Salamaua; drop ANU 1, PNG 5, 2 ANU sets

DAY D-2

Personnel location: Pop 4, Salamaua 2, Lake Trist 2, Tufi 1, Morobe 1

Helicopter

Route: Lae - Salamaua - Kui - Lake Trist - Kui

Load: Nil Ex-Lae

Salamaua; P/U ANU 1, PNG 5, 1 ANU set

Kui; drop ANU 1, PNG 5, 1 ANU set

Lake Trist; P/U ANU 2, PNG 6

Route: Kui - Morobe - Pop

Load: ANU 1, ANU 2, PNG 5, PNG 6

4.5 Recording Network Servicing

Manned recording stations will be expected to be self-sufficient for the duration of the shooting period at the time of installation.

Unmanned recording stations will be inspected once per week and serviced if necessary. The purpose of this routine is to detect any physical disturbance of the site and any recording system failure.

The inspection and servicing will be conducted by the officers technically responsible for the operation of the equipment and will normally involve vehicle, aircraft, or helicopter sorties from Port Moresby and Popondetta on two days a week. These sorties will be planned and scheduled by H.Q. staff in Port Moresby and Popondetta as the need arises and aircraft charters will be arranged.

4.6 Equipment and Personnel Movements during Shooting Operations

When the shooting vessel is sailing round the southeastern tip of the Papuan mainland it is expected that there will 1-2 days in which to move recording stations and personnel. The following moves are planned:

1. The BMR sets at Yule Is and Owers Corner will be transferred to Finschhafen and Lindenhafen by BMR 7 and BMR 5 using aircraft charter (B.N. Islander)

2. The Qld set at Kwikila will be transferred to Wau by Qld 2 using the same charter.

3. BMR 7 will remain at Lindenhafen, Qld 2 will remain at Wau and BMR 5 will return to Port Moresby with the charter aircraft.

4. ANU 1 and ANU 2 will service all ANU recording equipment and return to Canberra.

The following changes are planned for personnel on board the shooting vessel. After the shots have been fired along traverses A-B-C and A-D-B the vessel will return to Port Moresby and BMR 3 will exchange places on board the Sir Alan with BMR 2.

Similarly once the shot traverses A-E, F-G, H-I and G-I have been completed the Sir Alan will put into Killerton and BMR 2 will exchange places with BMR 4.

4.7 Movements Schedule, Recording Network Demobilization

It is expected that demobilizing the recording network will be accomplished in a much shorter time than it takes to establish the network. The matters which will have to be attended to at each site are as follows:

1. Completion of equipment log, labelling of recording tapes and safe storage of tapes.

2. Dismantling of shelters and packing of equipment.

3. Disposal of surplus materials such as batteries, cable, aerials, etc.

4. Contact with local councillors, PNG Administration officers, etc., to thank them for cooperation.

5. Paying of all locally-hired assistants

At stations which are manned this is not expected to take very long after shooting has been completed. At unmanned stations it could take 1-2 hours.

4.7.1 Green Sector

Personnel: Drummond (BMR 3), Dent (RAB), (PNG 1)

Equipment: 1 RAB set, 4 BMR sets

DAY F + 1

Personnel location: Pom 2, Kupiano 1

Vehicle

Route: Pom - Mt Lawes - Pom

Load: BMR 3, PNG 1

Mt Lawes; P/U 1 BMR set

Aircraft (Beech Baron)

Route: Pom - Kupiano - Cape Rodney - Pom

Load: Nil Ex-Pom

Kupiano: P/U RAB, 1 RAB set

Cape Rodney; P/U 1 BMR set

Route: Pom - Daugo Is - Pom

Load: BMR 3, PNG 1

Daugo Is; P/U 1 BMR set

Green Sector (continued)

DAY F + 2

Personnel location: Pom 3

Vehicle

Route: Pom - Sirinumu Dam - Pom

Load: BMR 3, RAB

P/U 1 BMR set

4.7.2 Blue Sector

Personnel: Ryan (BMR 5), Carr (BMR 6), Parker (BMR 16), Rynn (QLD 2), (PNG 2), Gibson (MELB 2), Petkovic (BMR 7)

Equipment: 10 BMR sets, 1 Qld sets, 2 Melb sets.

DAY F + 1

Personnel location: Pom 3, Kerema 1, Garaina 1, Wau 1, Lindenhafen 1

Aircraft (Beech Baron) Ex-Lae

Route: Lae - Lindenhafen - Finschhafen - Lae

Load: Nil Ex-Lae

Lindenhafen (Gasmata); P/U BMR 7, 1 BMR set

Finschhafen; P/U 1 BMR set

Route: Lae - Wau - Garaina - Pom

Load: BMR 7, 2 BMR sets

Wau; P/U Qld 2, 1 Qld set

Garaina; P/U Melb 2, 1 Melb set

Blue Sector (continued)

Aircraft (B.N. Islander)

Route: Pom - Bereina - Malalaua - Kerema - Malalaua - Bereina - Kubuna - Pom

Load: BMR 5, BMR 6, PNG 2

Bereina; drop BMR 6, PNG 2

Malalaua; drop BMR 5

Kerema; P/U BMR 16, 1 Melb set

Malalaua; P/U BMR 5, 1 BMR set

Bereina; P/U BMR 6, PNG 2, 1 BMR set

Kubuna; P/U 1 BMR set

DAY F + 2

Personnel location: Pom 7

Aircraft (B.N. Islander)

Route: Pom - Woitape - Tapini - Guari - Tapini - Woitape - Pom

Load: BMR 5, BMR 6, BMR 16

Woitape; drop BMR 16

Tapini; drop BMR 6

Guari; P/U 1 BMR set

Tapini; P/U BMR 6, 1 BMR set

Woitape; P/U BMR 16, 1 BMR set

DAY F + 3

Personnel location: Pom 7

Aircraft (B.N. Islander)

Route: Pom - Efogi - Pom

Load: BMR 5, BMR 6

Efogi; P/U 1 BMR set

Blue Sector (continued)

Route: Pom - Aroa - Pom

Load: BMR 5, BMR 6

Aroa; P/U 1 BMR set

4.7.3 Red Sector

Personnel: Ripper (BMR 8), Connelly (BMR 2), Furumoto (HIG 1), Broyles (HIG 2), Russell (Melb 1), Furness (QLD 3), (PNG 5)

Equipment: 5 BMR sets, 9 ANU sets, 1 HIG set, 1 MELB set, 1 QLD set.

DAY F + 1

Personnel distribution: Pop 5, Tufi 1, Morobe 1

Aircraft (Cessna 206)

Route: Pop - Tufi - Pop

Load: Nil Ex-Pop

Tufi; P/U QLD 3, 1 QLD set.

Helicopter

Route: Pop - Morobe - Lake Trist - Kui - Salamaua - Kui - Morobe

Load: HIG 2

Morobe; P/U MELB 1

Lake Trist; P/U 1 ANU set

Kui; drop 1 ANU set, HIG 2

Salamaua; P/U 1 ANU set

Kui; P/U HIG 2, 2 ANU sets

Red Sector (continued)

Vehicle

Route: Pop - Killerton - Pop

Load: HIG 1, PNG 5

Killerton: P/U HIG set

Route: Pop - Oro - Pop

Load: BMR 2

Oro: P/U 1 BMR set

DAY F + 2

Personnel location: Pop 5, Morobe 2

Aircraft (C206)

Route: Pop - Morobe - Pop

Load: BMR 2, PNG 5

Morobe: drop PNG 5, BMR 2

P/U 3 ANU sets, 1 MELB set, HIG 2, MELB 1

Helicopter

Route: Morobe - Cape Ward Hunt - Ioma - Pop

Load: BMR 2, PNG 5

Cape Ward Hunt; P/U 1 ANU set

Ioma: P/U 1 BMR set

Vehicle

Route: Pop - Gorari - Kokoda - Pop

Load: BMR 8, HIG 1, Heli fuel

Gorari: P/U 1 BMR set

Kokoda: P/U 1 BMR set

Drop heli fuel

Red Sector (continued)

DAY F + 3

Personnel location: Pop 7

Helicopter

Route: Pop - Tetebedi - Namudei - Pop

Load: BMR 8, MELB 1

Tetebedi; P/U 1 ANU set

Namudei; P/U 1 ANU set

Route: Pop - Musa - Afore - Pop

Load: BMR 8, MELB 1

Musa: P/U 1 ANU set

Afore: P/U 1 ANU set

DAY F + 4

Personnel location: Pop 7

Helicopter

Route: Pop - Karukaru - Kokoda - Pom

Load: BMR 2, MELB 1

Karukaru; P/U 1 ANU set

Kokoda; refuel

Aircraft (DC 3)

Route: Pom - Pop - Pom

Load: Nil Ex-Pop

Pop; P/U 5 BMR sets, 8 ANU sets, 1 HIG set, 2 MELB sets, 5 persons.

5. COMMUNICATIONS

5.1 Mail, Telephone and Telegrams

Official and personal mail may be sent to the address given belowand will be collected daily by H.Q. staff and distributed at the earliest opportunity.

Name
C/- E. Papua Crustal Survey,
Box 7123 P.O.,
BOROKO, PNG.

Useful telephone numbers are listed below.

H.Q.,	Queenscliffe St, Korobosea.	Tel. 56439
PNG Geol. Survey,	Elanese Rd, Konedobu	Tel. 44128
BMR Observatory,	Lawes Rd, Konedobu	Tel. 44458
Geophysical Observatory,	Table Top	Tel. 56215

The telegraphic address of the survey H.Q. is; "BUROMIN, PORT MORESBY, FOR EAST PAPUA CRUSTAL SURVEY".

Provided H.Q. is given the authority in advance, personal telegrams can be sent and received during general survey radio schedules. This service should be reserved for urgent messages only.

5.2 Radio Communications

Each independent survey party will be equipped with an Codan SSB transceiver. In the case of H.Q. offices at Port Moresby/Popondetta and on board theL/C Sir Alan they will be 100-watt type and in the case of mobile parties they will be of 25-W type. Those persons required to use this equipment should seek advice on how to use it before leaving Port Moresby.

The call signs for the survey are VJ/8JA 1, 2.....18 , which will be shortened to 8JA-1,2.....18 for regular use. The call sign allotted to a particular set of equipment will be labelled on the transceiver control panel. The call signs of the larger transceivers are

H.Q. Port Moresby	8JA 1	("MORESBY BASE")
L/C Sir Alan	8JA 2	("SIR ALAN")
H.Q. Popondetta	8JA 3	("POPONDETTA")

The call signs of mobile parties are given in chapter 3.3 along with the other equipment specifications. The phonetic alphabet should be used when calling up stations. This is written in the lid of the Codan transceivers (call signs "EIGHT JULIET ALPHA" etc.).

There will be network communication tests on the day indicated in Table 1. This network test will follow the procedure detailed below for the three general communication schedules which are programmed for each day after the L/C Sir Alan leaves Port Moresby for shooting operations.

DAILY COMMUNICATIONS SCHEDULES

Times: 07.30, 11.30 and 16.30 E.S.T.

Frequency: 4525 kHz

Moresby Base (8JA 1) will call the Sir Alan (8JA 2). All parties are expected to listen in to this traffic which will include details of the intended shooting schedule for the next 24 hours. After this call is finished, Moresby Base will call up stations 3.....18 to ascertain whether they have any questions regarding the shooting schedule or any other matter.

Example of Procedure.

Time	Transmit Station	Receive Station	Message
07.30	H.Q.	Ship	8JA2 Sir Alan. This is 8JA1 Moresby Base. How do you read me over?
	Ship	H.Q.	8JA1 Moresby Base. Read you strength (1 - 5). Proposed shooting program for next 24 hours is as follows:..... .....Over

H.Q.	Ship	Roger. Do you have any other traffic? Over.
Ship	H.Q.	Moresby Base. No more traffic. Over and out.
H.Q.	Popondetta	8JA3 Popondetta. This is Moresby Base. How do you read me? Over.
Popondetta	H.Q.	Moresby Base. Read you strength (1 - 5). Received all ship traffic. Over and out.
H.Q.	.....	8JA4. This is Moresby Base .....etc.

The phrases used in routine communication must be as shown. General communication messages must be as brief as possible.

As a general rule, parties should reserve the 7.30 and 16.30 radio schedules for shot-firing information and other essential traffic. The 11.30 schedule should be used for general traffic, supply requirements, notification of future aircraft movements, personal traffic through H.Q. etc. There is no objection to inter-party communication provided this avoids daily schedule times and shot times.

On the hours following the network communication tests on the day indicated in Table 1 (i.e. at hours 08.00, 12.00, and 17.00 E.S.T.) there will be a test of communications for shot firing. Communications at this time will be according to the procedure set out below and will involve the shooting ship and the SHORAN navigation network. Recording parties should listen only.

SHOT-FIRING COMMUNICATIONS

Example of Procedure

If it is proposed to fire a shot at 09.05 the communications will be as follows

Time	Transmit Station	Receive Station	Message
08.45	Ship	All parties	All 8JA stations. This is 8JA2 Sir Alan. A.....can shot will be fired at 09.05 approximately. (repeated several times). Over and out.
09.00	SHORAN	NETWORK COMMUNICATIONS	
09.15	Ship	All parties	All 8JA stations this is 8JA2 Sir Alan. A.....can shot was successfully fired at 09.05 approx. The next proposed shot is of .....cans at .....E.S.T. Over and out.

There are a number of contingencies which could occur in the communications network operation.

1. The transmissions from the H.Q. network are not good enough. In this case the transmissions will be transferred to the I.P.S. Collins transceiver at BMR Table Top Observatory until the H.Q. transmitter can be improved.

2. The H.Q. transmissions are not being received or H.Q. cannot receive transmissions from the other side of the Owen Stanley Ranges. In this case the Popondetta office will assume the role of H.Q. with the purpose of transferring messages to and from Port Moresby by telephone. Shot-time information will be re-broadcast by Port Moresby office at the end of the Daily Communication Schedules.

5.3 Supplies

Parties should attempt to deploy all essential supplies during the survey mobilization period. However, further essential supplies can be deployed from Port Moresby by either commercial airlines or charter aircraft. The consigning of these supplies will be the responsibility of H.Q. staff.

5.4 Time Signals

It is essential for this survey that a common time standard is maintained. This will be derived from the VNG radio time signal. All recording stations and the shooting ship must be equipped with radio receivers capable of recording VNG on 10 kHz. This frequency is the most reliable during the daylight hours in Papua New Guinea. A chronometer should also be connected to recording equipment to preserve timing accuracy during periods of poor radio reception.

6. ACCOMMODATION

Notes on accommodation at sites are contained in the site files. At recording stations where personnel are required to stay throughout the survey, accommodation will be provided and the type of accommodation is listed in Table 5. At unmanned stations where overnight accommodation only is required, the advice given in the site files should be followed. The standard of overnight accommodation will vary but it is probably wise to carry the equipment listed in chapter 4.1.

7. HELICOPTER GRAVITY OPERATIONS

One of the objectives set down in 1.1 is to record gravity changes across the tectonic plate boundary between the Solomon Sea and Australian plates.

Some gravity work has previously been carried out in East Papua, but large gaps totalling about 2½ map sheets in area at present exist within the survey boundaries. The 1:250 000 map sheets involved, either in whole or in part, are AROA, BUNA, PORT MORESBY, SALAMAUA, TUFI, and YULE.

It is proposed that the gravity work on this survey be undertaken during those periods when the helicopter is not involved in servicing runs to recording sites. Work will commence on the Port Moresby sheet at the earliest opportunity and will extend to adjoining sheets as coverage is completed. The operating base for the gravity survey will be progressively moved from Port Moresby to cut down the daily transit time, but the helicopter will remain in constant contact with H.Q. in the event of a maintenance run to a seismic site being necessary.

Mr D.A. Coutts of Regional Gravity Group will be responsible for the gravity operation and will be attached to the crustal survey from mid-September to mid-November for the purpose. He will be joined by Mr J.C. Allen of Seismic, Gravity, and Marine Group early in November as part of a training exercise for the latter.

8. GENERAL

8.1 Climate

The months of October and November are in the doldrum period after the southeast trade winds have ceased and before the northwest monsoon season begins (about Christmas). These survey months have been chosen to coincide with the probable period of best sea conditions coinciding with reasonable flying weather along the Papuan Peninsula.

The climate at that time of year should not be unpleasant or unhealthy but some rain should be expected and nights in the Owen Stanley Ranges will be quite cool.

8.2 Population

The survey area has a considerable expatriate Australian population but with approaching self-government on 1 Dec 1973 an increasing number of government officials are indigenous inhibitants. English is widely spoken in the town but Motu, Pidgin, and numerous dialects are spoken in villages although at most sites being used for this survey there are English-speaking Administration officers, teachers etc. However an Administration assistant will accompany geophysicists to the more remote sites.

There is a wide spectrum of cultural development and education in the local population and, inevitably, natural community groups occur which respect the tastes and customs of others. The stranger need have no fear of causing offence if he adopts the behaviour pattern of the mixed community in which he finds himself.

Tipping is not practised except for a special service and in some circumstances cigarettes and tobacco are more welcome. Rates of pay for casual labour should be worked out with Administration officers or plantation staff.

Accidents do happen, and where this involves personal injury and the indigenous population it is prudent to remember that Australian 'rules' don't always apply. In such circumstances it is advisable to seek the immediate assistance of Administration officers even if this delays survey work.

8.3 Clothing

Shorts and short-sleeved shirts are common wear by day and in town these are are accompanied by long stockings and shoes. At night, long trousers and long-sleeved shirts are commonly worn as a protection against mosquitoes. In town, a tie and long trousers are customarily worn in the evening in some hotels.

8.4 Health

Apart from the usual injections essential before entering tropical climates (Typhoid, Tetanus, Smallpox, Cholera), it is necessary to take an anti-malarial prophylactic throughout the time spent in PNG and for at least one month after leaving. Chloroquine tablets will be issued to personnel in Port Moresby.

A good antiseptic (Savlon), Elastoplast, and insect repellent should be included in personal kit. Minor cuts should be treated; otherwise they go septic very easily.

Reliable drinking water should be used (rain water).

8.5 Travel Arrangements to and from Port Moresby

The party leaders from the participating organizations are responsible for seeing that personnel assemble in Port Moresby in time to prepare their equipment in readiness for the start of the survey.

Requests for the reservation of accommodation prior to the start of the project and on return to Port Moresby should be sent to the Party Leader at survey H.Q. before the end of September.

Each individual must have an Entry Permit obtainable from the Dept of External Territories, Canberra or from the nearest Australian Consulate. Airlines will not accept passengers without an entry permit.

8.6 Survey Briefing

A survey briefing will be held at survey H.Q. on Friday 5 October at 3 p.m. All party leaders and geophysicists will be required to attend.

8.7 Dispersal

Party leaders will be responsible for seeing that all their equipment is packed and consigned to their own establishments. Special care should be taken with survey records, tapes, logbooks etc. They will also be responsible for making travel reservations for their personnel. The H.Q. staff will assist with these jobs where possible. Personnel leaving the survey area should notify survey H.Q.

9. REFERENCES

FINLAYSON, D.M., 1971 - Preview Report, East Papua Crustal Survey. Bur. Miner. Resour. Aust. Rec. 1971/118 (unpubl.).

TABLE 1

SURVEY SCHEDULE

Day D-28	Advance Party arrives Port Moresby, Office open. Customs clearance of equipment
D-19	Ship fitting out party arrives Port Moresby
D-14	Shooting vessel on hire. Fitting out begins
D-12	Survey personnel arrive Port Moresby. Customs clearance of equipment
D-11	Survey personnel arrive Port Moresby. Customs clearance of equipment
D-10	All survey personnel Port Moresby. Survey briefing, 3 p.m.
D-9	Equipment assembly
D-8	RED Sector station mobilization begins
D-7	GREEN & BLUE Sectors station mobilization begins. SHORAN deployment
D-6	
D-5	Sir Alan sails for "shakedown" cruise
D-4	SHORAN tests
D-3	Communications tests 07.30, 11.30, 16.30. Sir Alan returns Port Moresby
D-2	
D-1	Recording network mobilization complete
D	Sir Alan sails Port Moresby. First shot fired (Target date 15 Oct)
D + 8	Shooting lines A-B-C, B-D, D-A completed, Sir Alan calls Port Moresby
D + 11	Shooting line A-E completed
D + 12	Personnel and equipment moves
D + 14	Shooting line F-G complete
D + 20	Shooting lines H-I, G-I completed, Sir Alan calls Killerton

Day F = D + 28	Shooting lines I-J, J-K, J-L, L-M, L-N completed, Sir Alan heads for Port Moresby
F + 2	SHORAN system shut down
	GREEN Sector demobilization complete
F + 3	BLUE Sector demobilization complete
F + 4	RED Sector demobilization complete. Sir Alan returns Port Moresby.

TABLE 2

PROPOSED SHOT POSITIONING

SHORAN STATIONS	SHOT	SIZE	POSITION	
Mt LAWES - GUBBINS Pt.	1	1028 kgm	9° 34'S	147° 02'E
	2	181	9 31	146 55
	3	1028	9 26	146 48
	4	181	9 25	146 46
	5	181	9 22	146 42
	6	1028	9 19	146 41
	7	181	9 14	146 35
	8	181	9 09	146 29
	9	1028	9 02	146 26
GUBBINS Pt - KEREMA (Mt LAWES MOVES TO HOOD PT)	10	181	8 58	146 21
	11	181	8 54	146 17
	12	1028	8 49	146 15
	13	181	8 44	146 08
	14	181	8 38	146 04
	15	1028	8 32	146 00
	16	1028	8 17	145 46
	17	1028	8 15	145 23
	18	181	8 59	146 17
	19	1028	9 03	146 15
	20	181	9 08	146 11
	21	181	9 13	146 08
	22	1028	9 17	146 05
	23	1028	9 36	145 52
GUBBINS Pt - HOOD Pt (KEREMA MOVES TO Mt LAWES)	24	1028	9 56	145 39
	25	1028	10 16	145 25
	26	1028	10 39	145 08

TABLE 2 (continued)

	27	1028	11	00	145	00
	28	1028	10	48	145	14
	29	1028	10	37	145	30
	30	1028	10	23	145	52
	31	1028	10	09	146	13
Mt LAWES - HOOD Pt (GUBBINS Pt MOVES TO SPEAR ISLAND VIA TUFI)	32	1028	9	56	146	32
	33	181	9	52	146	37
	34	181	9	47	146	44
	35	1028	9	43	146	50
	36	181	9	40	146	53
	37	181	9	37	146	58
	38	181	9	39	147	07
	39	181	9	43	147	12
	40	1028	9	47	147	17
	41	181	9	52	147	20
	42	181	9	59	147	24
	43	1028	10	03	147	32
	44	181	10	08	147	38
Mt LAWES MOVES TO KILLERTON VIA POP.	45	181	10	10	147	45
HOOD Pt MOVES TO CAPE CRETIN VIA FINSCHHAFEN.	46	1028	10	11	147	52
	47	1028	10	19	148	23
SHOTS 45 - 53 INCLUSIVE	48	1028	10	24	148	58
FIXED BY HYDRODIST TO KNOWN POSITION MARKERS.	49	1028	10	32	149	34
	50	1028	9	42	150	42
	51	1028	9	38	150	05
	52	1028	9	32	149	45
	53	1028	9	09	149	26
KILLERTON - SPEAR ISLAND	54	1028	8	53	149	26
	55	1028	8	37	149	26

TABLE 2 (continued)

KILLERTON - SPEAR ISLAND - CAPE CRETIN	56	1028	7	00	150 00
	57	1028	7	15	149 45
	58	1028	7	30	149 30
	59	1028	7	45	149 15
	60	1028	8	00	149 00
	61	181	8	05	148 55
	62	181	8	10	148 50
	63	1028	8	15	148 45
	64	181	8	18	148 41
	65	181	8	21	148 38
	66	1028	8	26	148 34
	67	181	8	31	148 29
	68	1028	8	34	148 33
	69	181	8	38	148 35
	70	181	8	42	148 37
	71	181	8	46	148 41
	72	1028	8	50	148 44
	73	181	8	52	148 49
	74	181	8	54	148 54
	75	1028	8	54	149 01
	76	181	8	54	149 06
	77	181	8	20	148 20
	78	1028	8	13	148 16
	79	181	8	07	148 14
	80	1028	8	01	148 11
	81	181	7	55	148 16
	82	181	7	50	148 21
	83	1028	7	45	148 28

TABLE 2 (continued)

KILLERTON MOVES TO CAPE WARD HUNT

84	181	7 40	148 34
85	181	7 35	148 39
86	1028	7 30	148 45
87	181	7 55	148 05
88	181	7 51	147 52
89	1028	7 45	147 44
90	181	7 41	147 40
91	181	7 36	147 35
92	1028	7 33	147 34
93	181	7 32	147 30
94	181	7 27	147 24
95	1028	7 23	147 19
96	181	7 21	147 17
97	181	7 17	147 14
98	1028	7 14	147 13
99	181	7 10	147 10
100	181	7 07	147 07
101	1028	7 03	147 05
102	181	6 56	147 01
103	1028	6 49	147 00
104	181	7 21	147 22
105	181	7 18	147 25
106	1028	7 16	147 28
107	181	7 13	147 31
108	181	7 09	147 33
109	1028	7 05	147 35
110	1028	6 35	147 44
111	1028	6 36	147 53

TABLE 2 (continued)

112	1028	6	25		148	03
113	1028	6	10		148	12

SHORAN STATIONS REMAIN OPERATIONAL UNTIL SIR ALAN FINISHES SPARKER TRAVERSING IN SOLOMON SEA.

TABLE 3

SURVEY PERSONNEL CODING

BMR 1	Finlayson	HIG 1	Furumoto
" 2	Connelly	" 2	Broyles
" 3	Drummond	" 3	Ichenose
" 4	Collins	" 4	Mitiguy
" 5	Ryan		
" 6	Carr	RAB	Dent (or McKee)
" 7	Petkovic	SUR	Ingham (or other)
" 8	Ripper		
" 9	Mann	SHOR 1	Navigation Aust. Pty Ltd
" 10	Cherry	" 2	" " " "
" 11	Spence	" 3	" " " "
" 12	Sommerville	" 4	" " " "
" 13	Wiebenga	" 5	" " " "
" 14	Coutts		
" 15	Allen	PNG 1	PNG Administration Staff
" 16	Parker	" 2	" " "
QLD 1	Webb	" 3	" " "
" 2	Rynn	" 4	" " "
" 3	Furness (or other)	" 5	" " "
		" 6	" " "
ANU 1	Cleary		
" 2	Muirhead		
MELB 1	Russell		
" 2	Gibson		

TABLE 4

EQUIPMENT AND PERSONNEL LOCATION DURING SHOOTING OPERATIONS

	CORAL SEA SHOTS	SOLOMON SEA SHOTS
PORT MORESBY (radio 8JA 1)	Observatory (BMR 1, BMR 2/3, BMR 5, BMR 6, BMR 7, BMR 12, QLD 1, HIG 3, HIG 4)	Observatory (BMR 1, BMR 2/3, BMR 5, BMR 6, BMR 12, QLD 1)
DAUGO ISLAND	1 BMR Set	1 BMR Set
AROA	1 BMR Set	1 BMR Set
YULE ISLAND	1 BMR Set	
KUBUNA	1 BMR Set	1 BMR Set
BEREINA	1 BMR Set	1 BMR Set
MALALAUA	1 BMR Set	1 BMR Set
KEREMA (8JA 4)	1 MELB Set (BMR 16)	1 MELB Set (BMR 16)
GUARI	1 BMR Set	1 BMR Set
TAPINI	1 BMR Set	1 BMR Set
WOITAPE	1 BMR Set	1 BMR Set
EFOGI	1 BMR Set	1 BMR Set
KUPIANO (8JA 5)	1 RAB Set (RAB)	1 RAB Set (RAB)
CAPE RODNEY	1 BMR Set	1 BMR Set
TUFI (8JA 6)	1 QLD Set (QLD 3)	1 QLD Set (QLD 3)
NAMUDEI	1 ANU Set	1 ANU Set
AFORE	1 ANU Set	1 ANU Set
TETEBEDI	1 ANU Set	1 ANU Set
KOKODA	1 BMR Set	1 BMR Set
POPONDETTA (8JA 3)	1 BMR Set (BMR 8, BMR 4, ANU 1, ANU 2)	1 BMR Set (BMR 8, BMR 2/4)
ORO	1 BMR Set	1 BMR Set
KILLERTON (8JA 8)	1 HIG Set (HIG 1, HIG 2)	1 HIG Set (HIG 1, HIG 2)

TABLE 4 (continued)

IOMA	1 BMR Set	1 BMR Set
MOROBE (8JA 9)	1 MELB Set (MELB 2)	1 MELB Set (MELB 2)
GARAINA (8JA 10)	1 MELB Set (MELB 3)	1 MELB Set (MELB 3)
KUI	1 ANU Set	1 ANU Set
WAU (8JA 11)		1 QD Set (QLD 2)
SALAMAUA	1 ANU Set	1 ANU Set
FINSCHHAFEN		1 BMR Set
LINDENHAFEN (8JA 12)		1 BMR Set (BMR 7)
LAE	Observatory	Observatory
ESA ALA	Observatory	Observatory
LAKE TRIST	1 ANU Set	1 ANU Set
MUSA	1 ANU Set	1 ANU Set
CAPE WARD HUNT	1 ANU Set	1 ANU Set
KWINKILA (8JA 11)	1 QLD Set (QLD 2)	
SIRINUMU DAM	1 BMR Set	1 BMR Set
MT LAWES	1 BMR Set	1 BMR Set
OWERS CORNER	1 BMR Set	
KARUKARU	1 ANU Set	1 ANU Set
GORARI	1 BMR Set	1 BMR Set
LAMINGTON	Observatory	Observatory
IRON RANGE	BMR Observatory	
COEN	QLD Observatory	
SHOOTING VESSEL (radio 8JA 2)	BMR 9	BMR 9
	BMR 10	BMR 10
	BMR 3/2	BMR 2/4
	SUR 1	SUR 1
	SHOR 5	SHOR 5

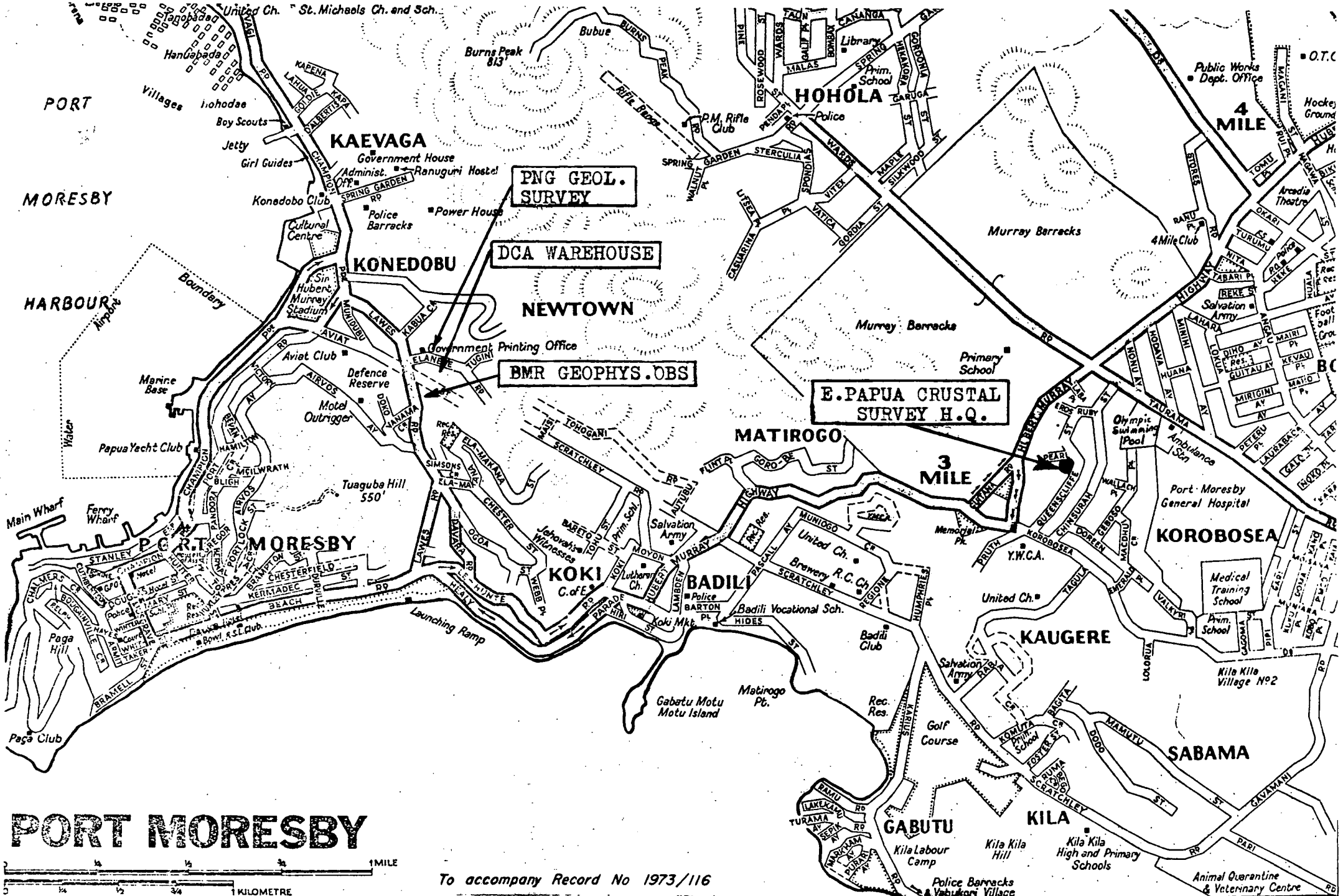
TABLE 4 (continued)

SHORAN		
MT LAWES (HOOD PT) (8JA 13)	SHOR 2	
KEREMA (MT LAWES) (8JA 14)	SHOR 3	
GUBBINS PT (8JA 15)	SHOR 4	
PORT MORESBY H.Q. (8JA 1)	SHOR 1	SHOR 1
FINSCHHAFEN (8JA 14)		SHOR 3
KILLERTON (CAPE WARD HUNT) (8JA 13)		SHOR 2
TUFI (SPEAR ISLAND) (8JA 15)		SHOR 4
REGIONAL GRAVITY		
PORT MORESBY (8JA 1)	BMR 13	BMR 13
HELICOPTER (8JA 16)	BMR 14	BMR 14/15

TABLE 5

ACCOMMODATION

STATION	ACCOMMODATION		REMARKS
PORT MORESBY	Hotel	approx.	$20-24 bed + 3 meals
	Hostel		$ 8-10 per day
	House (H.Q.)		cost of meals + laundry
KEREMA	Hotel		$20-24 bed + 3 meals or $8-10 (Admin.)?
KUPIANO	Guest House		$18-20 ? bed + 3 meals or $8-10 (Admin.) ?
TUFI	Guest House		$18-20 ? bed + 3 meals or $8-10 (Admin.)
POPONDETTA	Hotel	approx.	$20-24 bed + 3 meals
	House (H.Q.)		cost of meals + laundry
MOROBE	Admin. Guest House		$8-10
GARAINA	Tea Plantation		$8-10
WAU	Hotel	approx.	$20-24 bed + 3 meals or $8-10 (Admin.) ?
LINDENHAFEN	Mission		$8-10
KWIKILA	Hotel		$18-20 ? bed + 3 meals $ 8-10 (Admin.).



To accompany Record No 1973/116

PLATE I

EAST PAPUA CRUSTAL SURVEY

SHOT AND STATION PLANNING MAP

TRAVERSE SHOOTING ORDER

TRAVERSE	
	A – B – C
	B – D – A
	A – E
	F – G
	H – I
	G – I – J
	J – K
	J – L – N
	L – M

LEGEND

- Named place
- DCA Aerodrome
- CA Aerodrome
- Private landing area (commercial operations permitted)
- Private landing area (commercial operations not permitted)
- Restricted landing area
- 26 Recording station site and number
- Shot location (1000 kg)
- Shot location (180 kg)
- SHORAN SITE

100 50 0 100 200 KILOMETRES

To accompany Record No. 1973/116

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