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DIVISION OF NATIONAL MAPPING
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NATMAP

TECHNICAL REPORT 24

CRUSTAL MOVEMENT SURVEY
ST GEORGES CHANNEL – PAPUA NEW GUINEA - 1975

by

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CANBERRA, AUSTRALIA.
1976

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ABSTRACT

Following an inspection of the St Georges Channel area in 1968 by a geologist from the Bureau of Mineral Resources and a surveyor from the Division of National Mapping, it was decided to go ahead with a complete crustal movement survey across the Channel.

In 1973 some Geodimeter test lines were measured in the area to determine the maximum range of the model 8 Geodimeter under local tropical conditions and in 1974 the concrete observing pillars were placed at the seven selected control stations.

Finally, in 1975, the first crustal movement survey was carried out. This report describes the techniques used in that survey and lists the results of the horizontal and vertical adjustments.

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1. INTRODUCTION

As explained in the Introduction to Technical Report 18 (TR18) by Cook and Murphy (1974), geologists from the Bureau of Mineral Resources selected two sites in Papua New Guinea where accurate surveys of the order of 1ppm, if repeated on a regular basis, would greatly assist in the study of crustal movements across plate boundaries. These sites were the west Markham Valley and the St Georges Channel.

A preliminary network was designed for the St Georges Channel survey area but some of the lines were of the order of 60 km and there was some doubt as to whether the Model 8 Geodimeter could measure lines of this length under tropical conditions. To resolve the problem a small party visited the area in September 1973, after the first Markham Valley Crustal Movement survey, and measured six test lines between proposed control station sites. As a result of this work the network was adopted with a few minor alterations. In 1974 the survey pillars were constructed and all necessary clearing carried out for access and intervisibility.

This report describes the first St Georges Channel crustal movement survey which was carried out in June/July 1975, immediately after the second survey of the Markham Valley network. Like the latter, this survey was done solely by trilateration techniques.

The equipment and techniques used for the distance measurements were identical to those used in the Markham Valley surveys described in TR18 and by Sloane and Steed (1976) in Technical Report 23 (TR23), and will not be described in this report.

2. GEOLOGICAL BACKGROUND by D.Denham, Bureau of Mineral Resources

Recent geophysical and geological work has shown that the surface of the Earth is divided up into a series of comparatively rigid plates all moving relatively to one another. The plates can be several thousand kilometres across and are about 100 km thick.

The Papua New Guinea region contains the zone of interaction between the large Australian and Pacific Plates, which are converging there at about 10 cm/yr. However, these two major plates do not meet at a single boundary, instead there are several small plates, each separated by active margins.

The New Britain-New Ireland region contains a triple junction between the South Bismarck, Solomon Sea, and Pacific plates (see figure 1). The area is tectonically very active with a high level of seismicity and several active volcanoes. Hence it is expected that the relative rate of movement between New Britain and New Ireland should be several centimetres per year.

These high rates are supported by the presence of active faults trending northwest across the southern part of New Ireland and St Georges Channel; most of these faults are thought to be left-lateral strike-slip.

The geodimeter survey across St Georges Channel should enable the rate of movement between the two islands to be measured precisely.

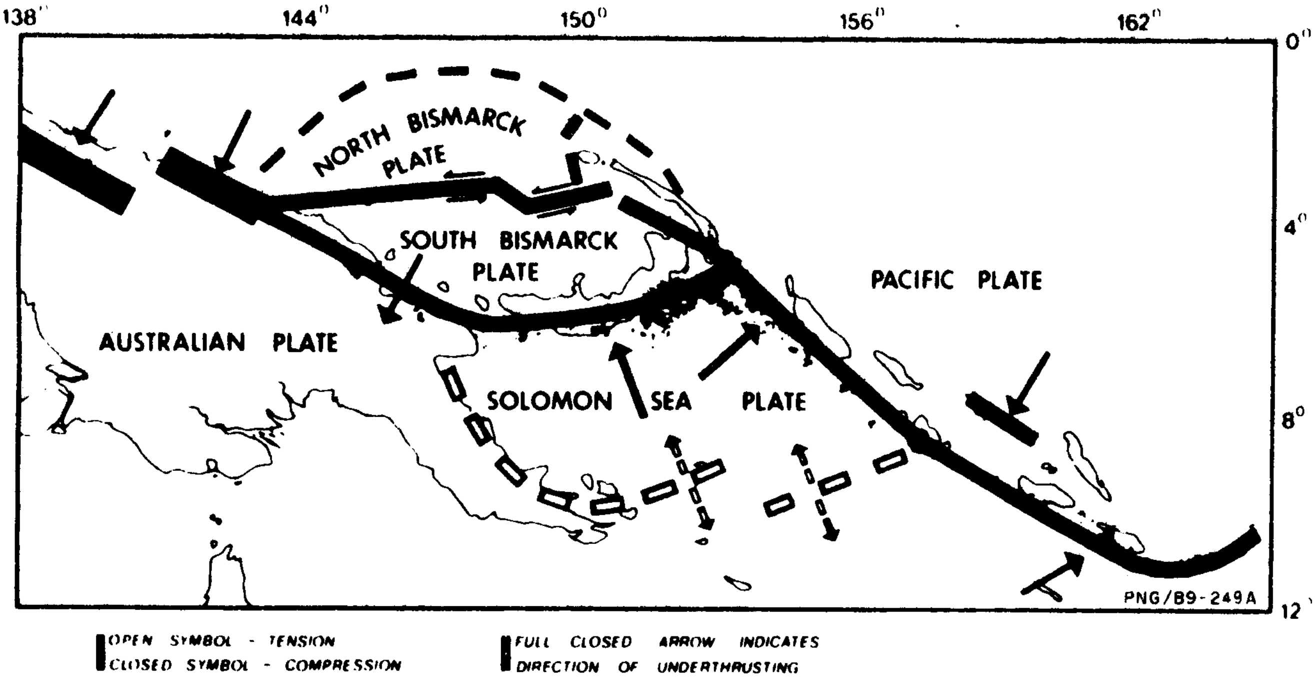

Figure 1

Location of Plates in the Papua New Guinea area.

3. GENERAL INFORMATION

3.1 Area description

The survey network covers the northern part of St Georges Channel, with New Britain on the western side, New Ireland on the eastern side and the Duke of York Island in the centre. (See Figure 2).

Unlike the Markham Valley, there is very little uniformity or symmetry about the topography of this area. Most of the lines are across water, but some are across land and some are across land and water. The stations vary in elevation from 63 m at Put Put (NM/J/41) to 690 m at Mother (NM/J/43) and the vegetation varies from mixtures of kunai grass and coconut trees on New Britain to dense rain forest at all the New Ireland stations.

3.2 Selection of stations

In 1968, Mr P. Hohnen, a geologist from the BMR, and Mr A. Roelse, a surveyor from the Division of National Mapping carried out a joint reconnaissance of the St Georges Channel area and they selected seven control station sites which satisfied the geological and surveying criteria.

ST GEORGES CHANNEL
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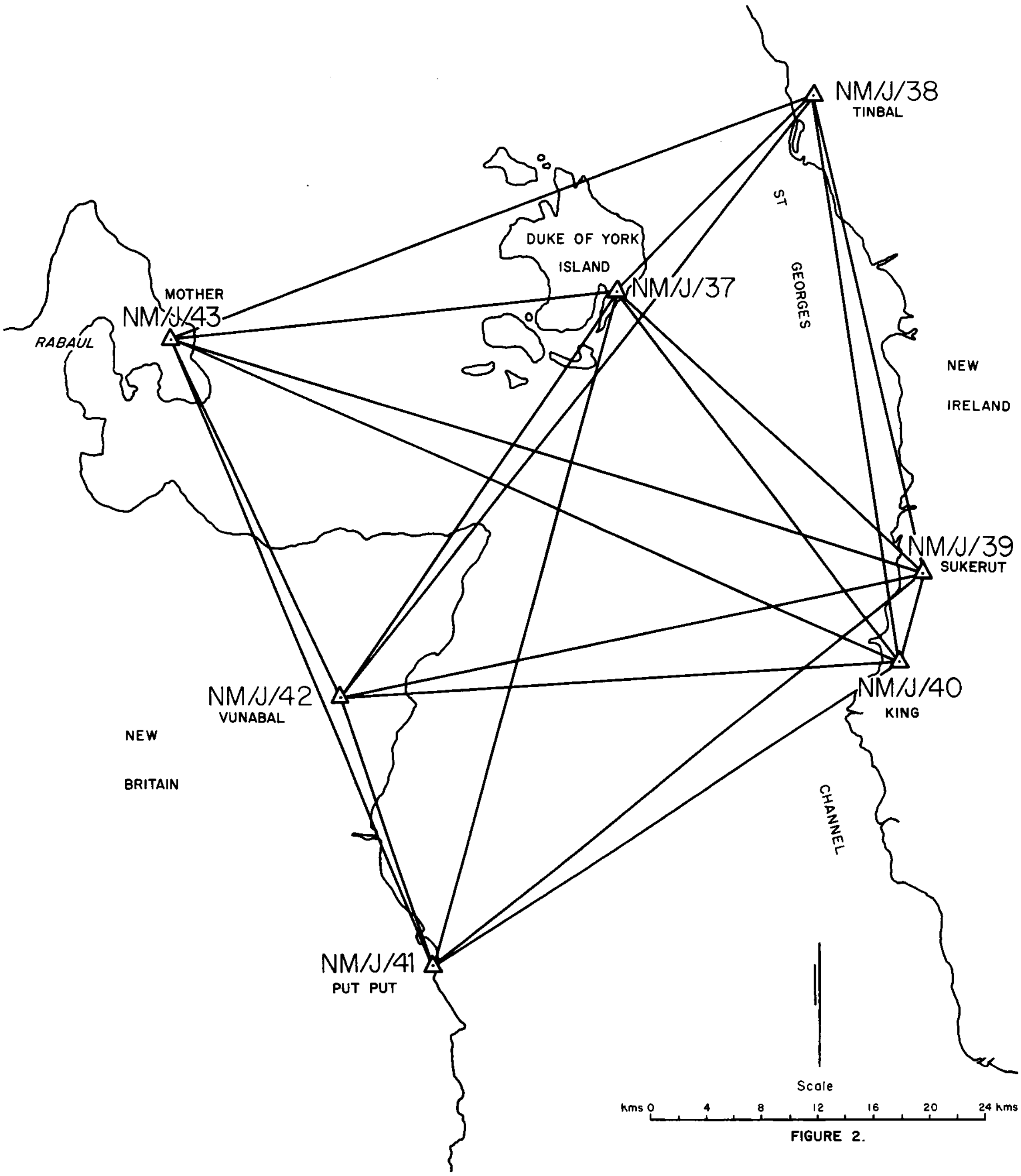

FIGURE 2.

However, as a result of the test measurements carried out in 1973, two of these sites were reselected. Vunabal (NM/J/42) was moved about 100 m to the west as it was discovered that a network of wartime tunnels undermined the previous site, possibly making it unstable; and Tinbal (NM/J/38) was moved further up the ridge to avoid the sloping site previously selected.

3.3 Land tenure

An annual rental was negotiated with the landowners of the station sites by the Department of Lands, Surveys and Mines in 1973. Additional compensation was made for the destruction of cash crops such as coconut trees.

This arrangement appeared to be satisfactory as no complaints were received by any member of the 1975 survey party with regard to rental payments or access to land.

3.4 Marking

A pillar and three recovery marks were built at each of the seven stations in the network. The designs of the marks were identical to those used in the Markham Valley (see TR18, paragraph 3.4) and all the marks were fastened to bedrock.

The construction of the marks was carried out by the PNG Department of Public Works in 1974.

3.5 Transport

Vehicular transport consisted of a four-wheel-drive station wagon and a small sedan. The former was used for access to Vunabal and Put Put while the latter was used for transport in Rabaul.

The supply boat that runs between Rabaul and the Duke of York Island was used on several occasions to ferry men and fuel across to York (NM/J/37) from Rabaul. A small power-boat belonging to the Department of Lands, Surveys and Mines was also used on several occasions to ferry men and equipment from the mouth of the Warrengoi river to Put Put.

The main form of transport was a Bell 47G3BI helicopter which was hired on a period contract from Helitrans, an Australian company based in Cairns and operating in PNG. About 80 hours were involved in this contract.

3.6 Access

All stations were accessible by helicopter except Put Put where further clearing was required. As this was not possible in the time available, the pilot used an airstrip to the north of the station and all equipment and personnel was moved from there to the station by motor vehicle.

On New Britain, stations Put Put and Vunabal were accessible by conventional motor vehicle and the Mother could be climbed on foot in about two hours. The station on the Duke of York Island could be reached by a combination of boat and tractor transport. The New Ireland stations could be reached by foot from the coast in an emergency, but as this manner of access was extremely difficult with a load, these stations should be regarded as helicopter access only.

Regrowth at all stations was very rapid and much thought will have to be given to the clearing of station sites and helicopter pads before another survey is attempted.

3.7 Local departments

As with the other Crustal Movement surveys in Papua New Guinea, valuable assistance was received from the local government departments.

The Plant and Transport Authority hired two motor vehicles to the survey party and supplied six 12 volt car batteries on a loan basis.

The Department of Lands, Surveys and Mines, in Rabaul, provided a storeroom for the equipment and battery charging facilities as well as supplying camping equipment, a motor boat and extra manpower when it was available.

3.8 Weather

The weather was generally fine at the station sites, but at almost anytime of the day or night there would be a shower somewhere in the Channel. Showers most often occurred in the evening at about the time when measurements were due to begin.

Wind was not usually a problem but on one occasion it did make it impossible for the helicopter to land at Sukerut (NM/J/39), which had a difficult pad and it sometimes made landing on the Mother (NM/J/43) dangerous due to the exposed nature of the site.

The worst feature of the weather pattern in the Rabaul area was the cloud build up on top of the Mother near sunset. This made camping conditions on the mountain unpleasant and it often hampered the measuring program.

One other problem which was encountered was that of sea mist. In the evenings, when there was little wind, sea mist would often form in the channel, making visibility poor and measurement difficult.

4. DISTANCE MEASUREMENT

4.1 Equipment

Geodimeter model 8, S/N 80053, was used for all measurements in the network. Other technical equipment used in the survey was similar to that listed in paragraph 4.2 of TR18 with the addition of small Honda generators to charge batteries. On the 67 km line from NM/J/38 to NM/J/41 a special 84-prism reflector mounting was tried but all attempts to measure this line were unsuccessful.

4.2 Calibrations

As this survey immediately followed the second Markham Valley survey, the equipment calibrations used for the latter survey were adopted. See TR23 paragraph 4.

Figure 3
Bell 47G3BI helicopter

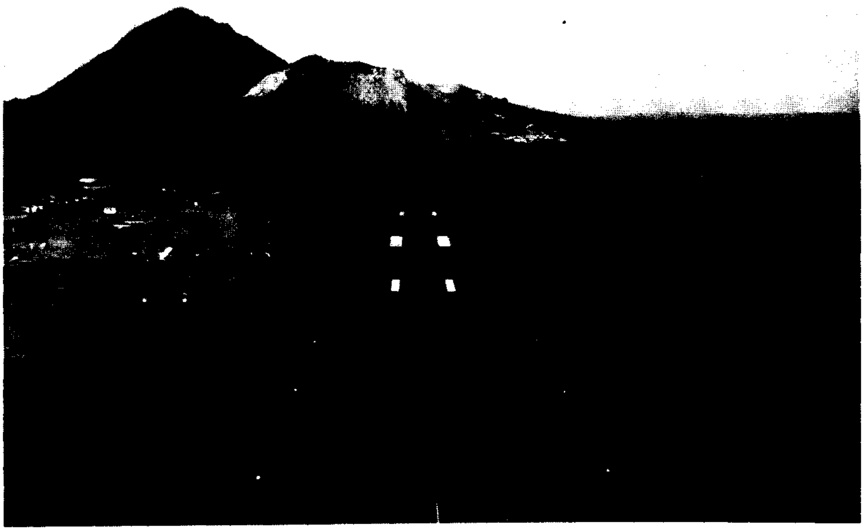

Figure 4
Mother from above
Rabaul airstrip

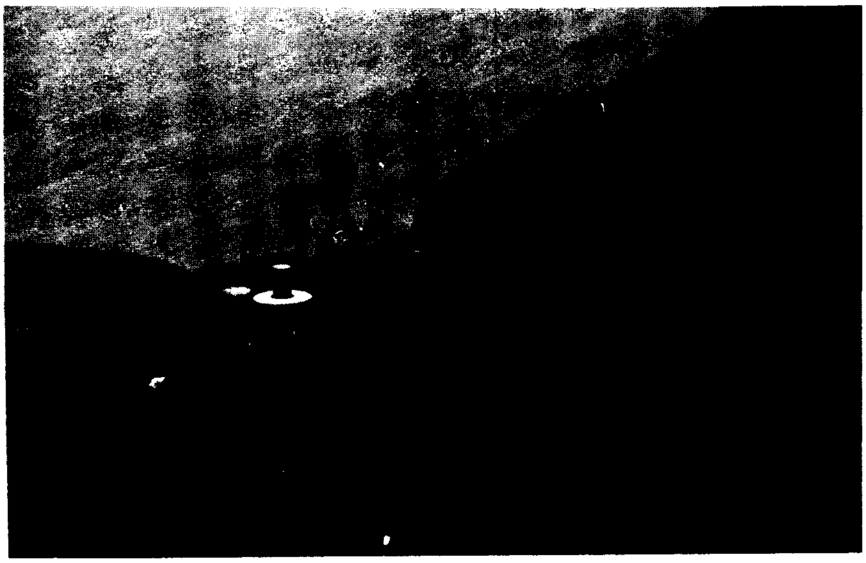

Figure 5
NM/J/43 and AA 113
on Mother

Figure 6
Vunabal (NM/J/42)

Figure 7
Camp site at
Vunabal

Figure 8
York (NM/J/37)

Figure 9
Pillar at York

Figure 10
Tinbal (NM/J/38)

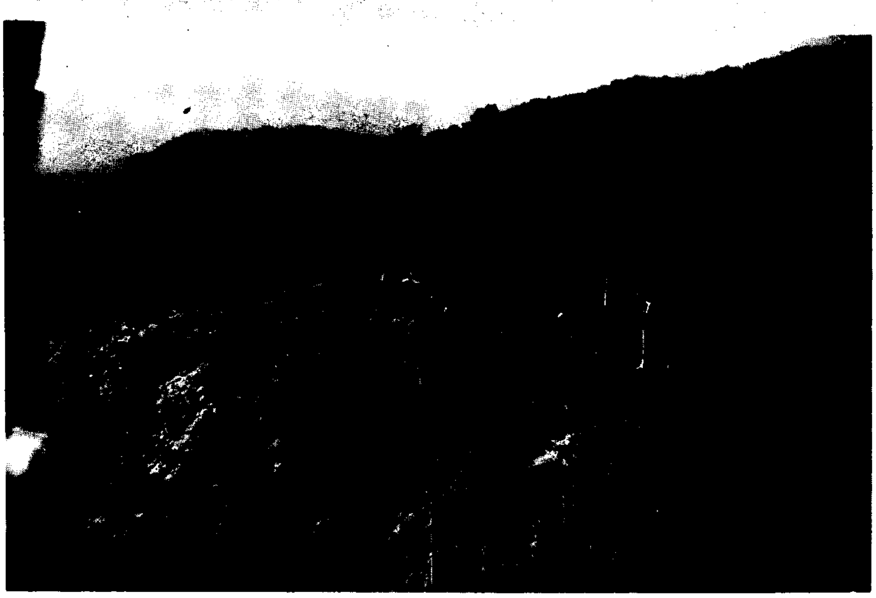

Figure 11
Tinbal (NM/J/38)

4.3 Measuring procedure

The measuring procedure detailed in paragraph 4.6 of TR18 was closely followed. In addition, simultaneous reciprocal vertical angle observations had to be carried out for each line to determine the value of "k", the coefficient of refraction. These vertical angles were read in the middle of each pair of distance measurements of a line.

The Geodimeter party consisted of three men at all times because of the workload. During periods of peak activity, one man operated the Geodimeter, one man observed T3 vertical angles, operated the signal lights and looked after camp duties, and the third man took care of all booking duties and radio communications. All three men were involved in the reduction and checking of each day's work.

4.4 Time of measurements

Because distances measured with a Geodimeter model 8 vary by up to 4ppm in accordance with the time of day they are carried out (Willington and Roelse, 1972), it was essential that a time of day was selected at which it was possible to measure all the lines in the net. The distances measured at this selected time would not necessarily be true distances but at least the same scale could be preserved over all lines in the network. If future surveys are carried out at about the same time of day and year, it would be expected that a similar scale factor would apply and accurate comparisons between measured distances could be made.

The deciding factor in this matter was the weather at station Mother. A cloud halo sat on the hill almost every day from mid afternoon to just after sunset, effectively preventing any measures from being carried out until about 1800 hours. This then became the starting time for the Geodimeter measurements.

4.5 Reductions

Reductions of measurements proved to be very tiresome work. At the conclusion of a night's observation at about 2000 hours, the Geodimeter party was confronted with the reduction and checking of eight Geodimeter lines as well as numerous simultaneous reciprocal vertical angles. Because of the need to know if all the observations were acceptable before the helicopter was called out next morning, this meant many hours of work late into the night with HP45 calculators.

On future surveys a calculator such as a HP97, which is a small programmable calculator, with printer, should be used for these reductions. With the resultant increase in speed of the calculations, it should be possible to introduce a third reflector party and hence considerably reduce the duration of the survey.

4.6 Results

Twenty out of a possible 21 lines were measured. The 67 km line from NM/J/38 to NM/J/41 proved to be too long for the Model 8 Geodimeter.

All measurements were recomputed in Canberra on the Cyber 76 computer using program GEODIMET.

A schedule of distance measurements showing comparisons between single measurements, sets and days is at Annex A.

A summary of the measurements of each line showing the adopted lengths, the standard deviation of a single measure and the standard deviation of the mean is at Annex B.

5. VERTICAL CONTROL

5.1 General

Vertical control was required solely for the reduction of the Geodimeter slope distances to MSL distances.

Because of the size of the network, the only feasible way of determining the heights of the control stations was by simultaneous reciprocal vertical angles.

In an attempt to achieve the utmost accuracy from this method, it was decided to adopt the techniques described by Cook and Steed (1973) in Technical Report 19 (TR19).

5.2 Equipment

All observations were made with Wild T3 theodolites with graduated alidade bubbles. They were all "double reading" with one-minute micrometer run and two-minute minimum reading on the circles.

Targets were generally 12-volt sealed beam lights, fully variable in intensity through rheostats.

Communications between the parties were achieved with NEC ATR 400PI mini-transceivers operating on a frequency of 470 MHz.

5.3 Calibrations

The alidade bubble calibrations on the T3 theodolites were carried out in Rabaul at the start of the survey. The method used is described at Annex C of TR19.

5.4 Field procedure

The procedure described in paragraph 5.4 of TR19 was adopted.

In order to fit the observations in with the Geodimeter work it was necessary to observe at various times of the day when the quality of the signal lights was sufficient to allow for accurate pointing.

5.5 Reductions

All work was checked in the field and preliminary height differences were derived to check for gross errors.

However, the final differences in height were calculated in Canberra on the CYBER 76 using program MTTELLY.

5.6 Datum

The height of the Army Survey mark AA 113 on Mother was adopted as the datum for this survey. It was 688.3 m above MSL.

5.7 Adjustment of network

The height differences were adjusted on the Cyber 76 using program TRIGHT, which is a least squares adjustment using observation equations.

The output from this adjustment and the accepted heights of the seven control stations is at Annex C.

6. RECOVERY MARKS

The three recovery marks at each control station were connected carefully in order that any local movement of the pillars could be detected in later surveys. The necessary measurements were firstly carried out with the theodolite set up on the pillar and then, as a check, with the theodolite set over one of the recovery marks.

Final computation of all recovery mark measurements was completed in Canberra using program RMCOORD.

The recovery mark measurements, together with access and other information for each station were recorded on trig station summaries, the originals of which are kept in the Division of National Mapping, Canberra.

7. SEISMIC ACTIVITY

Many small tremors occurred during the survey but none were of sufficient magnitude to warrant the remeasurement of any lines.

8. CONNECTION TO THE AGD

In order to provide AGD coordinates for the control stations, the coordinates of the army mark AA 113 on Mother and the azimuth of the line from AA 113 to PSM C572 were adopted. These values are:

AA 113 Latitude = S 4° 12' 50.301"
Longitude = E 152° 12' 39.360"

Azimuth from AA 113 to PSM C572 = 154° 27' 51.71"

Mother (NM/J/43) was then treated as an ecce to AA 113 and the single horizontal angle was read at NM/J/43 between NM/J/42 and PSM C572 to orientate the network. This angle was measured to normal first order specifications as described in paragraph 6 of TR18 with the following result:

$359^{\circ}44'32.39''$ s.e. $\pm$ 0.30"

9. HORIZONTAL ADJUSTMENT

Program VARYCORD, which is described in TR6, was used to adjust the network. The output is at Annex D.

The coordinates for Mother (NM/J/43) were held fixed along with the azimuth from Mother to Vunabal (NM/J/42).

NM/J/43 Latitude = S $4^{\circ}12'$ 50.2799"
Longitude = E $152^{\circ}12'$ 39.3827"

Azimuth from NM/J/43 to NM/J/42 = $154^{\circ}43'27.14''$

10. COMPARISON WITH 1973 TEST MEASURES

The 1975 survey party was able to find four of the stations established by the 1973 party which had carried out test measurements across the St Georges Channel before the construction of the pillars.

These original stations were first checked for local movement by a connection to the original reference marks and then connected to the relevant control stations used in the 1975 surveys. The greatest distance between a pillar and an original mark, which consisted of a star picket driven flush with the ground, was 8 m.

In this way the 1973 measures were reduced to those that would have been made between the pillars and a direct comparison of four lines from the 1973 and 1975 surveys was made.

The results of this comparison are at Annex E.

No significant differences in the measured distances were detected.

11. CONCLUSION

Although a comparison has been made at Annex E between four distances measured in 1973 and 1975, the small amount of data available prevents any conclusion being drawn in regard to crustal movement in the Channel area between those two years.

12. RECOMMENDATIONS FOR FUTURE SURVEYS

A thorough review of all aspects of the field work for the initial survey of the St Georges Channel network was carried out on the return of the survey party to Canberra. Comments and recommendations for future surveys were placed on file NM 74/587, which is held in the Division of National Mapping, Canberra.

13. ACKNOWLEDGEMENTS

The Division of National Mapping is greatly indebted to the Department of Lands, Surveys and Mines in Rabaul for the success of this survey. Mr Stewart Scriven, Supervising Surveyor, and Mr Graham Kendall, Staff Surveyor, provided valuable assistance and without their help the survey would have come to a halt on several occasions.

The authors would also like to thank the other members of the team for their enthusiasm and dedication under trying conditions. They were Messrs D. Gray, J. Edmonstone, P. Allen, W. Stuchbery, R. Twilley and J. Guilfoyle.

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Sloane B.J. & Steed J., *Crustal Movement Survey - Markham Valley - Papua New Guinea 1975*, Division of National Mapping Technical Report 23, 1976.

Willington B.H. & Roelse A., *24 Hour EDM Test - Canberra*, Division of National Mapping Technical Report 14, 1972.

Date	Time	Distance	Mean of Distances	Mean of Sets	Mean of Days	Range L1, L2K, L3k mm	Range L1, L2K, L3k ppm	Range ppm Dist	Range ppm Sets	Range ppm Days
NM/J/42 to NM/J/37										
30-5-75	1932-1942	35240.657				8	0.2			
			35240.655					0.1		
30-5-75	1944-1955	35240.654				13	0.4			
				35240.643					0.7	
30-5-75	2136-2143	35240.628				3	0.1			
			35240.630					0.1		
30-5-75	2145-2153	35240.632				14	0.4			
					35240.650					0.4
31-5-75	1905-1914	35240.662				1	0.0			
			35240.660					0.1		
31-5-75	1926-1934	35240.658				10	0.3			
				35240.656					0.2	
31-5-75	2100-2107	35240.658				8	0.2			
			35240.653					0.3		
31-5-75	2118-2126	35240.648				12	0.3			
NM/J/42 to NM/J/41										
2-6-75	1900-1908	19462.913				2	0.1			
			19462.915					0.3		
2-6-75	1912-1921	19462.918				14	0.7			
				19462.913					0.2	
2-6-75	2100-2110	19462.909				7	0.4			
			19462.911					0.2		
2-6-75	2113-2121	19462.913				8	0.4			
3-6-75	1901-1910	19462.926				2	0.1			
			19462.920					0.7		
3-6-75	1913-1920	19462.913				18	1.0			
				19462.917	19462.913				0.3	0.4
3-6-75	2100-2107	19462.911				16	0.8			
			19462.914					0.4		
3-6-75	2110-2116	19462.918				26	1.4			
4-6-75	1858-1907	19462.912				27	1.4			
			19462.913					0.1		
4-6-75	1909-1918	19462.914				3	0.2			
				19462.910					0.3	
4-6-75	2058-2110	19462.914				26	1.4			
			19462.907					0.8		
4-6-75	2111-2120	19462.899				35	1.8			
NM/J/42 to NM/J/38										
6-6-75	1952-2006	54394.650				4	0.1			
			54394.656					0.2		
6-6-75	2014-2032	54394.662				10	0.2			
				54394.669					0.5	
6-6-75	2154-2204	54394.673				13	0.2			
			54394.682					0.2		
6-6-76	2216-2228	54394.687				12	0.2			
7-6-75	1947-2002	54394.727				16	0.3			
			54394.723					0.1		
7-6-75	2013-2030	54394.719				21	0.4			
				54394.707	54394.681				0.6	0.7
7-6-75	2213-2223	54394.691				8	0.1			
			54394.690					0.0		
7-6-75	2235-2248	54394.690				37	0.7			
8-6-75	1929-1939	54394.673				20	0.4			
			54394.668					0.2		
8-6-75	1948-2000	54394.663				4	0.1			
				54394.668					0.0	
8-6-75	2129-2140	54394.657				11	0.2			
			54394.667					0.4		
8-6-75	2148-2201	54394.677				15	0.3			
NM/J/42 to NM/J/40										
7-6-75	2033-2045	39342.743				27	0.7			
			39342.747					0.2		
7-6-75	2057-2107	39342.750				25	0.6			
				39342.757					0.5	
7-6-75	2249-2300	39342.767				15	0.4			
			39342.766					0.1		
7-6-75	2312-2320	39342.765				9	0.2			
					39342.747					0.5
8-6-75	1900-1908	39342.749				18	0.5			
			39342.741					0.4		
8-6-75	1918-1926	39342.732				33	0.8			
				39342.738					0.2	
8-6-75	2059-2108	39342.734				20	0.5			
			39342.735					0.1		
8-6-75	2117-2127	39342.737				14	0.4			

Date	Time	Distance	Mean of Distances	Mean of Sets	Mean of Days	Range L1, L2K, L3K mm	Range L1, L2K, L3K ppm	Range Dist	Range ppm Sets	Range ppm Days
NM/J/42 to NM/J/43										
11-6-75	1923-1935	28879.399	28879.402			12	0.4	0.2		
11-6-75	1937-1948	28879.404		28879.402		17	0.6		0.0	
11-6-75	2124-2133	28879.402	28879.402			16	0.6	-		
12-6-75	1750-1759	28879.400			28879.398	13	0.5			0.2
12-6-75	1801-1810	28879.390	28879.395			12	0.4	0.3		
12-6-75	1943-1952	28879.390		28879.395		15	0.5		0.0	
12-6-75	1953-2002	28879.400	28879.395			7	0.2	0.3		
NM/J/42 to NM/J/39										
11-6-75	1952-2004	41926.553	41926.557			10	0.2	0.2		
11-6-75	2013-2023	41926.560		41926.550		14	0.3		0.3	
11-6-75	2159-2208	41926.540	41926.544			28	0.7			
11-6-75	2217-2225	41926.549								
12-6-75	1915-1923	41926.553	41926.557		41926.556	6	0.2	0.2		0.[illegible]
12-6-75	1931-1940	41926.560		41926.562		7	0.2		0.2	
12-6-75	2114-2126	41926.579	41926.566			18	0.4	0.6		
12-6-75	2135-2143	41926.556				7	0.2			
NM/J/41 to NM/J/43										
13-6-75	1750-1805	48274.699	48274.697			14	0.3	0.1		
13-6-75	1815-1826	48274.695		48274.690		7	0.2		0.3	
13-6-75	1950-2008	48274.686	48274.683			11	0.2	0.1		
13-6-75	2020-2032	48274.680				24	0.5			
14-6-75	1751-1806	48274.688	48274.679		418274.678	9	0.2	0.1		0.5
14-6-75	1813-1824	48274.671		48274.665		10	0.2		0.6	
14-6-75	1953-2002	48274.645	48274.651			16	0.3	0.2		
14-6-75	2011-2023	48274.656				22	0.5			
NM/J/41 to NM/J/39										
13-6-75	1840-1852	44015.729	44015.727			7	0.2	0.1		
13-6-75	1900-1912	44015.725		44015.731		14	0.3		0.2	
13-6-75	2035-2045	44015.736	44015.735			5	0.1	0.2		
13-6-75	2055-2105	44015.734				7	0.2			
14-6-75	1827-1835	44015.707	44015.710		44015.723	6	0.1	0.1		0.4
14-6-75	1844-1852	44015.713		44015.715		5	0.1		0.2	
14-6-75	2027-2036	44015.723	44015.721			3	0.1	0.1		
14-6-75	2045-2056	44015.720				16	0.4			

Date	Time	Distance	Mean of Distances	Mean of Sets	Mean of Days	Range L1, L2K, L3K mm	Range L1, L2K, L3K ppm	Range ppm Dist	Range ppm Sets	Range ppm Days
NM/J/41 to NM/J/40										
24-6-75	1759-1810	38954.130	38954.127			12	0.3	0.2		
24-6-75	1822-1833	38954.123		38954.115		10	0.3		0.6	
24-6-75	1956-2006	38954.111	38954.104			11	0.3	0.4		
24-6-75	2015-2026	38954.096				27	0.7			
25-6-75	1834-1845	38954.147	38954.144		38954.121	10	0.3	0.2		0.3
25-6-75	1855-1903	38954.141		38954.127		19	0.5		0.9	
25-6-75	2030-2038	38954.112	38954.110			3	0.1	0.1		
25-6-75	2047-2057	38954.107				13	0.3			
NM/J/41 to NM/J/37										
24-6-75	1837-1845	49710.942	49710.940			7	0.1	0.1		
24-6-75	1850-1910	49710.939		49710.937		35	0.7		0.1	
24-6-75	2027-2039	49710.938	49710.933			36	0.7	0.2		
24-6-75	2047-2058	49710.927				16	0.3			
25-6-75	1807-1813	49710.960	49710.962		49710.947	10	0.2	0.1		0.4
25-6-75	1823-1828	49710.964		49710.957		19	0.4		0.2	
25-6-75	2001-2007	49710.941	49710.953			19	0.4	0.5		
25-6-75	2016-2023	49710.966				55	1.1			
NM/J/39 to NM/J/37										
26-6-75	1740-1747	30367.366	30367.370			5	0.2	0.2		
26-6-75	1801-1808	30367.373		30367.368		27	0.9		0.1	
26-6-75	1927-1934	30367.372	30367.367			24	0.8	0.3		
26-6-75	1946-1955	30367.363				5	0.2			
27-6-75	1743-1748	30367.367	30367.373		30367.363	17	0.6	0.4		0.3
27-6-75	1806-1814	30367.379		30367.359		35	1.2		1.0	
27-6-75	1934-1940	30367.340	30367.344			26	0.9	0.3		
27-6-75	1950-1955	30367.348				38	1.3			
NM/J/39 to NM/J/40										
26-6-75	1814-1822	6541.729	6541.737			24	3.7	2.5		
26-6-75	1825-1831	6541.745		6541.728		25	3.8		2.8	
26-6-75	1959-2006	6541.725	6541.719			8	1.2	1.7		
26-6-75	2009-2018	6541.714				13	2.0			
27-6-75	1817-1823	6541.739	6541.735		6541.730	18	2.8	1.2		0.6
27-6-75	1825-1831	6541.731		6541.732		14	2.2		1.1	
27-6-75	2001-2007	6541.733	6541.728			17	2.6	1.4		
27-6-75	2010-2016	6541.724				20	3.1			

			Mean of			Range				
						LT, L2K, L3K		ppm		
Date	Time	Distance	Distances	Sets	Days	mm	ppm	Dist	Sets	Days
NM/J/40 to NM/J/43										
6-7-75	1814-1830	56756.162				23	0.4			
			56756.156					0.2		
6-7-75	1839-1850	56756.150				67	1.2			
				56756.150					0.2	
6-7-75	2015-2024	56756.153				31	0.5			
			56756.144					0.3		
6-7-75	2032-2040	56756.136				3	0.1			
7-7-75	1752-1800	56756.185			56756.158	46	0.8			0.3
				56756.166						
7-7-75	1946-1956	56756.148				16	0.3			
								0.3		
7-7-75	2002-2015	56756.166				18	0.3			
NM/J/37 to NM/J/43										
8-7-75	1803-1815	31515.318				10	0.3			
			31515.312					0.4		
8-7-75	1825-1832	31515.306				15	0.5			
				31515.309					0.2	
8-7-75	2000-2008	31515.305				14	0.4			
			31515.305					0.0		
8-7-75	2019-2025	31515.305				11	0.3			
9-7-75	1800-1811	31515.280			31515.293	13	0.4			1.0
			31515.279					0.1		
9-7-75	1814-1822	31515.278				9	0.3			
				31515.278					0.1	
9-7-75	2000-2017	31515.276				29	0.9			
			31515.277					0.1		
9-7-75	2017-2026	31515.279				23	0.7			
NM/J/37 to NM/J/38										
8-7-75	1835-1846	19493.168				7	0.4			
			19493.167					0.0		
8-7-75	1848-1855	19493.167				26	1.4			
				19493.163					0.4	
8-7-75	2028-2035	19493.157				5	0.3			
			19493.159					0.2		
8-7-75	2036-2042	19493.160				9	0.5			
9-7-75	1822-1838	19493.151			19493.153	10	0.5			1.1
			19493.145					0.6		
9-7-75	1838-1845	19493.139				9	0.5			
				19493.142					0.3	
9-7-75	2027-2035	19493.139				16	0.8			
			19493.139					0.0		
9-7-75	2036-2045	19493.140				15	0.8			
NM/J/38 to NM/J/43										
11-7-75	1800-1810	48447.096				27	0.6			
			48447.087					0.3		
11-7-75	1819-1828	48447.079				19	0.4			
				48447.082					0.2	
11-7-75	2000-2006	48447.077				13	0.3			
			48447.077					0.0		
11-7-75	2036-2045	48447.076				20	0.4			
12-7-75	1800-1808	48447.105			48447.085	30	0.6			0.1
			48447.096					0.4		
12-7-75	1815-1825	48447.088				44	0.9			
				48447.088					0.4	
12-7-75	2000-2008	48447.079				35	0.7			
			48447.079					0.0		
12-7-75	2017-2025	48447.078				25	0.5			

Date	Time	Distance	Mean of Distances	Mean of Sets	Mean of Days	Range L1, L2K, L3K mm	Range L1, L2K, L3K ppm	Range ppm Dist	Range ppm Sets	Range ppm Days
NM/J/39 to NM/J/38										
28-6-75	1741-1752	35395.378				13	0.4			
			35395.371					0.4		
28-6-75	1801-1810	35395.365				23	0.7			
				35395.372					0.0	
28-6-75	1932-1938	35395.370				22	0.6			
			35395.372					0.1		
28-6-75	1947-1954	35395.373				23	0.7			
29-6-75	1808-1814	35395.377			35395.379	10	0.3			0.4
			35395.383					0.3		
29-6-75	1826-1837	35395.389				5	0.1			
				35395.386					0.2	
29-6-75	2009-2023	35395.385				23	0.7			
			35395.390					0.3		
29-6-75	2035-2042	35395.395				30	0.9			
NM/J/39 to NM/J/43										
30-6-75	1820-1838	56075.825				19	0.3			
			56075.815					0.4		
30-6-75	1843-1900	56075.805				42	0.7			
				56075.808					0.3	
30-6-75	2023-2045	56075.801				43	0.8			
			56075.800					0.0		
30-6-75	2100-2113	56075.799				24	0.4			
1-7-75	1834-1843	56075.839			56075.818	51	0.9			0.4
			56075.836					0.1		
1-7-75	1853-1901	56075.834				23	0.4			
				56075.829					0.2	
1-7-75	2028-2036	56075.826				43	0.8			
			56075.823					0.1		
1-7-75	2046-2055	56075.819				50	0.9			
NM/J/40 to NM/J/38										
4-7-75	1824-1831	41265.301				8	0.2			
			41265.297					0.2		
4-7-75	1840-1848	41265.293				32	0.8			
				41265.310					0.6	
4-7-75	2022-2029	41265.312				31	0.8			
			41265.323					0.5		
4-7-75	2037-2043	41265.334				28	0.7			
5-7-75	1816-1825	41265.332			41265.314	20	0.5			0.2
			41265.322					0.5		
5-7-75	1833-1841	41265.313				13	0.3			
				41265.317					0.2	
5-7-75	2015-2022	41265.312				34	0.8			
			41265.312					0.0		
5-7-75	2030-2037	41265.311				21	0.5			
NM/J/40 to NM/J/37										
4-7-75	1852-1902	33949.405				23	0.7			
			33949.409					0.3		
4-7-75	1911-1928	33949.414				14	0.4			
				33949.422					0.7	
4-7-75	2049-2058	33949.442				68	2.0			
			33949.434					0.5		
4-7-75	2108-2118	33949.426				22	0.7			
5-7-75	1846-1856	33949.440			33949.431	20	0.6			0.5
			33949.446					0.3		
5-7-75	1906-1915	33949.452				10	0.3			
				33949.440					0.4	
5-7-75	2046-2055	33949.431				24	0.7			
			33949.433					0.1		
5-7-75	2105-2111	33949.435				6	0.2			

STATION YORK NM J 37 TO STATION TINBAL NM J 38

DATE	TIME	DISTANCES	FREQ CORRECTIONS	CORRECTED DISTANCES
08-07-75	1835-1840	19493,169	-.001	19493,168
08-07-75	1848-1852	19493,169	-.001	19493,167
08-07-75	2028-2032	19493,158	-.001	19493,157
08-07-75	2036-2044	19493,160	-.001	19493,160
09-07-75	1822-1832	19493,152	-.001	19493,151
09-07-75	1838-1845	19493,139	0.000	19493,139
09-07-75	2027-2032	19493,139	-.000	19493,139
09-07-75	2036-2042	19493,141	-.001	19493,140

REJECTS	GOOD MEAS,	STANDARD DEVIATION METRES	PPM	S,E, OF MEAN METRES	PPM
0	8	,012	,629	,004	,222

MEAN OF ACCEPTABLE MEASUREMENTS 19493,153

STATION SUKERUT NM J 39 TO STATION YORK NM J 37

DATE	TIME	DISTANCES	FREQ CORRECTIONS	CORRECTED DISTANCES
26-06-75	1740-1747	30367,369	-,004	30367,366
26-06-75	1801-1808	30367,374	-,001	30367,373
26-06-75	1927-1932	30367,376	-,004	30367,372
26-06-75	1946-1952	30367,366	-,003	30367,363
27-06-75	1743-1749	30367,364	,003	30367,367
27-06-75	1806-1814	30367,379	,001	30367,379
27-06-75	1934-194	30367,341	-,000	30367,340
27-06-75	1950-1955	30367,347	,000	30367,348

REJECTS	GOOD MEAS,	STANDARD DEVIATION METRES	PPM	S,E, OF MEAN METRES	PPM
0	8	,013	,434	,005	,154

MEAN OF ACCEPTABLE MEASUREMENTS 30367,363

STATION KING NM J 40 TO STATION YORK NM J 37

DATE	TIME	DISTANCES	FREQ CORRECTIONS	CORRECTED DISTANCES
04-07-75	1852-1904	33949,408	-,003	33949,405
04-07-75	1911-1920	33949,415	-,002	33949,414
04-07-75	2049-2056	33949,444	-,002	33949,442
04-07-75	2108-2112	33949,430	-,003	33949,426
05-07-75	1846-1850	33949,444	-,003	33949,440
05-07-75	1906-1912	33949,453	-,002	33949,452
05-07-75	2046-2052	33949,435	-,003	33949,431
05-07-75	2105-2112	33949,437	-,002	33949,435

REJECTS	GOOD MEAS,	STANDARD DEVIATION METRES	PPM	S,E, OF MEAN METRES	PPM
0	8	,015	,454	,005	,161

MEAN OF ACCEPTABLE MEASUREMENTS 33949,431

STATION PUT PUT NM J 41 TO STATION YORK NM J 37

DATE	TIME	DISTANCES	FREQ CORRECTIONS	CORRECTED DISTANCES
24-06-75	1837-1845	49710,944	-,002	49710,942
24-06-75	1850-1910	49710,941	-,002	49710,939
24-06-75	2027-2034	49710,941	-,002	49710,938
24-06-75	2047-2050	49710,932	-,005	49710,927
25-06-75	1807-1812	49710,960	,001	49710,961
25-06-75	1823-1828	49710,964	-,001	49710,962
25-06-75	2001-2007	49710,949	-,007	49710,941
25-06-75	2016-2022	49710,968	-,002	49710,966

REJECTS	GOOD MEAS,	STANDARD DEVIATION METRES	PPM	S,E, OF MEAN METRES	PPM
0	8	,014	,286	,005	,101

MEAN OF ACCEPTABLE MEASUREMENTS 49710,947

STATION VUNABAL NM J 42 TO STATION YORK NM J 37

DATE	TIME	DISTANCES	FREQ CORRECTIONS	CORRECTED DISTANCES
30-05-75	1932-1942	35240,654	,003	35240,657
30-05-75	1944-195?	35240,652	,002	35240,654
30-05-75	2136-2143	35240,629	-,001	35240,628
30-05-75	2145-2153	35240,630	,002	35240,632
31-05-75	1905-1914	35240,660	,002	35240,662
31-05-75	1926-1935	35240,654	,004	35240,658
31-05-75	2100-210?	35240,659	-,001	35240,658
31-05-75	2118-2126	35240,648	-,001	35240,648

REJECTS	GOOD MEAS,	STANDARD DEVIATION METRES	PPM	S,E, OF MEAN METRES	PPM
0	8	,013	,357	,004	,126

MEAN OF ACCEPTABLE MEASUREMENTS 35240,650

STATION YORK NM J 37 TO STATION MOTHER NM J 43

DATE	TIME	DISTANCES	FREQ CORRECTIONS	CORRECTED DISTANCES
08-07-75	1803-1812	31515,318	0,000	31515,318
08-07-75	1825-183?	31515,305	,000	31515,306
08-07-75	2000-2009	31515,306	-,001	31515,305
08-07-75	2019-202?	31515,304	,000	31515,305
09-07-75	1800-1811	31515,279	,001	31515,280
09-07-75	1814-182?	31515,279	-,001	31515,278
09-07-75	2000-201?	31515,275	,001	31515,276
09-07-75	2017-2029	31515,279	-,001	31515,279

REJECTS	GOOD MEAS,	STANDARD DEVIATION METRES	PPM	S,E, OF MEAN METRES	PPM
0	8	,017	,531	,006	,188

MEAN OF ACCEPTABLE MEASUREMENTS 31515,293

STATION SUKERUT NM J 39 TO STATION TINBAL NM J 38

DATE	TIME	DISTANCES	FREQ CORRECTIONS	CORRECTED DISTANCES
28-06-75	1741-175?	35395,383	-,005	35395,378
28-06-75	1801-181?	35395,370	-,005	35395,365
28-06-75	1932-1939	35395,377	-,007	35395,370
28-06-75	1947-1952	35395,377	-,005	35395,373
29-06-75	1808-181?	35395,380	-,003	35395,377
29-06-75	1826-183?	35395,390	-,001	35395,389
29-06-75	2009-202?	35395,389	-,003	35395,385
29-06-75	2035-204?	35395,395	-,001	35395,395

REJECTS	GOOD MEAS,	STANDARD DEVIATION METRES	PPM	S,E, OF MEAN METRES	PPM
0	8	,010	,293	,004	,104

MEAN OF ACCEPTABLE MEASUREMENTS 35395,379

STATION KING NM J 40 TO STATION TINBAL NM J 38

DATE	TIME	DISTANCES	FREQ CORRECTIONS	CORRECTED DISTANCES
04-07-75	1824-1831	41265,299	,001	41265,301
04-07-75	1840-1849	41265,294	-,001	41265,293
04-07-75	2022-202?	41265,315	-,003	41265,312
04-07-75	2037-2043	41265,334	0,000	41265,334
05-07-75	1816-1825	41265,336	-,004	41265,332
05-07-75	1833-1841	41265,316	-,003	41265,313
05-07-75	2015-2022	41265,313	-,000	41265,312
05-07-75	2030-203?	41265,314	-,003	41265,311

REJECTS	GOOD MEAS,	STANDARD DEVIATION METRES	PPM	S,E, OF MEAN METRES	PPM
0	8	,014	,337	,005	,119

MEAN OF ACCEPTABLE MEASUREMENTS 41265,314

STATION DATE	VUNABAL TIME	NM J 42 TO DISTANCES	STATION TINBAL FREQ CORRECTIONS	NM J 38 CORRECTED DISTANCES
06-06-75	1952-2009	54394,644	.006	54394,650
06-06-75	2019-2032	54394,657	.005	54394,662
06-06-75	2154-2204	54394,672	.001	54394,673
06-06-75	2216-2225	54394,686	.001	54394,687
07-06-75	1947-2002	54394,723	.003	54394,727
07-06-75	2013-2039	54394,713	.007	54394,719
07-06-75	2213-2222	54394,693	-.002	54394,691
07-06-75	2235-2249	54394,692	-.002	54394,690
08-06-75	1929-1932	54394,674	-.001	54394,673
08-06-75	1948-200[illegible]	54394,664	-.001	54394,663
08-06-75	2129-2140	54394,660	-.003	54394,657
08-06-75	2148-2201	54394,680	-.002	54394,677

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	STANDARD DEVIATION PPM	S.E. OF MEAN METRES	S.E. OF MEAN PPM
0	12	.024	.433	.007	.125

MEAN OF ACCEPTABLE MEASUREMENTS 54394.681

STATION DATE	TINBAL TIME	NM J 38 TO DISTANCES	STATION MOTHER FREQ CORRECTIONS	NM J 43 CORRECTED DISTANCES
11-07-75	1800-1810	48447,092	.004	48447,096
11-07-75	1819-1828	48447,075	.003	48447,079
11-07-75	2000-2009	48447,077	-.000	48447,077
11-07-75	2036-2045	48447,078	-.002	48447,076
12-07-75	1800-1808	48447,101	.004	48447,105
12-07-75	1815-1825	48447,085	.003	48447,088
12-07-75	2000-2009	48447,080	-.002	48447,079
12-07-75	2017-2022	48447,081	-.002	48447,078

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	STANDARD DEVIATION PPM	S.E. OF MEAN METRES	S.E. OF MEAN PPM
0	8	.011	.223	.004	.079

MEAN OF ACCEPTABLE MEASUREMENTS 48447.085

STATION DATE	SUKERUT TIME	NM J 39 TO DISTANCES	STATION KING FREQ CORRECTIONS	NM J 40 CORRECTED DISTANCES
26-06-75	1814-1822	6541.729	-.000	6541.729
26-06-75	1825-1831	6541.745	-.001	6541.745
26-06-75	1959-2003	6541.725	-.000	6541.725
26-06-75	2009-2012	6541.714	-.001	6541.714
27-06-75	1817-1823	6541.739	.000	6541.739
27-06-75	1825-1831	6541.731	.000	6541.731
27-06-75	2001-2007	6541.733	.000	6541.733
27-06-75	2010-2012	6541.724	.000	6541.724

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	STANDARD DEVIATION PPM	S.E. OF MEAN METRES	S.E. OF MEAN PPM
0	8	.010	1.478	.003	.522

MEAN OF ACCEPTABLE MEASUREMENTS 6541.730

STATION DATE	PUT PUT TIME	NM J 41 TO DISTANCES	STATION SUKERUT FREQ CORRECTIONS	NM J 39 CORRECTED DISTANCES
13-06-75	1840-1852	44015,731	-.003	44015,729
13-06-75	1900-1915	44015,725	.000	44015,725
13-06-75	2035-2042	44015,739	-.003	44015,736
13-06-75	2055-2105	44015,736	-.002	44015,734
14-06-75	1827-1833	44015,709	-.002	44015,707
14-06-75	1844-1852	44015,713	-.000	44015,713
14-06-75	2027-2036	44015,725	-.003	44015,723
14-06-75	2045-2050	44015,722	-.002	44015,720

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	STANDARD DEVIATION PPM	S.E. OF MEAN METRES	S.E. OF MEAN PPM
0	8	.010	.225	.004	.080

MEAN OF ACCEPTABLE MEASUREMENTS 44015.723

STATION DATE	VUNABAL TIME	NM J 42 TO DISTANCES	STATION SUKERUT FREQ CORRECTIONS	NM J 39 CORRECTED DISTANCES
11-06-75	1952-2004	41926.551	.002	41926.553
11-06-75	2013-2023	41926.561	-.000	41926.560
11-06-75	2159-2208	41926.538	.003	41926.540
11-06-75	2217-2225	41926.548	.002	41926.549
12-06-75	1915-192[illegible]	41926.553	0.000	41926.553
12-06-75	1931-1940	41926.557	.003	41926.560
12-06-75	2114-2120	41926.578	.002	41926.579
12-06-75	2135-2143	41926.555	.001	41926.556

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	PPM	S.E. OF MEAN METRES	PPM
0	8	.011	.269	.004	.095

MEAN OF ACCEPTABLE MEASUREMENTS 41926.556

STATION DATE	SUKERUT TIME	NM J 39 TO DISTANCES	STATION MOTHER FREQ CORRECTIONS	NM J 43 CORRECTED DISTANCES
30-06-75	1820-1838	56075.827	-.002	56075.825
30-06-75	1843-1900	56075.806	-.001	56075.805
30-06-75	2023-2045	56075.806	-.006	56075.801
30-06-75	2100-2113	56075.801	-.003	56075.799
01-07-75	1834-184[illegible]	56075.840	-.001	56075.839
01-07-75	1853-1901	56075.839	-.005	56075.834
01-07-75	2028-203[illegible]	56075.827	-.001	56075.826
01-07-75	2046-2055	56075.820	-.002	56075.819

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	PPM	S.E. OF MEAN METRES	PPM
0	8	.015	.274	.005	.097

MEAN OF ACCEPTABLE MEASUREMENTS 56075.818

STATION DATE	PUT PUT TIME	NM J 41 TO DISTANCES	STATION KING FREQ CORRECTIONS	NM J 40 CORRECTED DISTANCES
24-06-75	1759-1810	38954.131	-.001	38954.130
24-06-75	1822-183[illegible]	38954.123	-.000	38954.123
24-06-75	1956-2006	38954.113	-.002	38954.111
24-06-75	2015-202[illegible]	38954.098	-.002	38954.096
25-06-75	1834-1842	38954.152	-.005	38954.147
25-06-75	1855-1903	38954.146	-.005	38954.141
25-06-75	2030-2038	38954.117	-.005	38954.112
25-06-75	2047-205[illegible]	38954.113	-.006	38954.107

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	PPM	S.E. OF MEAN METRES	PPM
0	8	.018	.455	.006	.161

MEAN OF ACCEPTABLE MEASUREMENTS 38954.121

STATION DATE	VUNABAL TIME	NM J 42 TO DISTANCES	STATION KING FREQ CORRECTIONS	NM J 40 CORRECTED DISTANCES
07-06-75	2033-2042	39342.741	.001	39342.743
07-06-75	2057-210[illegible]	39342.749	.001	39342.750
07-06-75	2249-2300	39342.765	.001	39342.767
07-06-75	2312-2320	39342.767	-.002	39342.765
08-06-75	1900-1909	39342.749	.000	39342.749
08-06-75	1918-1929	39342.733	-.000	39342.732
08-06-75	2059-210[illegible]	39342.735	-.001	39342.734
08-06-75	2117-212[illegible]	39342.738	-.000	39342.737

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	PPM	S.E. OF MEAN METRES	PPM
0	8	.013	.340	.005	.120

MEAN OF ACCEPTABLE MEASUREMENTS 39342.747

STATION DATE	KING TIME	NM J 40 TO DISTANCES	STATION MOTHER FREQ CORRECTIONS	NM J 43 CORRECTED DISTANCES
06-07-75	1814-1830	56756,167	-.004	56756,162
06-07-75	1839-1850	56756,154	-.004	56756,150
06-07-75	2015-2024	56756,159	-.006	56756,153
06-07-75	2032-2040	56756,145	-.009	56756,136
07-07-75	1752-1800	56756,186	-.001	56756,185
07-07-75	1946-1952	56756,156	-.008	56756,148
07-07-75	2002-2012	56756,175	-.009	56756,166

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	STANDARD DEVIATION PPM	S.E. OF MEAN METRES	S.E. OF MEAN PPM
0	7	.016	.275	.006	.104

MEAN OF ACCEPTABLE MEASUREMENTS 56756,157

STATION DATE	VUNABAL TIME	NM J 42 TO DISTANCES	STATION PUT PUT FREQ CORRECTIONS	NM J 41 CORRECTED DISTANCES
02-06-75	1900-1908	19462,911	.002	19462,913
02-06-75	1912-1921	19462,915	.003	19462,918
02-06-75	2100-2110	19462,907	.001	19462,909
02-06-75	2113-2124	19462,913	.001	19462,913
03-06-75	1901-1914	19462,922	.004	19462,926
03-06-75	1913-1920	19462,909	.004	19462,913
03-06-75	2100-2107	19462,907	.004	19462,911
03-06-75	2110-2119	19462,914	.004	19462,918
04-06-75	1858-1907	19462,910	.002	19462,912
04-06-75	1909-1919	19462,913	.001	19462,914
04-06-75	2058-2110	19462,914	-.000	19462,914
04-06-75	2111-2127	19462,900	-.001	19462,899

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	STANDARD DEVIATION PPM	S.E. OF MEAN METRES	S.E. OF MEAN PPM
0	12	.006	.326	.002	.094

MEAN OF ACCEPTABLE MEASUREMENTS 19462,913

STATION DATE	PUT PUT TIME	NM J 41 TO DISTANCES	STATION MOTHER FREQ CORRECTIONS	NM J 43 CORRECTED DISTANCES
13-06-75	1750-1802	48274,697	.002	48274,699
13-06-75	1815-1826	48274,700	-.005	48274,695
13-06-75	1950-2008	48274,691	-.004	48274,686
13-06-75	2020-2032	48274,683	-.003	48274,680
14-06-75	1751-1802	48274,689	-.000	48274,688
14-06-75	1813-1824	48274,672	-.000	48274,671
14-06-75	1953-2006	48274,645	-.000	48274,645
14-06-75	2011-2022	48274,660	-.003	48274,656

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	STANDARD DEVIATION PPM	S.E. OF MEAN METRES	S.E. OF MEAN PPM
0	8	.019	.395	.007	.140

MEAN OF ACCEPTABLE MEASUREMENTS 48274,678

STATION DATE	VUNABAL TIME	NM J 42 TO DISTANCES	STATION MOTHER FREQ CORRECTIONS	NM J 43 CORRECTED DISTANCES
11-06-75	1923-1932	28879,397	.002	28879,399
11-06-75	1937-1940	28879,402	.002	28879,404
11-06-75	2124-2132	28879,400	.003	28879,402
12-06-75	1750-1757	28879,398	.002	28879,400
12-06-75	1801-1810	28879,391	-.000	28879,390
12-06-75	1943-1952	28879,389	.001	28879,390
12-06-75	1953-2004	28879,400	.000	28879,400

REJECTS	GOOD MEAS.	STANDARD DEVIATION METRES	STANDARD DEVIATION PPM	S.E. OF MEAN METRES	S.E. OF MEAN PPM
0	7	.005	.190	.002	.072

MEAN OF ACCEPTABLE MEASUREMENTS 28879,398

PROGRAM TRIGHT

PROGRAM AMENDED FEB 1971

COMPUTED ON 03/12/76

TRIG HEIGHT ADJUSTMENT OF AUSTRALIA

STATE - NEW BRITAIN-NEW IRELAND

NATIONAL ADJUSTMENT SECTIONS - ST. GEORGES CHANNEL CRUSTAL MOVEMENT SURVEY

ALL HEIGHTS AND HEIGHT DIFFERENCES ARE IN METRES

HEIGHTS ARE ON THE AUSTRALIAN HEIGHT DATUM

WEIGHT = WEIGHT INDICATOR/D SQUARED, D = DISTANCE IN KILOMETRES/10

WEIGHT INDICATORS - SIM RECIP = 9.0, NON SIM RECIP = 4.0, SINGLE RAY = 1.0

SERIAL NUMBERS FROM A	TO B	DISTANCE (KM)	WT IND	WEIGHT	OBS HT DIFF	ADJ HT DIFF	ADJ-OBS	STATION B		ADJ HT OF B
1	2	48.4	9.0	.384	-476.582	-475.610	.972	TINBAL	NM J 38	214.310
1	3	31.5	9.0	.907	-607.406	-609.125	-1.719	YORK	NM J 37	80.795
1	4	56.1	9.0	.286	-293.959	-290.834	3.125	SUKERUT	NM J 39	399.086
1	5	56.8	9.0	.279	-577.191	-574.452	2.739	KING	NM J 40	115.468
1	6	28.9	9.0	1.078	-431.582	-431.689	-.107	VUNABAL	NM J 42	258.231
2	3	19.5	9.0	2.367	-133.977	-133.515	.462	YORK	NM J 37	80.795
2	4	35.4	9.0	.718	185.030	184.776	-.254	SUKERUT	NM J 39	399.086
2	5	41.3	9.0	.528	-98.052	-98.842	-.790	KING	NM J 40	115.468
2	6	54.4	9.0	.304	44.313	43.921	-.392	VUNABAL	NM J 42	258.231
3	4	30.4	9.0	.974	318.904	318.291	-.613	SUKERUT	NM J 39	399.086
3	5	33.9	9.0	.783	35.486	34.673	-.813	KING	NM J 40	115.468
3	6	35.2	9.0	.726	176.667	177.436	.769	VUNABAL	NM J 42	258.231
3	7	49.7	9.0	.364	-17.741	-17.171	.570	PUT PUT	NM J 41	63.623
4	5	6.5	9.0	21.302	-283.618	-283.618	-.000	KING	NM J 40	115.468
4	6	41.9	9.0	.513	-139.832	-140.855	-1.023	VUNABAL	NM J 42	258.231
4	7	44.0	9.0	.465	-336.843	-335.463	1.380	PUT PUT	NM J 41	63.623
5	6	39.3	9.0	.583	143.570	142.764	-.806	VUNABAL	NM J 42	258.231
5	7	39.0	9.0	.592	-52.143	-51.844	.299	PUT PUT	NM J 41	63.623
6	7	19.5	9.0	2.367	-194.325	-194.608	-.283	PUT PUT	NM J 41	63.623
7	1	48.3	9.0	.386	625.373	626.297	.924	MOTHER	NM J 43	689.920

MAX ADJ (WITHOUT SIGN) = 3.125 FROM 1 TO 4

MEAN (WITHOUT SIGN) = .902

MEAN (WITH SIGN) = .222

PROGRAM TRIGHT

PROGRAM AMENDED FEB 1971

COMPUTED ON 03/12/76

TRIG HEIGHT ADJUSTMENT OF AUSTRALIA

STATE - NEW BRITAIN-NEW IRELAND

NATIONAL ADJUSTMENT SECTIONS - ST. GEORGES CHANNEL CRUSTAL MOVEMENT SURVEY

HEIGHTS ARE IN METRES ON THE AUSTRALIAN HEIGHT DATUM

SUMMARY OF FIXED AND ADJUSTED STATION HEIGHTS

SERIAL NUMBER	STATION NAME		HEIGHT
1	MOTHER	NM J 43	689.9
2	TINBAL	NM J 38	214.3
3	YORK	NM J 37	80.8
4	SUKERUT	NM J 39	399.1
5	KING	NM J 40	115.5
6	VUNABAL	NM J 42	258.2
7	PUT PUT	NM J 41	63.6

PROGRAM AMENDED MAY 1971 GEODETIC SURVEY OF AUSTRALIA COMPUTED 16/09/75

SURVEY ADJUSTMENT - LEAST SQUARES VARIATION OF COORDINATES ON THE SPHEROID

ST.GEORGES CHANNEL CRUSTAL MOVEMENT SURVEY SECTION STGE075

AUSTRALIAN GEODETIC DATUM
A= 6378160.00 MS 1/F= 298.250

UNIT WEIGHTS ACCORD WITH THE FOLLOWING STANDARD ERRORS -
DIRECTIONS (SECONDS) AZIMUTHS DISTANCES MS
0.5 1.0 0.03 +3.0 PPM
NORMAL SECTION AZIMUTHS

OBSERVED VALUES OF ANGLES AND AZIMUTHS REJECTED IF MORE THAN***** SECONDS FROM VALUES COMPUTED FROM COORDINATES
OBSERVED VALUES OF DISTANCES REJECTED IF MORE THAN***** MS FROM VALUES COMPUTED FROM COORDINATES
NO REJECTIONS

ORDER OF MATRIX = 12 BANDWIDTH = 11 BANDMAT = 78 INVERSION TIME IN SECONDS .009
NUMBER OF ACCEPTABLE OBSERVATIONS 21 OF WHICH ANGLES = 0 AZIMUTHS = 1 DISTANCES = 20

STATION		SERIAL	SOUTH LATITUDE	ADJ-INIT	EAST LONGITUDE	ADJ-INIT	RHO	NU	HEIGHT MS
FIXED POINTS									
MOTHER	NM J 43	1	4. 12. 50.2799	0.0000	152. 12. 39.3827	0.0000	6335804.67	6378275.28	689.92
ADJUSTED POINTS									
TINBAL	NM J 38	2	4. 3. 31.9190	.0003	152. 37. 8.4632	-.0015	6335779.89	6378266.96	214.31
YORK	NM J 37	3	4. 10. 53.6164	-.0004	152. 29. 34.6582	-.0007	6335799.42	6378273.52	80.79
SUKERUT	NM J 39	4	4. 22. 14.1545	-.0011	152. 41. 28.9771	-.0021	6335830.63	6378283.99	399.08
KING	NM J 40	5	4. 25. 39.5545	-.0011	152. 40. 32.9186	-.0015	6335840.32	6378287.24	115.46
VUNABAL	NM J 42	6	4. 27. .4189	.0003	152. 19. 19.3481	.0002	6335844.17	6378288.54	258.23
PUT PUT	NM J 41	7	4. 36. 59.1298	-.0034	152. 22. 46.0198	-.0018	6335873.28	6378298.30	63.62
			AVERAGE	.0011	AVERAGE	.0013			
			MAXIMUM	.0034 AT 7	MAXIMUM	.0021 AT 4			

OBSERVATIONS AT		SERIAL	SOUTH LATITUDE	EAST LONGITUDE	HEIGHT		SECTION
MOTHER	NM J 43	1	4. 12. 50.2799	152. 12. 39.3827	689.92	MS	STGE075

OBSERVATIONS TO			ADJ AZIMUTH	OBS DIRN	OBS-ADJ	LPL AZ	LPL-ADJ	ADJ LENGTH	OBS LENGTH	OBS-ADJ
VUNABAL	NM J 42	6	154. 43. 27.14			27.14	0.00	28879.391	28879.398	.007
YORK	NM J 37	3	83. 28. 52.46					31515.286	31515.293	.007
TINBAL	NM J 38	2	69. 16. 53.96					48447.101	48447.085	-.016
SUKERUT	NM J 39	4	108. 0. 33.80					56075.809	56075.818	.009
KING	NM J 40	5	114. 37. 15.52					56756.169	56756.157	-.012
PUT PUT	NM J 41	7	157. 12. 41.46					48274.697	48274.678	-.019
ORIENTATION CONSTANT			0. 0. 0.00	AVERAGE		AVERAGE			AVERAGE	.012
				MAXIMUM		MAXIMUM			MAXIMUM	.019

OBSERVATIONS AT	SERIAL		SOUTH LATITUDE	EAST LONGITUDE	HEIGHT		SECTION
TINBAL	NM J 38	2	4, 3, 31.9190	152, 37, 8.4632	214.31	MS	STGE075

OBSERVATIONS TO			ADJ AZIMUTH	OBS DIRN OBS-ADJ	LPL AZ	LPL-ADJ	ADJ LENGTH	OBS LENGTH	OBS-ADJ
SUKERUT	NM J 39	4	166, 53, .03				35395.373	35395.379	.006
KING	NM J 40	5	171, 12, 48.06				41265.329	41265.314	-.015
VUNABAL	NM J 42	6	217, 17, 50.95				54394.669	54394.681	.012
MOTHER	NM J 43	1	249, 15, 7.99				48447.101	48447.085	-.016
YORK	NM J 37	3	225, 53, 14.48				19493.151	19493.153	.002
PUT PUT	NM J 41	7	203, 19, 19.96				67145.789		
ORIENTATION CONSTANT			0, 0, 0.00	AVERAGE	AVERAGE			AVERAGE	.010
				MAXIMUM	MAXIMUM			MAXIMUM	.016

OBSERVATIONS AT	SERIAL		SOUTH LATITUDE	EAST LONGITUDE	HEIGHT		SECTION
YORK	NM J 37	3	4, 10, 53.6164	152, 29, 34.6582	80.79	MS	STGE075

OBSERVATIONS TO			ADJ AZIMUTH	OBS DIRN OBS-ADJ	LPL AZ	LPL-ADJ	ADJ LENGTH	OBS LENGTH	OBS-ADJ
TINBAL	NM J 38	2	45, 53, 47.09				19493.151	19493.153	.002
SUKERUT	NM J 39	4	133, 30, 31.20				30367.358	30367.363	.005
KING	NM J 40	5	143, 17, 18.02				33949.432	33949.431	-.001
PUT PUT	NM J 41	7	194, 40, 37.86				49710.945	49710.947	.002
VUNABAL	NM J 42	6	212, 34, 3.28				35240.651	35240.650	-.001
MOTHER	NM J 43	1	263, 27, 38.14				31515.286	31515.293	.007
ORIENTATION CONSTANT			0, 0, 0.00	AVERAGE	AVERAGE			AVERAGE	.003
				MAXIMUM	MAXIMUM			MAXIMUM	.007

OBSERVATIONS AT	SERIAL		SOUTH LATITUDE	EAST LONGITUDE	HEIGHT		SECTION
SUKERUT	NM J 39	4	4, 22, 14.1545	152, 41, 28.9771	399.08	MS	STGE075

OBSERVATIONS TO			ADJ AZIMUTH	OBS DIRN OBS-ADJ	LPL AZ	LPL-ADJ	ADJ LENGTH	OBS LENGTH	OBS-ADJ
KING	NM J 40	5	195, 19, 9.61				6541.728	6541.730	.002
PUT PUT	NM J 41	7	231, 50, 50.11				44015.739	44015.723	-.016
VUNABAL	NM J 42	6	257, 52, 45.90				41926.565	41926.556	-.009
MOTHER	NM J 43	1	287, 58, 24.35				56075.809	56075.818	.009
TINBAL	NM J 38	2	346, 52, 40.88				35395.373	35395.379	.006
YORK	NM J 37	3	313, 29, 37.94				30367.358	30367.363	.005
ORIENTATION CONSTANT			0, 0, 0.00	AVERAGE	AVERAGE			AVERAGE	.008
				MAXIMUM	MAXIMUM			MAXIMUM	.016

OBSERVATIONS AT		SERIAL	SOUTH LATITUDE	EAST LONGITUDE	HEIGHT		SECTION
KING	NM J 40	5	4, 25, 39.5545	152, 40, 32.9186	115.46	MS	STGE075

OBSERVATIONS TO			ADJ AZIMUTH	OBS DIRN	OBS-ADJ	LPL AZ	LPL-ADJ	ADJ LENGTH	OBS LENGTH	OBS-ADJ
PUT PUT	NM J 41	7	237, 35, 6.16					38954.110	38954.121	.011
VUNABAL	NM J 42	6	266, 21, 59.52					39342.742	39342.747	.005
MOTHER	NM J 43	1	294, 35, 9.44					56756.169	56756.157	-.012
YORK	NM J 37	3	323, 16, 28.61					33949.432	33949.431	-.001
TINBAL	NM J 38	2	351, 12, 32.93					41265.329	41265.314	-.015
SUKERUT	NM J 39	4	15, 19, 13.91					6541.728	6541.730	.002
ORIENTATION CONSTANT			0, 0, 0.00	AVERAGE		AVERAGE			AVERAGE	.008
				MAXIMUM		MAXIMUM			MAXIMUM	.015

OBSERVATIONS AT		SERIAL	SOUTH LATITUDE	EAST LONGITUDE	HEIGHT		SECTION
VUNABAL	NM J 42	6	4, 27, .4189	152, 19, 19.3481	258.23	MS	STGE075

OBSERVATIONS TO			ADJ AZIMUTH	OBS DIRN	OBS-ADJ	LPL AZ	LPL-ADJ	ADJ LENGTH	OBS LENGTH	OBS-ADJ
PUT PUT	NM J 41	7	160, 53, 42.67					19462.909	19462.913	.004
YORK	NM J 37	3	32, 34, 49.58					35240.651	35240.650	-.001
TINBAL	NM J 38	2	37, 19, 10.26					54394.669	54394.681	.012
SUKERUT	NM J 39	4	77, 54, 28.15					41926.565	41926.556	-.009
KING	NM J 40	5	86, 23, 38.09					39342.742	39342.747	.005
MOTHER	NM J 43	1	334, 42, 56.93					28879.391	28879.398	.007
ORIENTATION CONSTANT			0, 0, 0.00	AVERAGE		AVERAGE			AVERAGE	.006
				MAXIMUM		MAXIMUM			MAXIMUM	.012

OBSERVATIONS AT		SERIAL	SOUTH LATITUDE	EAST LONGITUDE	HEIGHT		SECTION
PUT PUT	NM J 41	7	4, 36, 59.1298	152, 22, 46.0198	63.62	MS	STGE075

OBSERVATIONS TO			ADJ AZIMUTH	OBS DIRN	OBS-ADJ	LPL AZ	LPL-ADJ	ADJ LENGTH	OBS LENGTH	OBS-ADJ
VUNABAL	NM J 42	6	340, 53, 26.34					19462.909	19462.913	.004
MOTHER	NM J 43	1	337, 11, 54.76					48274.697	48274.678	-.019
YORK	NM J 37	3	14, 41, 9.20					49710.945	49710.947	.002
SUKERUT	NM J 39	4	51, 52, 18.09					44015.739	44015.723	-.016
KING	NM J 40	5	57, 36, 30.28					38954.110	38954.121	.011
TINBAL	NM J 38	2	23, 20, 25.19					67145.789		
ORIENTATION CONSTANT			0, 0, 0.00	AVERAGE		AVERAGE			AVERAGE	.010
				MAXIMUM		MAXIMUM			MAXIMUM	.019

WHOLE ADJUSTMENT	AVERAGE	0.00	AVERAGE	0.00		AVERAGE	.008
	MAXIMUM	0.00	MAXIMUM	0.00	AT 0 AND 0.	MAXIMUM	.019 AT 7
ABSOLUTE	AVERAGE	0.00	AVERAGE	0.00		AVERAGE	-.001

COMPARISON OF DISTANCES MEASURED IN 1973 AND 1975

Distance		1. 1975 distance	s.d. Single Obs		2. 1973 distance	s.d. Single Obs		1975-1973 = 1. - 2.	
from	to		mm	ppm		mm	ppm	mm	ppm
NM J 43	NM J 41	48274.678	19	0.4	48274.668	20	0.4	+ 10	+ 0.2
NM J 37	NM J 41	49710.947	14	0.3	49710.948	1	0.0	- 1	0.0
NM J 37	NM J 43	31515.293	17	0.5	31515.338	3	0.1	- 45	- 1.5
NM J 37	NM J 40	33949.431	15	0.5	33949.447	13	0.4	- 16	- 0.5

Annex E