

DIVISION OF NATIONAL MAPPING

SIMULTANEOUS RECIPROCAL AZIMUTHS

Since early 1954, Division of National Mapping has read almost the whole of its geodetic horizontal angles to opaque beacons or to helios during the last 1 - 2 hours of daylight.

Until the middle of 1957, normal triangulation methods of reconnaissance and figure selection were used.

Much of the work has been in flattish country in N.T, S.A, and W.A, but it has also embraced triangulation through the Flinders, Musgrave, Mann and MacDonnell Ranges - all ranges of considerable elevation.

The highest and clearest rays have always been selected, both before and after the arrival of the Tellurometer, and side points, usually occupied, have been included wherever economically possible, to give checks against angle and distance work as well as to establish further control points.

The average triangle misclose over 1954 and 1955 was 0.9", but with more experience and better weather conditions, the overall average for triangle closures to date is 0.75".

Numerous single direction T3 azimuths were taken initially along all our early triangulation routes (uncorrected for any Laplace conditions), and in general these gave remarkably close agreement when compared with carried forward geodetic bearings. Side equations also indicated good angular work.

It was noticeable, however, when the Tellurometer became available, that scale, carried through apparently well-closing, well-shaped figures, sometimes fell away quickly.

At the end of 1958, some very large swings encountered near the Bight, coupled with these unexpected fallaways in scale, made single direction work, including azimuth work, suspect in certain areas, more especially near the coast. It was thus decided to see if T3 Simultaneous Reciprocal Azimuths, observed along a line simultaneously from both ends, would help to counteract consistent swings.

At one of these stations near the Bight, the horizontal angle progressed steadily through a swing of 13" over 5 sets (each set being 6 arcs). This is the largest swing encountered by the Division.

Another traverse between Mataranka and Newcastle Waters in N.T., observed to lights after dark, from 30 feet high towers in 1959 over flat, thickly timbered country, accumulated 40" in 48 lines.

This same traverse was re-observed this year to daylight lamps in the last 45-60 minutes before sunset. Simultaneous reciprocal azimuths were also commenced about 10 minutes after sunset over 36 of the 48 lines. The swing in the geodetic azimuths carried forward, using these horizontal angles, and compared with the various meaned reciprocal astronomical azimuths, gave a gradual accumulation of less than 4".

On the Mataranka-Newcastle Waters traverse, the late afternoon lamps were usually steady and sharp at sunset, but almost invariably deteriorated within an hour after sunset into a woolly ball, whilst Sigma Octantis at 15° altitude remained clean and sharp throughout.

The 30 feet high internal windmill towers were shaded all the afternoon by hessian draped the full length of the Western side of the external scaffoldings.

The T3 Plate bubble was read at each pointing to Sigma Octantis, and frequently re-levelled to avoid stickiness or misreading during the sets. 2FL and 2FR pointings made up each arc; 12 arcs were read at each end of a line each night, usually by two observers, each observer reading 6 arcs, before changing over. Usually when a wide range was found between the two ends, another night was observed; also along lines previously observed one way by the T4.

On the Bight traverse in Latitude 32° one had an uneasy feeling that the 6.5" plate bubble might be too coarse. The 15° - 18° Latitude traverse near Mataranka would not be so affected should this be the case, however the T4 also showed wide ranges in its azimuth arcs in the Mataranka area.

Comparisons of T4 with T3 results, and of several nights work at the one station are summarized on the following pages.

The Bight is coastal and as with Mataranka both are low, flat areas where one might well expect difficulties. Such results are for all to see, but on a smaller scale they probably occur on many lines. Further simultaneous results on more elevated points SW of Giles Weather Station are awaiting computation, and comparisons of T3 and T4 simultaneous azimuths are shortly to be observed along a common line near Cooma to clarify what one may expect from T3 instruments used by experienced observers.

Results will be circulated.

Impressions so far gained are :

- (a) the importance of simultaneous reciprocal azimuths on as many lines as possible;
- (b) the need for more frequent but less laborious Laplace positions;
- (c) the need for geodetic horizontal angles to be read on two days;
- (d) horizontal angles and azimuths arc best read in the very late afternoon and very early evening.

COMPARISON OF SINGLE T4 WITH RECIPROCAL T3 AZIMUTHS.

NEAR GREAT AUSTRALIAN BIGHT.

<u>Station</u>	<u>Date</u>	<u>Forward Az.</u>	<u>Reverse Az.</u>
Oak - Nurka	T4 Feb. 60.	301 22 32.25	
	T3 Apl. 61.		31.82
Coppu - Black	T4 Feb. 60.	281 55 17.34	
	T3 Apl. 61.		18.04
Cooper - Wantiby	T4 Feb. 60.	269 36 43.76	
	T3 Apl. 61.		42.59
Black - Colona	T4 Feb. 60.	275 28 33.80	
	T3 Apl. 61.		30.47
NME89 - 88	T4 Feb. 60.	78 50 35.22	
	T3 Apl. 61.		34.59
NME94 - 93	T4 Feb. 60.	82 00 33.00	
	T3 Apl. 61.		30.79
NME110 - 109	T4 Feb. 60.	89 44 46.89	
	T3 Apl. 61.		45.13

BETWEEN MATARANKA AND NEWCASTLE WATERS N.T.

Stott - MacDrill	T4 Aug. 58.	28 40 35.07	
	T3 June 61.		32.52
NMG109 - 110	T4 Sep. 60.	348 37 08.28	
	T3 July 61.		09.73
NMG18 - 15	T4 Sep. 60.	6 37 56.04	
	T3 Sep. 61.		54.07

NEAR MARREE S.A.

Attraction - Alford	T4 Jul. 57.	278 27 20.03	
	T3 May 57.		23.62
	T3 Oct. 60.		18.31

On the Bight traverse, Longitudes were estimated at the reverse azimuth stations and Laplace corrections were applied to bring Forward and Reverse Azimuths into sympathy. Longitudes were closely spaced along the Bight, where anomalies were large.

Anomalies on the Mataranka traverse were small, and no Laplace corrections have been applied.

WILD T3 SIMULTANEOUS RECIPROCAL AZIMUTHS.

RESULTS OF TWO SEPARATE NIGHTS.

<u>Station</u>	<u>Date</u>	<u>Forward Az.</u>	<u>Reverse Az.</u>
<u>NEAR THE BIGHT S.A.</u>			
Wantiby - Browns	22.4.61	295° 58' 19.41	14.14
" "	1.5.61	18.61	15.25
<u>BETWEEN MATARANKA & NEWCASTLE WATERS N.T.</u>			
NMG77 - 78	30.8.61	3 13 09.19	05.18
" "	31.8.61	04.94	12.05
NMG80 - 81	26.8.61	322 08 02.62	02.96
	27.8.61	02.52	01.32
(T4)	-8.58	07 58.65	
NMG82 - 83	23.8.61	349 24 30.79	36.45
	24.8.61	32.67	36.04
NMG94-95	2.8.61	6 26 48.78	51.20
	3.8.61	51.06	51.71
(T4)	-9.60	47.80	
NMG99 - 100	26.7.61	5 40 52.72	59.76
	29.7.61	58.88	56.05
NMG112 - 113	29.6.61	331 31 34.30	39.04
	3.7.61	36.10	38.77
NMG88-89	12.8.61	28 05 04.28	08.33
	13.8.61	04.02	08.80