III. — AUSTRALIE

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In 1957 the Joint Observatory of Yale and Columbia Universities commenced a series of site surveys in Australia under the direction of Dr. I. Epstein. While astronomers at Mount Stromlo Observatory were greatly interested in this activity, it was not until 1958 that Mount Stromlo actively commenced site testing. Tests were initiated in the first instance with a desire to find a not-too-distant location suitable for a field station where observing conditions would be better than those at Mount Stromlo, and later with the idea of finding a site anywhere in Australia which would satisfy the needs of a large telescope.

As is usual in such cases, a general review of meteorological and topographical data was followed by a preliminary inspection of various sites. In Australia there are two areas of minimum cloudiness; one in the West, centred at about latitude 23°S, and the other somewhat South-East of the central region at about latitude 25°S. Unfortunately these are relatively low latitudes for a predominantly southern observatory. Whilst the western area does include some high ground (Mount Bruce at about 1200 m and Mount Augustus at about 1100 m) it is rather inaccessible. The other area, which is in the vicinity of the Lake Eyre basin, does not contain any significant high ground at all. Thus, the search for sites has been confined to areas south of latitude 25° and initially has been directed to areas in the south-eastern part of the continent.

Early in 1958 a party consisting of Prof. B. J. Bok, Mr Harley Wood, Dr. A. W. Rodgers and A. R. Hogg made a preliminary inspection of places in central and southern New South Wales, as a result of which preliminary meteorological observations were begun by local residents at Condobolin, Lake Cargelligo and Griffith. These observations included eye estimates of cloud, scintillation and transparency. Similar visits of inspection were made by Stromlo staff to various parts of Australia and ultimately some 20 stations were reporting observations of night cloud, scintillation, etc. made at 9 p. m. These results were supplemented by data obtained through the Commonwealth Meteorological Bureau. From the preliminary assessments, two courses of action emerged :

1. the establishment at Mount Bingar, near Griffith, New South Wales, of an observing station with a 26-inch reflector;

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2. the commencement of a series of seeing tests using a portable telescope at various sites, first in New South Wales, and later in Western Australia.

The Mount Bingar Observing Station. — The Mount Bingar Observing Station served two purposes : firstly, to provide immediately more cloud-free conditions than were available at Mount Stromlo; secondly to serve as a control site for observations with a portable unit. The first observations with a 26-inch reflector were made by Prof. Bok in December 1959. The telescope has been used solely for photoelectric work, and while the conditions at Mount Bingar were not as good as was expected from the preliminary cloud results, they proved to be better than those at Stromlo. The station was used by Mount Stromlo staff making visits of approximately one week's duration, during which normal research programmes were pursued. The percentage of total dark time during which the telescope was used for photoelectric observations for two complete years of operation are as follows :

Year.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Mean.
1960.....	35	54	54	36	23	42	18	42	30	42	42	43	38
1961.....	56	55	43	20	63	21	21	39	74	59	47	58	46
Mean...	46	54	48	28	43	32	20	40	52	50	44	50	42

In addition to the photoelectric observing time, it has been estimated that at least another 10 % of the total time would be available for spectroscopic and other work where some variations in transparency are admissible in the course of a night. Measures of atmospheric absorption coefficients resulted as a by-product from the investigations carried out at the station, and the mean of results obtained by various observers showed the following figures for absorption at the zenith :

U (ultraviolet).....	3 900 Å	$K_a = 0.54$ magnitude
B (blue).....	4 300 »	$K_b = 0.25$ »
V (visual).....	5 300 »	$K_v = 0.10$ »

These figures indicate that satisfactorily clear conditions prevailed during the measures.

Optical turbulence. — Based on available cloud statistics, considerations of topography and local facilities, certain areas were selected for optical testing. For this purpose, stellar images given by a telescope of small aperture are examined under high power and the quality of the images is assessed using the visibility of the diffraction pattern as a guide (Danjon and Couder, *Lunettes et Télescopes*). This, in turn, leads to an estimate of " optical turbulence " expressed as the semi-vertical angle in seconds of arc of the cone which forms the envelope of the rays

TABLE I.

Optical turbulence. Seeing tests.

Location.	Long	Lat.	Elevation (m).	t_0 Mean.	Sets.	Nights.	Period.
New South Wales :							
Mount Bingar (*).....	146° 14′	34° 07′	455	0.″39	118	37	10 August 1961– 9 March 1962
Mount Dowe (*).....	150 10	30 16	1504	0.26	74	25	12 Feb. 1961– 4 Sept. 1961
Rocky Plateau.....	150 10	30 16	~1380	0.40	18	6	25 August 1961– 5 Sept. 1961
Siding Spring (*).....	148 41	31 16	1160	0.29	141	46	21 Feb. 1961–21 March 1962
Boona Mountain (*).....	147 08	32 39	463	0.19	12	4	1 March 1961–11 March 1961
West Australian :							
Mount Singleton.....	117 18	29 29	698	0.30	140	45	20 Nov. 1961–25 August 1962
» Burges.....	121 05	30 50	555	0.33	134	43	30 Oct. 1961– 2 August 1962
» Grey.....	118 05	31 02	419	0.35	63	20	11 Dec. 1961–30 June 1962
Central Australian :							
Mount Woodroffe.....	131 45	26 19	1440	0.20	14	5	9 May 1961–21 May 1961

(*) Values marked* were obtained with the polar telescope and have been adjusted to the scale of the Astrola.

from the point source (starlight) deviated by natural fluctuations in the atmosphere. The turbulence t is roughly proportional to the secant of the zenith distance (z) of the star observed. In practice, estimates of t are made for about 10 stars at various values of z and the value of t_0 = the optical turbulence at the zenith is derived.

The telescope initially used for the New South Wales sites was an 8-inch reflector on a polar mounting designed by Prof. T. Dunham and Mr. K. Gottlieb. A rigid polar frame was erected at each of five sites and the optics proper, comprising a coelostat flat with mechanical drive, and $f/12$ paraboloid and a small secondary flat with the necessary eye-pieces to give magnifications up to 600, were carried from place to place by the observer. As testing progressed, a commercially-available equatorially mounted 8-inch reflector (Astrola) was obtained and used at certain sites where the installation of a polar frame presented some difficulty. Comparative tests by the same observer using the two instruments showed that on the average the Astrola indicated a slightly lower turbulence than the polar telescope. The difference (amounting to $0.04''$) was applied to reduce the results shown in table I to the scale of the Astrola. Most of the New South Wales results given were obtained by Mr. G. Foxall, using the polar telescope. Mr. Foxall also obtained the Central Australian results with the Astrola telescope and Mr. A. Csorba carried out the West Australian tests with another Astrola. One of the major problems associated with the Astrola was to afford the observer and instrument protection from the wind. In Western Australia it was solved by the erection of a simple type of dome made of a canvas-covered metal pipe frame, rotatable on three whells on a base ring. In New South Wales, an inflatable tent mounted on an inclined frame, with openings in two directions, was used for the same purpose. Both observers were provided with a long-wheel base Landrover well equipped for camping. That for use in Western Australia was required to operate in areas not provided with telephones, so was fitted with radiocommunication equipment linked in with the Royal Flying Doctor medical services.

Table I summarizes the results to date.

As a result of these and other tests it has been decided to locate the Mount Stromlo Field Station on Siding Spring Mount near Coonabarabran with a 40-inch reflector as the principal instrument. Here the percentage of clear hours is expected to be no less than that at Mount Bingar and the image quality considerably better.