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THE PARKES 18-m ANTENNA: A BRIEF HISTORICAL EVALUATION

Wayne Orchiston
School of Engineering and Physical Sciences, James Cook University, Townsville, Queensland 4811, Australia; and National Astronomical Research Institute of Thailand, Heay Keaw Road, Chiang Mai, Thailand.
E-mail: Wayne.Orchiston@jcu.edu.au

Abstract: This short communication summarises the contribution to astronomy made by the 'Kennedy Dish', a stand-alone 18-m (60-ft) parabolic antenna that originally was located at the CSIRO's Fleurs Field Station near Sydney and subsequently was transferred to Parkes and used in conjunction with the 64-m Parkes Radio Telescope as the 'Parkes Interferometer'.

Keywords: 18-m Kennedy Dish, Fleurs Field Station, Parkes

1 INTRODUCTION

Australia has a long and proud history in radio astronomy that had its foundations in radar developments during WWII (see Sullivan, 2009). From the 1940s through to the 1960s much of Australia's radio astronomical research output derived from a network of field stations and remote sites maintained in and near Sydney by the CSIRO's Division of Radiophysics (e.g. see Orchiston and Slee, 2005; Stewart et al., 2010; Stewart, Orchiston and Slee, 2011; Wendt et al., 2011a, 2011b).

A feature of this period was the innovative range of new radio telescopes developed by the Radiophysics astronomers and engineers (Orchiston and Mathewson, 2009; Stewart, Wendt, Orchiston and Slee, 2011), but conventional antennas were also used, including Yagi arrays and single parabolic 'dishes' of various sizes. Initially the latter tended to be recycled WWII searchlight mirrors, but later purpose-built dishes were constructed and then in 1959 the Division purchased a prefabricated 18-m (60-ft) American antenna (Figure 1). This originally was sited at the Division's Fleurs Field Station, but in 1963 it was relocated to Parkes.

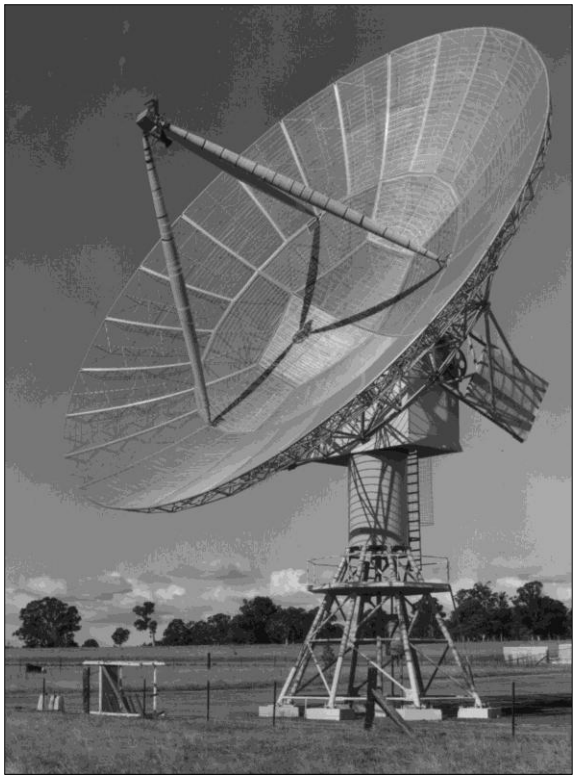

Figure 1: The prefabricated 18-m parabolic antenna (courtesy: ATNF Historic Photographic Archive).

After several decades of neglect the future of the '60-ft Parkes Dish' came under review in 2002, and I was asked to prepare a brief report on the historical significance of this radio telescope.[1] This short communication is based on that report, and its publication now—after a hiatus of ten years—was prompted by Don Mathewson's (2012) paper in this issue of the Journal, about his discovery of the Magellanic Stream.

2 THE FLEURS ERA

The Division of Radiophysics established a field station at Fleurs, near Sydney, in 1954 (Orchiston and Slee, 2002b), in order to provide a facility for the Mills Cross, Shain Cross and Chris Cross. These innovative radio telescopes were constructed between 1954 and 1957 (see Orchiston and Slee, 2005).

The Chris Cross was the world's first cross-grating interferometer, and was designed to generate daily 1423 MHz isophotes maps of the Sun (Orchiston and Mathewson, 2009). In order to use this instrument of an evening for non-solar astronomy the sensitivity had to be markedly improved, and the easiest way of achieving this was to install preamplifiers on the E-W arm antennas and to add a comparatively large parabolic antenna as a multiplying element at the eastern end of the E-W arm of the Cross. The antenna selected was the 18-m (60-ft) dish now at Parkes, and this prefabricated American antenna (known as the 'Kennedy Dish' after the manufacturer) was assembled at Fleurs in 1960 (Figure 2).[2] The resulting 'Fleurs Compound Interferometer' (Figure 3) had a 1.5 arc-minute fan beam (see Labrum et al., 1963), and was used by Labrum et al. (1964) to investigate the right ascensions and angular sizes of eight known discrete sources at 1423 MHz. Meanwhile, the 18-m Antenna could also operate independently of the Chris Cross, as a stand-alone radio telescope, and it was used in this mode by Mathewson et al. (1962a, 1962b) to survey the southern Milky Way at 1440 MHz.

3 THE PARKES ERA

In 1963 the 18-m Antenna was transferred to Parkes

Figure 2: An aerial view of the Chris Cross at Fleurs looking north-east, with the 18-m Antenna (far right) under construction at the eastern end of the E-W arm of the Cross (courtesy: ATNF Historic Photographic Archive).

to allow construction of the 'Parkes Variable-baseline Interferometer' (Figures 4 and 5). As Bachelor et al. (1969: 305) point out, this instrument employed a number of novel features, including

> … observation with one telescope in motion at up to 120 feet per minute on east-west or north-south tracks automatic path difference compensation and simultaneous operation at two different frequencies of 1402.8 and 467.6 MHz. The installation uses solid-state components throughout …

Unfortunately, phase instability associated with the exposed cable that linked the 18-m antenna to the 64-m Parkes Radio Telescope created problems (e.g. see Radhakrishnan, 1994) and so the Parkes Interferometer "… was never useful for position measurements, for which John [Bolton] had originally intended it." (Ekers, 1994: 574).

However, it did provide very useful data on source sizes (see Wall et al., 1968) and brightness distribution (Ekers, 1969a). It also showed that the lobes associated with double-lobed radio galaxies were not expanding with time and therefore could not have been formed from galactic explosions—as was the prevailing wisdom (Ekers, 1994). It was also used by Goss et al. (1970) for H-line work and by Radhakrishnan and Whiteoak (1967) for OH work.

As was the case at Fleurs, the 18-m Antenna also could function successfully as a stand-alone radiometer, and in this context Don Mathewson used it to map the Magellanic Stream (see Mathewson, 2012).

Finally, from an historical perspective, we should not forget that a youthful Ph.D. student named Ron Ekers cut his 'radio-astronomical teeth' on the Parkes Interferometer (see Ekers, 1969b).

4 CONCLUDING REMARKS

The Parkes 18-m Antenna (Figure 6) is an historically-significant radio telescope and deserves to be retain-

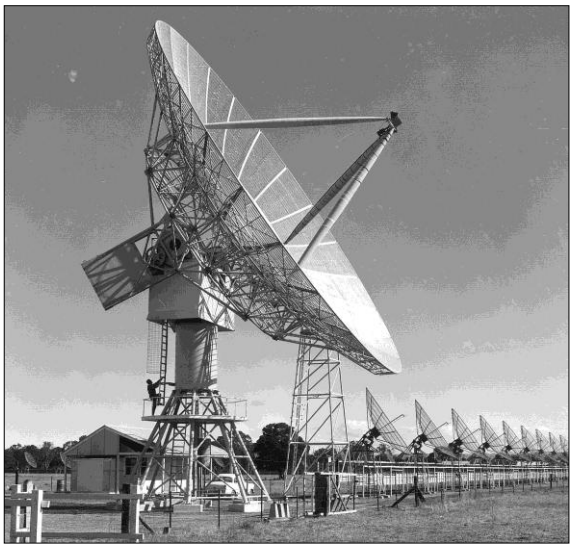

Figure 3: The completed 18-m Antenna at Fleurs, looking west along part of the E-W arm of the Chris Cross (courtesy: ATNF Historic Photographic Archive).

Figure 4: View showing the 64-m Parkes Radio Telescope and to the right of it the 18-m Antenna (courtesy: ATNF Historic Photographic Archive).

ed and preserved.[3] After the 64-m Parkes Radio Telescope, for a time the 18-m Antenna was the largest fully-steerable parabolic radio telescope owned and operated by the CSIRO's Division of Radiophysics.[4] It was part of the first high-resolution compound interferometer in the Southern Hemisphere, and was part of the first variable-baseline high-resolution interferometer in the Southern Hemisphere. While at Fleurs and at Parkes it contributed to international radio astronomy through published papers on H-line and OH work and on discrete sources, and was responsible for the identification and mapping of the Magellanic Stream. It also was associated with the Ph.D. of one of Australia's foremost astronomers, former ATNF Director and former IAU President, Professor Ron Ekers.

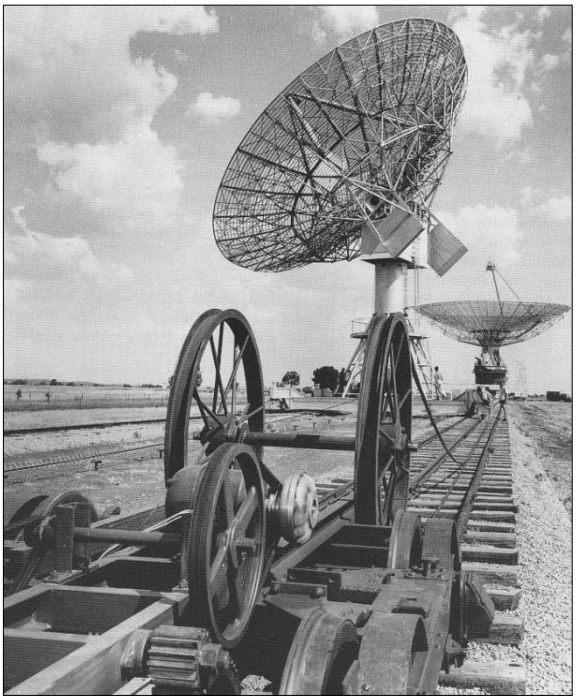

Figure 5: View of the Parkes Variable-baseline Interferometer, and the railway track used by the 18-m Antenna. The wheels in the foreground were part of the mechanism that drove the 18-m Antenna along the railway track (courtesy: ATNF Historic Photographic Archive).

5 NOTES

1. At the time Professor Ron Ekers was Director of the Australia Telescope National Facility (ATNF) and I was employed as the Facility's Archivist and Historian.

Figure 6: A picturesque view of the 18-m Antenna at sunset (courtesy: Roopesh Ojba).

2. Ekers (1994: 572) has erroneously stated that the 18-m radio telescope was located at the Murraybank Field Station, not Fleurs, before it was moved to Parkes. While it is true that Dick McGee lobbied for this radio telescope to be assigned to Murraybank, Joe Pawsey "… discounted this idea and a specification was drawn up for a new [much smaller] aerial … [to be sited there]." (see Wendt et al., 2011a: 437 for details).
3. But note that ATNF has since been superseded by CASS (CSIRO Astronomy and Space Sciences), which is now responsible for any decisions that might be made about the future of the 18-m Antenna.
4. Earlier, in 1951, a 21.9-m 'hole-in-the-ground' radio telescope was constructed at the Division's Dover Heights field station and in 1952 expanded to 24.4m diameter (see Orchiston and Slee, 2002a), but this antenna was not fully steerable and had ceased to exist by the time the 18-m Antenna was acquired.

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Dr Wayne Orchiston is an Associate Professor of Astronomy in the School of Engineering and Physical Sciences at James Cook University, in Townsville, Australia, and a Visiting Professor at the National Astronomical Research Institute of Thailand in Chiang Mai. Wayne is particularly interested in the history of radio astronomy in Australia, France, Japan and New Zealand. He is editor of the book *The New Astronomy: Opening the Electromagnetic Window and Expanding our View of Planet Earth* (Springer, 2005) and co-editor of the book *Highlighting the History of Astronomy in the Asia-Pacific Region* (Springer, 2011), both of which contain numerous papers on the history of radio astronomy. Wayne is the founder and current Secretary of the IAU Working Group on Historic Radio Astronomy.