SHORT COMMUNICATION

A SURVEY OF THE SOUTHERN SKY AT 153 MHz*

By P. A. Hamilton† and R. F. Haynes†

Recent low frequency surveys of the sky have shown the galactic plane in absorption as a region of low brightness. The analysis of this absorption has provided information on the distribution of ionized hydrogen in the galactic plane (Ellis and Hamilton 1966). The extension of this analysis required a number of surveys at higher frequencies, where absorption effects are less evident, and this paper presents the result of such a survey at 153 MHz.

The 210 ft paraboloid of the Australian National Radio Astronomy Observatory at Parkes, New South Wales, was used for the observations. At 153 MHz the beamwidth of the telescope is $2 \cdot 18°$. The receiver was one of the standard receivers available at the Observatory. It is a solid state, total power receiver with a nominal centre frequency of 153 MHz and a bandwidth of $3 \cdot 8$ MHz. The peak-to-peak fluctuations at the output were about $1 \cdot 5$°K when the second detector time constant was 1 sec. The feed consisted of a pair of half-wave dipoles with a plane reflector. The aerial response pattern was determined from a number of scans through strong isolated sources and found to be close to circular, with a Gaussian profile. No attempt was made to keep the feed angle constant during the survey.

The survey was made with scans in declination. The telescope was driven through 30° at a drive rate of $2 \cdot 5°$ per minute with the right ascension held constant. A grid of these scans was built up at a spacing of 12^{m} in right ascension. Regions showing fine detail were then examined again with a scan separation of 6^{m} in right ascension.

A number of reference scans were made in right ascension to tie together the main declination scans. The telescope was driven at $2 \cdot 5°$ per minute for a range of 3^{h} and then pointed to the south celestial pole. In this way the declination scans were related to one another, and the whole survey was referred to the south celestial pole.

The relative accuracy of the survey was established by making a number of scans across the same region of the sky at different times; the relative accuracy is believed to be $\pm 5\%$.

Thermal loads were used to calibrate a temperature-saturated noise diode which was used as a secondary standard throughout the survey. An additional check was made by comparing the noise diode calibrations with scans through the standard sources Hydra A and Hercules A. The results obtained were in close agreement with the flux densities of 340 and 420 f.u.‡ respectively given by Conway, Kellermann, and Long (1963). Noise diode calibrations were made at the beginning and end of each scan and the appropriate small adjustments were made to the records.

* Manuscript received May 19, 1969.

† Department of Physics, University of Tasmania, G.P.O. Box 252 C, Hobart, Tas. 7001.

‡ 1 flux unit $= 10^{-26}$ W m^{-2} Hz^{-1}.

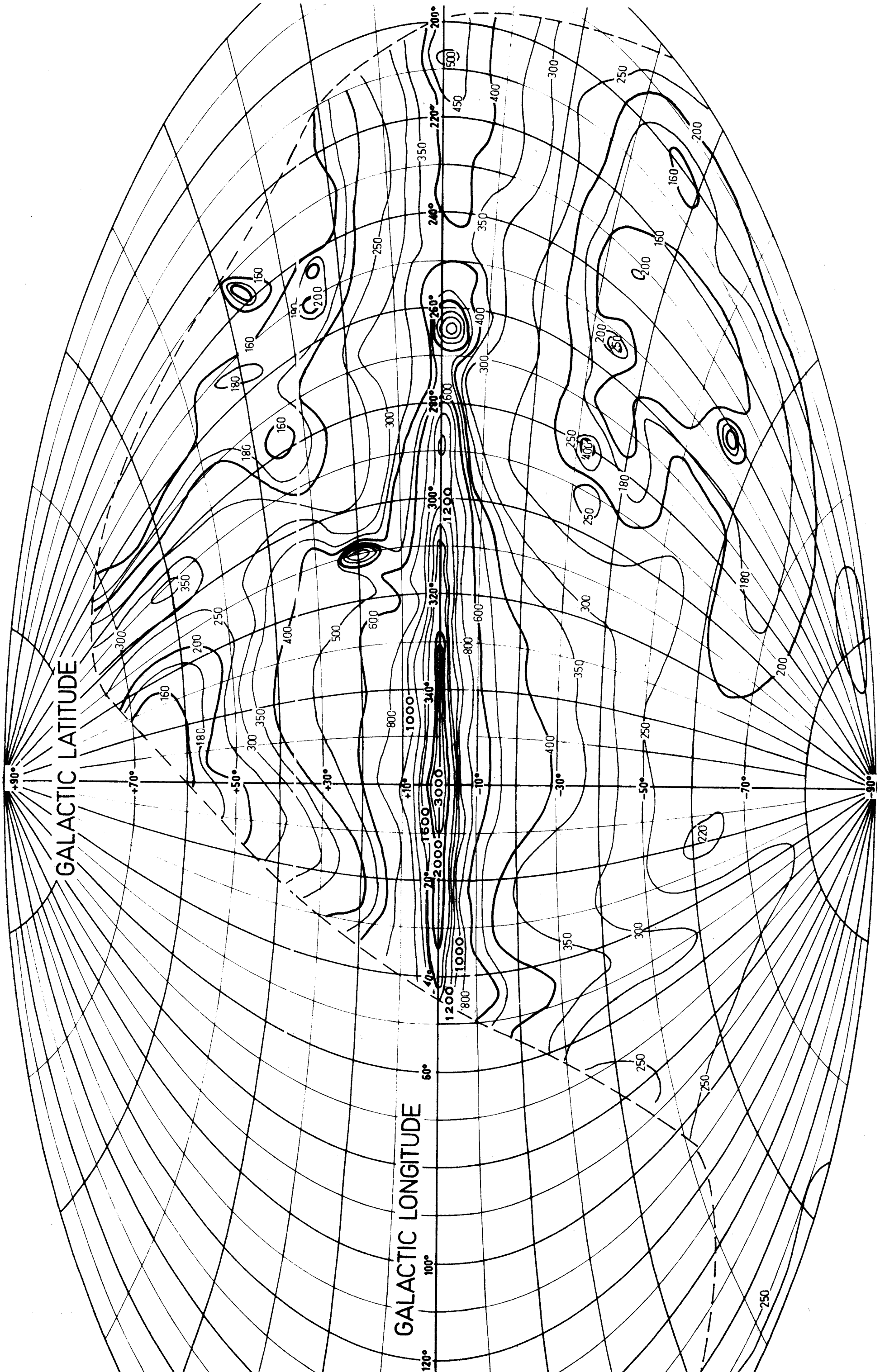

Fig. 1.—Contours of effective aerial temperature (°K) at 153 MHz.

The survey reference point was the south celestial pole, and the absolute calibration required the determination of the equivalent aerial temperature of this region. This was done by replacing the feed with a thermal load and adjusting the temperature of the load to give the same output from the receiver. The value obtained in this way was $280(\pm 15)$°K.

The survey was undertaken primarily to obtain information on the background emission. However, reliable measurements were made of some 300 sources, and these have been reported separately (Hamilton and Haynes 1967).

The results of the background survey are presented in Figure 1 as smoothed contours of effective aerial temperature. The coordinates of the map are new galactic coordinates, and the projection is the Hammer equal-area projection. The dashed line in the figure indicates the limits of the observations. The effects of small sources have been removed from the map, but no attempt was made to remove the larger extended sources such as the region $l = 310°$, $b = +20°$ due to Centaurus A because of the difficulty in assessing the relative contributions of source and background.

The most notable feature of the map is the spur at $l = 300°$, $b = -50°$ extending from the direction of the galactic centre into the large cold region centred on $l = 240°$, $b = -40°$. The position of the cold region corresponds to that of the similar region seen in the northern maps, but they do not show any feature corresponding to this spur. The part of the well-known northern spur near $l = 40°$ that extends into the southern galactic hemisphere is prominent, and the feature near $l = 280°$, $b = +70°$ could well be the continuation of this spur, as proposed by Quigley and Haslam (1965).

Along the plane a number of steps in emission are apparent. These agree with the corresponding effects noted by Mills (1959), who suggested that in these directions the line of sight is tangential to a spiral arm.

The present survey agrees well with the survey of the galactic plane region by Wielebinski, Smith, and Garzón Cárdenas (1968), who discuss the emission steps in more detail. Agreement is also good with the northern survey at 178 MHz by Turtle and Baldwin (1962) in the region common to the two maps.

We wish to thank Dr. E. G. Bowen and Mr. J. G. Bolton, CSIRO, for permission to use the facilities at the Australian National Radio Astronomy Observatory, and also the staff of the Observatory for the considerable assistance and advice given during the observations. The radiophysics group within the Physics Department, University of Tasmania, is assisted financially by grants from the Australian Research Grants Committee and the Radio Research Board. One of us (R.F.H.) is indebted to CSIRO for support in the form of a Senior Postgraduate Studentship.

References

Conway, R. G., Kellermann, K. I., and Long, R. J. (1963).—*Mon. Not. R. astr. Soc.* **125**, 261.

Ellis, G. R. A., and Hamilton, P. A. (1966).—*Astrophys. J.* **146**, 78.

Hamilton, P. A., and Haynes, R. F. (1967).—*Aust. J. Phys.* **20**, 697.

Mills, B. Y. (1959).—*Publs astr. Soc. Pacif.* **71**, 267.

Quigley, M. J. S., and Haslam, C. G. T. (1965).—*Nature, Lond.* **208**, 741.

Turtle, A. J., and Baldwin, J. E. (1962).—*Mon. Not. R. astr. Soc.* **124**, 459.

Wielebinski, R., Smith, D. H., and Garzón Cárdenas, X. (1968).—*Aust. J. Phys.* **21**, 185.