COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

RECORDS

1958, NO. 57

THE COSMIC NOISE RECORDER AT THE WATHEROO MAGNETIC OBSERVATORY.

by

M. KIRTON and P.M. McGREGOR.

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ABSTRACT.

Briefly described in this record is the Cosmic Noise Recorder being constructed and installed at the Watheroo Magnetic Observatory, Western Australia. The complete recorder is described, and a statement is given of progress so far and of work remaining before regular recording commences.

I. INTRODUCTION

In 1947 the Watheroo Magnetic Observatory was donated by the Carnegie Institute of Washington to the Commonwealth of Australia . Since then it has been operated by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. A description of the observatory site has been given in Record No. 58 (1958).

The main programme in geophysics at Watheroo consists of researches in geomagnetism and the ionosphere, earth current recordings and limited meteorological observations. To supplement the ionospheric and geomagnetic recordings an 18 Mc/s cosmic-noise recorder (Shain and Mitra 1954) is being installed.

Work on the cosmic-noise recorder began as early as 1956. During 1957 the aerial was designed and erected and some units of the recorder were installed. Sporadic test recordings with the incomplete instrument helped familiarise staff with some aspects of the technique but a virtually complete staff change towards the end of 1957 interrupted this work. Difficulty in obtaining parts for the remaining units has also delayed progress with the installation, so that at the time of writing no proper recordings have been made.

II. THE RECORDER

The purpose of the recorder is to give a continuous record of the cosmic-noise level in the 18 - 20 Mc/s region, primarily to assist in confirming geomagnetic solar flare effects and ionospheric fade-outs, but also to obtain more general ionospheric absorption data. It consists, basically, of an aerial with reasonably vertical directivity, a receiver, an amplifier, a recorder and a calibrator. A block diagram of the complete unit is shown on plate 1.

The aerial consists of an array of four horizontal half-wave dipoles arranged in pairs, with one pair vertically above the other at a distance of one-eighth wavelength, and the centre point of the array one-half wavelength above the ground. The pairs of dipoles are fed 180° out of phase with each other and the aerial gives vertical beam widths (half-power) of 42° in the plane of the array and 66° perpendicular to the array. The aerial is cut to the centre of the recording region namely 19 Mc/s, has an impedance of 2,500 ohms, and the plane of the array is east-west. A reflecting mat of wire-netting is spread over the ground for a distance of about one-half wavelength either side of the aerial. A 400 ohm (the receiver impedance) open-wire transmission line links the aerial and receiver. A stub line is used to match the line and aerial, and determinations of the standing wave ratio have shown the matching to be more than sufficient.

The receiver used is an Eddystone 680X communications type. Its stability, gain and bandwidth are suitable for recording purposes. The cosmic noise envelope is obtained from the A.V.C. diode and is fed into the amplifier.

The D.C. amplifier ("Fleurs" type) was designed by the Radiophysics Division of the C.S.I.R.O. The stabilised power supplies for it are taken from suitable points in the Eddystone receiver. After amplification the signal is passed through a circuit with a time-constant of 1 - 2 seconds to prevent rapid

fluctuations reaching the recorder. In addition the output signal is backed-off so that the receiver noise level just records above the zero of the record.

An Evershed and Vignoles recording milliammeter (1 MA full scale deflection) is used for recording the signals. The milliammeter has a siphon pen and linear scale and is run at a paper speed of six inches per hour.

For calibration a diode noise generator, also designed by the Radiophysics Division, and arranged to match the receiver impedance, is switched to the receiver input in place of the aerial. In order to measure the receiver noise level, a dummy aerial is switched in at hourly intervals.

III. PROGRESS WITH INSTALLATION

At the time of writing the aerial, receiver amplifier and recorder have been set-up and test operated. The noise diode calibrator is being constructed, and the remaining circuits and switching arrangements will then be assembled.

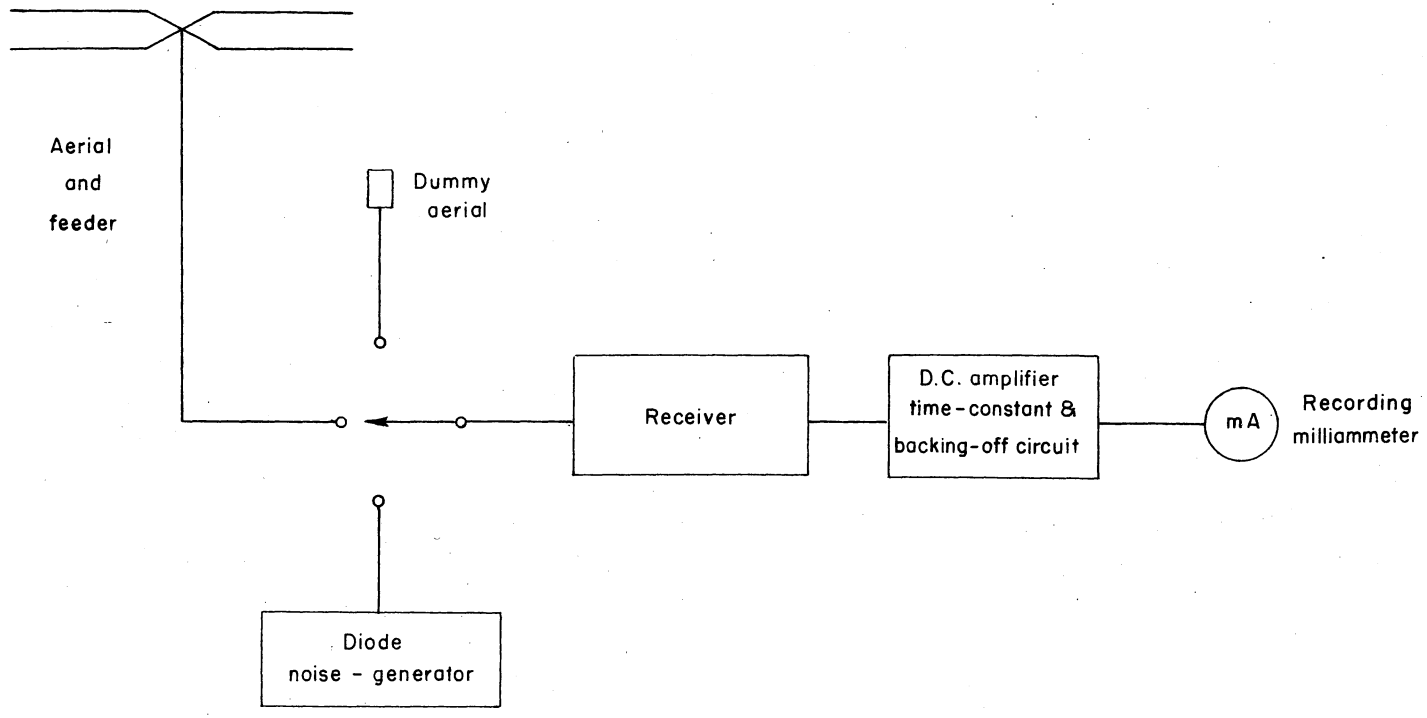
IV. CONCLUSION

Preliminary test recordings with the incomplete unit during 1957 showed that interference from local (observatory) sources may be troublesome. Difficulty has been experienced in finding a frequency in the 18 - 20 Mc/s range permanently free of station interference, and this may require alteration of the frequency recorded from time to time during the day. During these tests two solar flare effects were recorded, and the diurnal variation of ionospheric absorption and the meridian passage of the Milky Way were apparent on the records.

It is unfortunate that the installation of the recorder is not more advanced, but the small time available after carrying out the main observatory programme, the staff changes during the initial period of construction, and difficulties in procuring parts for the various components have made this unavoidable.

V. REFERENCE

Shain, C.A. & Mitra, A.P. 1954 - "Effects of Solar Flares on the absorption of 18.3 Mc/s cosmic noise". Journal of Atmospheric and Terrestrial Physics, Vol. 5, p.316.



MAGNETIC OBSERVATORY, WATHEROO, W.A.

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