LETTERS TO THE EDITORS

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Observations in Australia of Radio Transmissions from the First Artificial Earth Satellite

THE choice by the U.S.S.R. of frequencies of 20 and 40 Mc./s. for radio transmissions from their Earth satellites provided a new approach to the study of the ionosphere, the main interest of the Radio Research Board in Australia. So arrangements were made to record the intensity variations of the signals.

The Overseas Telecommunication Commission generously made available a low-noise site and good receiving facilities at Bringelly, near Sydney.

The 20 Mc./s. signal was recorded using a quarter-wave vertical dipole antenna, a sensitive stable highly selective receiver, and a Brown high-speed potentiometric pen recorder. Observation was confined mainly to times when the signal was received by a direct path and was no longer modulated by the $\frac{1}{3}$ sec. modulation.

A 60-sec. sample of one record is shown in Fig. 1. It will be noted that there is a slow signal variation

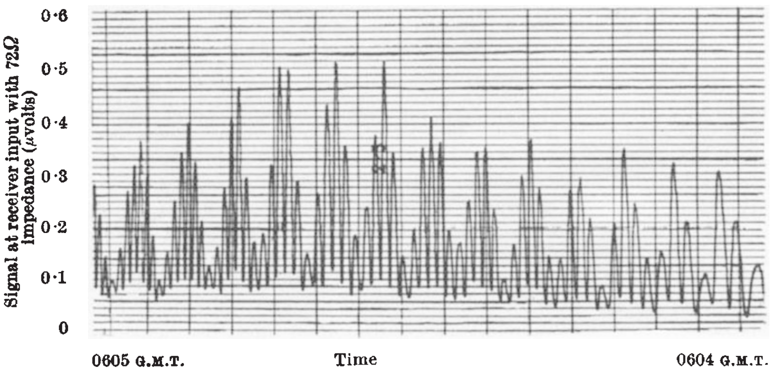

Fig. 1. Strength of 20 Mc./s. signals from satellite α1957 recorded at Bringelly, N.S.W., Australia, on October 19, 1957, at 0604–0605 G.M.T.

with sensibly constant period of the order of 5 sec. and a faster deep fading of variable periodicity.

The faster fading-rate varies according to a regular pattern which is shown plotted in Fig. 2 for three close transits. It can be seen that the rate passes through a minimum which occurred always to the south of the observing station. There are also points of inflexion in the curves which occur at times when the satellite is near to the position of closest approach to the station as deduced from Doppler shift measurements.

The south to north transits were at a height of approximately 500 km. and from north to south they were at approximately 900 km. For the north to south transits only one record has been found which shows both sides of the minimum.

The minimum appears to occur when the satellite position is such that the propagation of the wave is nearly perpendicular to the direction of the Earth's magnetic field ; but more accurate orbital informa-

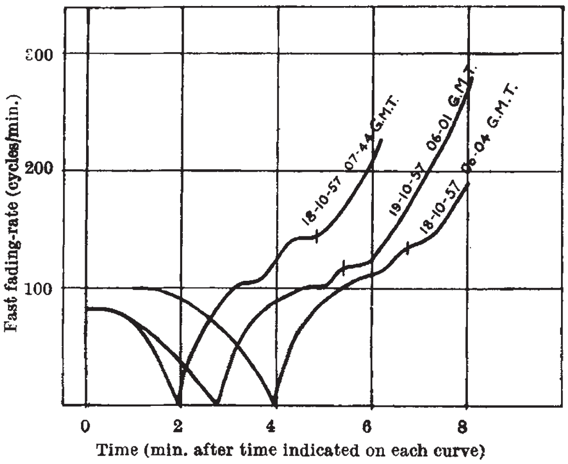

Fig. 2. The fast fading-rate of the 20 Mc./s. signal of satellite α1957 as a function of time during south to north transits. Vertical stroke, time of nearest approach to station

tion than is at present available is needed to establish this precisely.

Similar effects appear to be present on 40 Mc./s. records which were made simultaneously with the 20 Mc./s. measurements ; but the recordings were made with less satisfactory equipment. The slow fading pattern, because of its regularity, is considered to be a feature of the transmission, possibly due to rotation of the satellite. There seems little doubt that the fast deep fading is due to interference between the ordinary and extraordinary components as the respective received phases vary due to a combination of variation in path difference and Doppler frequency shift difference for the two components. The relative magnitude of the two effects has not yet been computed.

In addition, the depth of the beats has enabled calculation of the relative strengths of the two components as a function of time and hence of the relative absorption in the ray paths. Due to attenuation of the extraordinary component the fading at the time when the fading rate is a minimum is small so that if the attenuation was high or the transmitted signal weak, this portion of the curves was not recorded.

Theoretical examination and detailed computation are continuing in anticipation of accurate information on the satellite orbit being obtained.

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