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ERNESTO GHERZI

NOTE ON THE RECEPTION AT BREBEUF COLLEGE IN MONTREAL OF PULSES FROM DISTANT LORAN STATIONS ON THE ATLANTIC COAST

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NOTE ON THE RECEPTION AT BREBEUF COLLEGE IN MONTREAL OF PULSES FROM DISTANT LORAN STATIONS ON THE ATLANTIC COAST

ERNESTO GHERZI
Pontifical Academician

SVMMARIVM — Receptio stationis Loran (1,95 MHz) ultra horizonta ostendit, ut videtur, stratum ionosphaericum D celerius sub solis occasum dissolvi vel deminui quam sole exoriente restaurari. Magneticae tempestates, etsi magnam vim habent in strata E et F ionosphaerae, non tamen impediunt ne stratum D formetur aut dissolvatur.

The different aspect at sunset and at sunrise of the reception of pulses on 1.95 MHs from distant Loran stations, already pointed out in 1962 ([1]) has been confirmed by longer although intermittent series of recordings, obtained in 1963 and 1964. Namely the intensity of the reception increases faster at sunset than it does decrease at sunrise.

APPARATUS. A Marconi crystal controlled superheterodine receiver type CSR-5A, with a band-width of 1000 cycles was connected to a large Delta aerial vertically polarized. The sensitivity control was always kept at the same level, namely

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to that of 10 microvolts input on 300 ohms impendance, an input which would just move the pen of the Angus type recorder. Of course with a greater sensitivity the times of the arrival or of the cessation of the Loran pulses would have been sooner and later. Nonetheless even with a greater sensitivity no recording was ever obtained during the full day-light hours. Moreover our research was not concerned with the real time of the arrival or cessation of the pulses but with the building up of their amplitude on the recorded trace.

Method used

The time (+ or - minutes) when at sunset or at sunrise a reference amplitude, namely 50% of the « off scale value » was reached in the integrated reception trace was computed down to the time when only the receiver's noise was recorded. With this technique we have greatly avoided the danger of considering a fortuitous industrial disturbance acting on the recording pen as if it were the first or the last of the Loran pulses. Once more we state that we were not interested in the real time of the arrival or the cessation of the pulses but in their increase or decrease in amplitude. The more so that we could not know « a priori » at what time either the first or the last of these pulses should have been registered ([2]).

The author is well aware that the choice of a same amplitude as a reference datum for timing the increase of the reception at sunset and its decrease at sunrise might still raise some objections. Nevertheless such an amplitude value (50% of the off scale value) was always observed in all recordings and could easily be timed. The statistical fact is that in 90% of the cases the reference amplitude was reached sooner at sunset than it was lost at sunrise. (Cf. Table I).

Namely in 1963 (41 recordings) the 50% amplitude of the off-scale value was reached at sunset after 26.6 minutes of recording and lost after 40 minutes. In 1964 (30 cases) the figures are 27.8 minutes at sunset and 45 minutes at sunrise.

The 71 recordings used out of the 250 available were all « clean » records not marred by local or distant thunderstoms or industrial interferences. We do not think any objection can be raised against our very strict choice of data.

They clearly show that at sunset the D layer disappears faster than it builds up again at sunrise, at least for the 1.95 kHz frequency considered. Since upper air ionization data by means of rockets are not at hand we are not able to offer any explanation of the fact reported.

Disturbed recordings

Up to now all our statements were based on undisturbed recordings. We will now examine those showing a disorderly shape and a corresponding special fading of the intensity.

Of course there is no special interest in considering the well known and often so regular oscillations chiefly due to the interaction of the sky and the ground waves. This kind of fading was always more or less present in all the 250 recordings at hand.

The author would like to mention another not so often analyzed cause of disturbed traces. While letting aside those days with local thunderstorms we would recall how auroras and ionospheric storms, linked up with magnetic disturbances, did affect in a decided way the propagation of the Loran pulses recorded.

There were 72 nights when a strong or moderate magnetic storm was in action. The dates are those of the list published in the « Journal of Geophysical Research » for 1963 and 1964.

As surmised the registered trace becomes greatly modified, at least during the night hours when the Loran pulses were received. Unhappily most of these magnetic disturbances had begun when our place was still in full sun light... and no Loran pulse was received.

It was soon evident that notwithstanding the presence of a strong magnetic storm, lasting sometimes several days the usual aspect of the Loran recorded trace did not change. Namely the magnetic disturbance did not affect the ionosphere in such a way as to render it reflecting the Loran pulses even after sunrise. The D layer was not disturbed in any special way. Furthermore we never had any night with a total black-out. (Cf. Plates II, III). There was only a wild jumping up to off-scale value followed by a sudden downward trend of the trace, without any sequel or regular oscillations. The result was only that of a very shaggy integrated trace.

During these days of magnetic storm, due attention was given to the « A » magnetic factor published by the USA Fredericksburg Observatory. We found that even with a relatively moderate value (12 to 20) the magnetic perturbation of the recordings was just as strong as when an « A » figure of 30 to 40 had been reported.

In conclusion the interesting fact revealed by the registration obtained during magnetically disturbed nights is that in any research of radio waves fading one should take into account also weak magnetic disturbances. Some of those long or very short period radio fadings might not be due only to the interference of sky and ground waves. Magnetic action well below the usual sensitivity of magnetographs could be in action.

Ionospheric data

During this study some pulsing was made by means of our ionosonde (500 watts peak value). At sunset just as well as at sunrise the E and F layer were often present and remained acting even when the Loran pulses were no longer received, showing that the D layer was the one to be considered.

Our equipment was not sufficient for examining the ionization of this layer.

Although the E layer was most of the time present with the Maritime air mass over our regions and the F layer with the Polar air mass, no correlation was found between the magnetic disturbance and the different atmospheric synoptic conditions just mentioned.

Conclusions

A two years study of the reception of Loran pulses has shown that these pulses, owing to the great distance of the pulsing stations, were received only during night hours and rarely some time before local sunset or after local sunrise. The intensity of the reception increased faster at sunset than it decreased at sunrise, showing that the D layer disappeared at a quicker rate at sunset than it built up again at sunrise.

Magnetic storms greatly affected the shape of the recordings but never changed the D layer conditions in such a way that these Loran pulses could be recorded during full sunlight hours.

Any research on the radio waves fading should take into account even weak and unrecorded magnetic disturbances.

REFERENCES

(1) GHERZI E., *Note on the radio propagation of a Loran station.* « Bulletin de Géophysique » No. 12, pp. 3-11. Oct. 1962. Collège J. de Brébeuf. Montréal P.Q. - Canada.

(2) *Radio aids to Marine Navigation.* Vol. 8. March 1, 1963, p. 23 - Department of Transports- Telecommunications and electronics branch. Ottawa. Canada.

PLATE I

26 May 1964 E.S.T. (24 May Temp magnetique)

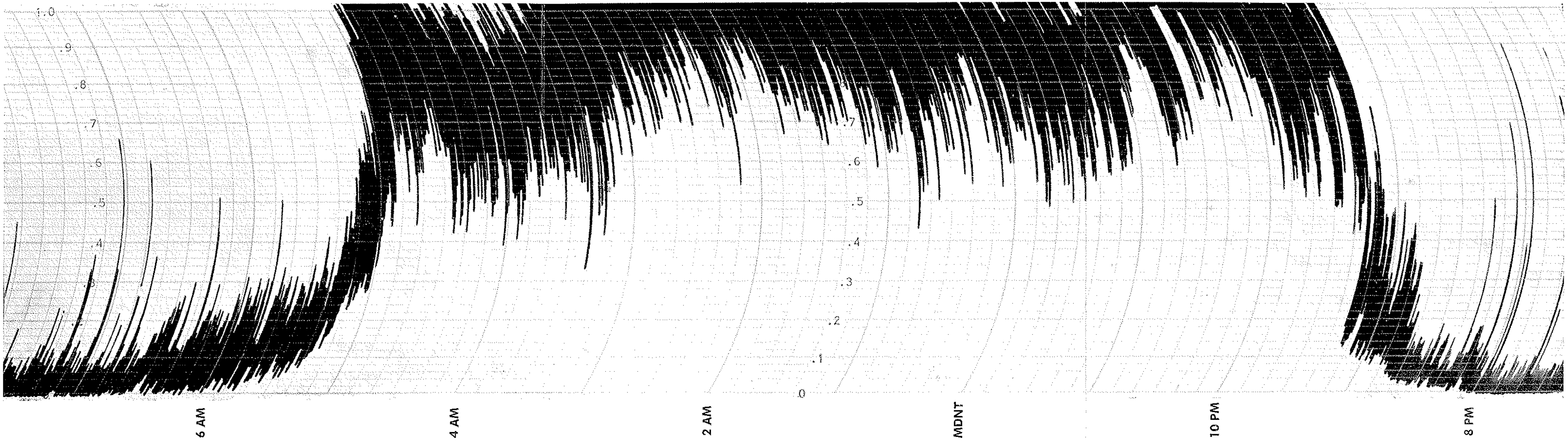

PLATE II

25 Sept. 1963 **GREAT AURORA BOREALIS** 24 Sept. 1963

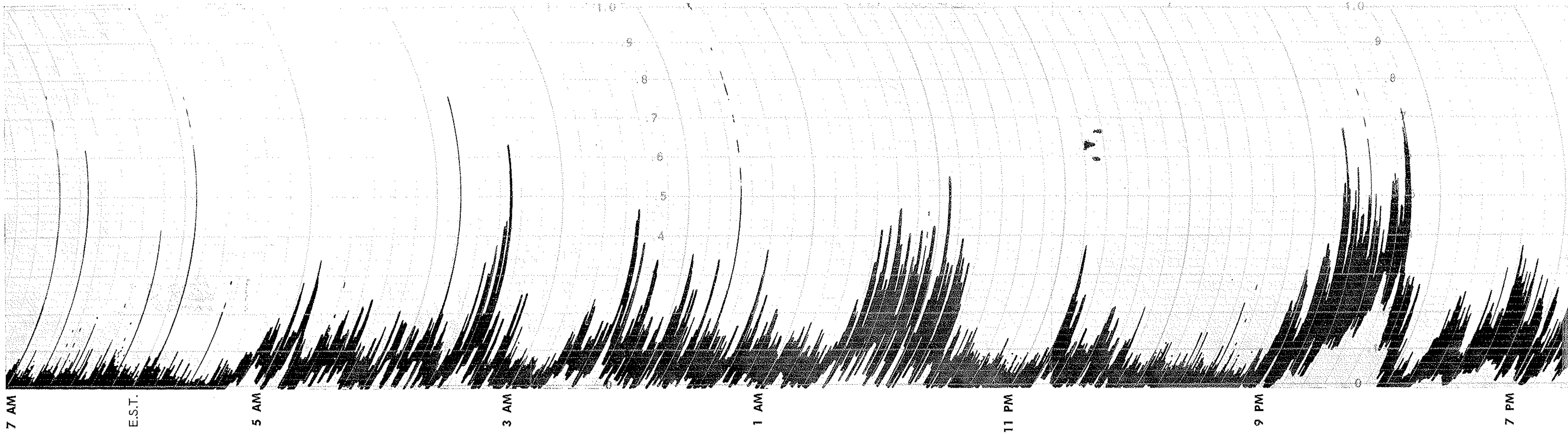

PLATE III 3 Jan. 1964 **MAGNETIC STORM** 2 Jan. 1964