OBSERVATION OF A VERY LOW FREQUENCY PLASMA RESONANCE BY ALOUETTE I

An unusual band of noise observed in the Alouette I satellite has been reported by Barrington and Belrose [1963], who noted that the band had a sharp lower frequency cutoff which usually increased in frequency with decreasing latitude of the satellite. Since this lower cutoff frequency varies consistently with the location of the satellite, it is deduced that the observed changes in this frequency arise from spatial rather than temporal effects. Because the lower cutoff frequency is sharp and changes measureably within a few seconds, we may deduce that the horizontal field of view of the satellite for this band is at most a few tens of kilometers.

From observations of triggering of this band by both atmospherics and whistlers, Brice, et. al. [1964] concluded that the noise was generated at the same height as the satellite. Thus the observed noise band is generated in the immediate vicinity of the satellite. Other evidence has been found suggesting that triggering of this band is enhanced for triggering signals propagating with large angles between the wave normal and the earth's magnetic field. Furthermore, from examination of simultaneous VLF recordings made by the satellite and by ground-based stations, it is found that the Alouette hiss band is never observed on ground-based recordings.

The observation of spikes in the Alouette top-side sounder at the resonance frequencies for the ambient plasma [Calvert

and Goe, 1963] suggests the Alouette hiss band arises from a simi[illegible] plasma resonance at very low frequencies. The only resonance for the frequencies of interest (5 to 10 kc) at the satellite height is the lower hybrid resonance [Stix, 1962] which defines a cutoff frequency for propagation transverse to the earth's magnetic field. Other features of this resonance support the hypothesis that the lower cutoff frequency of the Alouette hiss band is the lower hybrid resonance for the ambient plasma.

In a subsequent paper, it will be shown that from a knowledge of the electron plasma and gyrofrequencies and the lower hybrid resonance frequency, an effective mass for the ions in the ambient plasma may be determined. Thus this hiss band may provide a powerful diagnostic tool for determining the ionic constituents of the plasma surrounding a satellite.

Assuming that the suggestion made above is correct, the observation of the Alouette hiss band provides, to the best of the authors' knowledge, the first experimental confirmation of the existence of the lower hybrid resonance.

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