June 4th, 1950
P.O. Box 4868
Cleveland Park Station
Washington, D.C., U.S.A.

Via Air Mail

Dr. J. H. Piddington
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Dear Dr. Piddington:

Many thanks for your kind note of May 17th. Since my original inquiry of some months ago, I have been studying the subject of using the sea as a mirror because I believe it has very great advantages over the two collector technique. Please allow me to disagree with your reasons for difficulty at 25cm as follows.

(a) Oxygen absorption is closely associated with a wavelength of 5 to 6 millimeters. Also the water vapor region is near 12 millimeters. Thus, even at grazing incidence these would not be effective at 25cm.

(b) If the side lobes are small, the region outside the beam cannot affect what goes on within the beam. This is especially the case if the sea comes up close to the antenna so that there is not a lot of energy scattered into the antenna by land objects in the near foreground.

I would like to suggest the following explanations for the lack of a good interference pattern at 25cm.

(a) A site 250 feet high and a wavelength of 25cm will produce lobes less than six minutes of arc apart. If the source of the energy were as much as three minutes of arc in diameter most of the lobe pattern would be masked out. A test from same site at about 75cm or from a lower site at the original wavelength would check up on this point.

(b) The frequency is too high for the ionosphere to be effective. However, duct phenomenon can break up a lobe pattern if conditions are right. In general it requires a mass of hot dry air generated on land which moves out over the sea. The lower edge of this air mass both cools and absorbs moisture. The combined temperature and humidity gradients can be very bad for interference experiments. This is particularly true if the angle the wave front makes with the sea is less than one degree. Such abnormal conditions

are much more prevalent near continental areas than islands. Furthermore the detrimental effect is more pronounced at the shorter wavelengths where the size of the region of the gradient is commensurate or larger than a wavelength. The cure for this is to pick times of offshore winds or find an island.

In substantiation of the above I would like to point to the success of the tests on the Crab Nebula from New Zealand. Also recently some airplane tests were made in Hawaii. The receiver was on a tower 106 feet high on the northeast shore of Ohau. A wind was blowing from the northeast and a sea several feet high with white caps was running. The transmitter was in an airplane which flew at a variety of heights up to several thousand feet. It approximated a true point source. At a wavelength of 10cm the first six lobes showed ratios of maxima to minima of 15 to 20 DB. At 3cm the same lobes showed ratios of 8 to 10 DB. Apparently the sea is a mirror at very low angles, even when quite rough, provided there is no duct phenomena present. During the war a radar station was operated for a short time from the top of Mount Haleakala on Maui. The elevation was 10,100 feet and the frequency was 100mc. Airplane tests showed a very fine lobe pattern to be present. Unfortunately, I've not been able to learn anything quantitative about it, but the station seemed to be operable in the worst storms. I am continuing to investigate the matter but good evidence is very difficult to find.

Your mention of results upon galactic radiation at 1200mc and 3000mc is most intriguing. Several experimenters have attempted to make measures at these frequencies in this country without any success whatever. Apparently their equipment was too crude or their collectors too small. A few lines from you upon a synopsis of your findings would do wonders on satisfying my curiosity!

Best regards,

Grote Reber

P.S. If you wish, I'll be glad to have you pass this letter on for Pawsey to read. I got his letter of May 1st. Thanks.

G.R.