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Transatlantic transmission on 144MHz

Ionospheric long distance contacts over distances exceeding 3,000 kilometres are not unknown in amateur VHF radio and thus give grounds for the conjecture that transatlantic VHF contacts can not be ruled out. To provide experimental proof of terrestrial transatlantic contacts in the VHF range, radio amateurs on both sides of the ocean have already erected transatlantic beacons. The transmitter beacons F5XAR (France) and VE1SMU (Canada) are used to determine the potential reception areas on each side of the Atlantic and the geographical position of the reflection areas in the E layer in the event of a "double hop" propagation (double reflection of radio waves in the ionosphere).

1. Introduction

We are still waiting for the sensational news but there has been no indisputable report of a 144MHz terrestrial transatlantic contact as yet. The report of a meteor scatter connection between Newfoundland and Ireland, said to have been achieved on 20th March 2002 [1], has so far been received with scepticism in the pages of amateur radio literature [2].

However, many VHF radio amateurs consider a radio bridge across the Atlantic as being overdue. In relation to this idea, people are pinning their main hopes on unusual tropospheric overshoots, or on multiple reflections between the Earths surface and the ionosphere.

2. Distance between continents

The most favourable geographical preconditions for terrestrial radio links across the Atlantic can be found in Brazil and/or on the West coast of Africa.

The radio path to be traversed between the Brazilian province of Rio Grande do Norte on the Eastern tip of South America and the West African states of Gambia, Senegal, Guinea-Bissau, Guinea, Sierra Leone and Liberia is less than 3,000 kilometres long (Fig 1). So VHF radio amateurs living in these places could secure victory in the "radio races" to cross the Atlantic.

In the North Atlantic, the shortest distance is that between Newfoundland and Ireland, the minimum gap being approximately 3,050 (Fig 2), which corresponds to the distance between Frankfurt and the Canary Islands (EA8). After all, the distance between Hawaii and California (approximately 3,800 kilometres) has already been bridged several times at

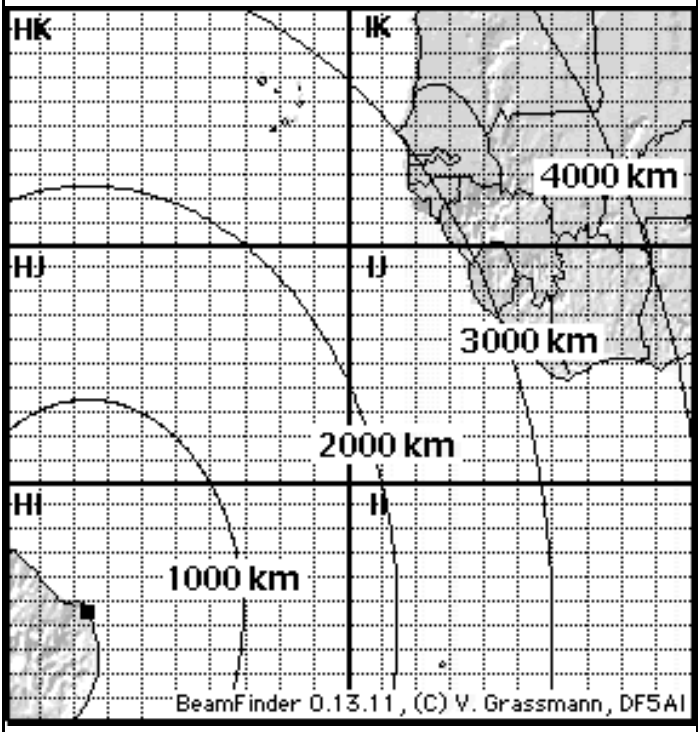

Fig 1: The shortest distance between South America and Africa is less than 3000 kilometres.

144MHz. However, comparably favourable tropospheric propagation conditions can scarcely be expected under North Atlantic climatic conditions.

3. Results for transatlantic beacon F5XAR

The possibility of double reflection between the ground and the ionospheric E layer (referred to in what follows by the customary radio amateur term of "double hop") has recently been investigated, using the example of transatlantic beacon F5XAR in Brittany (Quimper, IN87KW, 144.405MHz). The beacon transmits a signal with a transmission power of 400 Watts ERP in the direction 290° azimuth [3]. With an assumed reflection height of 105 kilometres, potential reception areas can be identified in Labrador, Newfoundland and Nova Scotia (see representation of regions in Fig 3). The grey areas in Fig 3 indicate the geographical position of the associated reflection areas in the ionosphere. It should be noted that the contours of these areas resemble the reception areas referred to above see, for example, the contours of Greenland which, due to the assumed double hop propagation, makes its appearance once over Ireland and again over Iceland.

The reception from beacon F5XAR in Newfoundland can be described through the following propagation route:

The signal from the beacon is reflected in the E layer in the South Western part of locator field "IO" and comes back down in the lower centre of the field "HO"

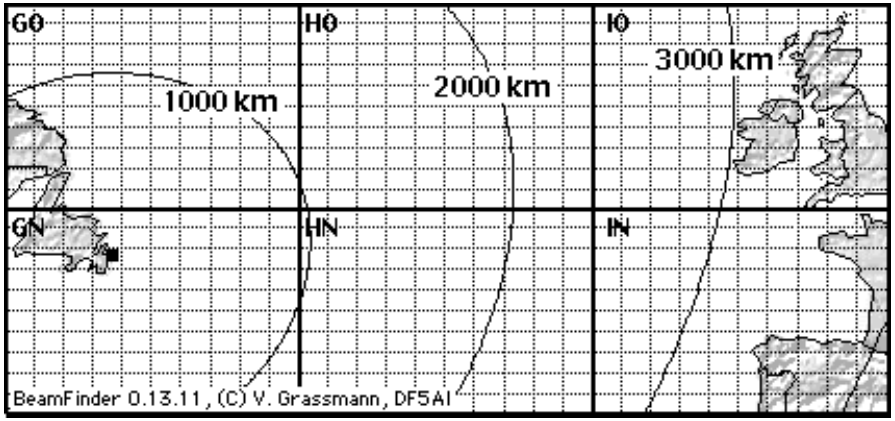

Fig 2: In the North Atlantic, Newfoundland and Ireland no more than 3050 kilometres apart.

(first "skip"). From the surface of the sea, the radio waves go back into the ionosphere and are reflected for the second time in the South Eastern part of the field "GO". This second "skip" comes back to earth in Newfoundland.

4. Results for transatlantic beacon VE1SMU

The reception area calculated for transatlantic beacon VE1SMU (Halifax/Nova

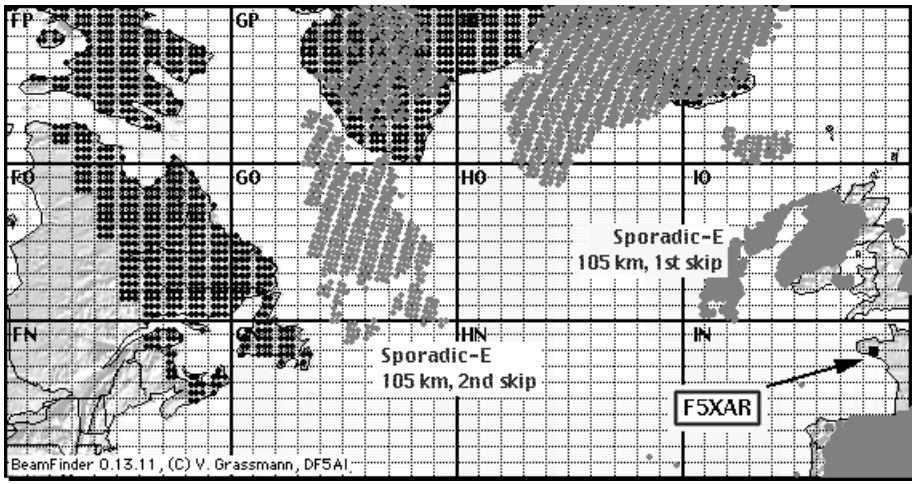

Fig 3: Possible reception of the beacon F5XAR is Labrador, Newfoundland and parts of Nova Scotia (black). The grey areas show the reflection areas in the ionosphere (105km, "double hop" distance).

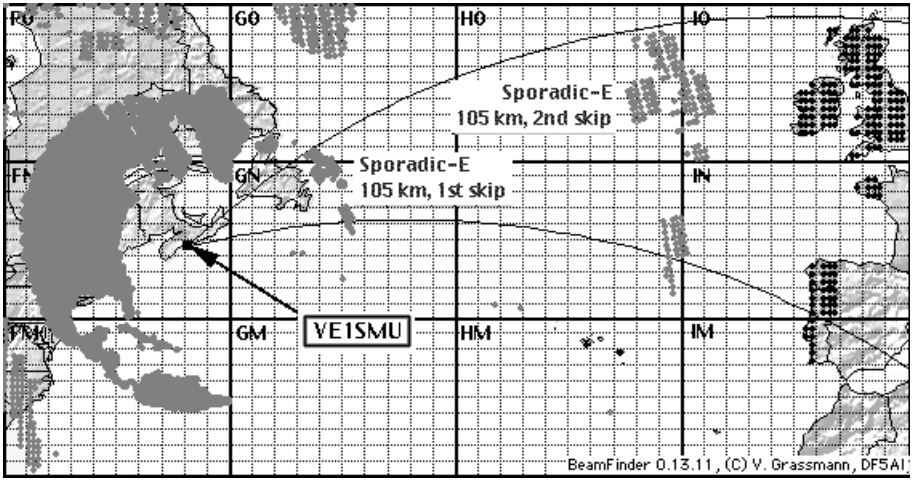

Fig 4: Possible reception of beacon VE1SMU is Portugal, Spain, France, Ireland and Great Britain (black). The reflections from the ionosphere are to the east and south of Newfoundland (first skip) and on the edges of locator squares HO and IO plus in the east the HN square (second skip).

Scotia, FN84CM, 144.300MHz) extends from the West Coast of Portugal and Spain as far as Ireland and Great Britain (Fig 4).

With a transmission power of 250 Watts, a 4 x 10 element antenna array and a direction of beam of 61° (see the apex angle drawn in Fig 4), the beacon represents an extremely interesting observation object for radio amateurs in the areas referred to. Since VE1SMU is transmitting on the international call frequency 144.300MHz, it would have been entirely possible for a chance observation to have occurred already. So are transatlantic 2m contacts in fact a vain hope? Or have any opportunities that have happened remained un-observed so far because the potential observers did not have their antennas aligned towards the Atlantic often enough?

Incidentally, the investigations also involved transatlantic beacon W1RJA (FN42CJ; 144.282MHz), but double hop propagation seems to exclude any reception of this beacon in Europe.

5. Discussion

The assessments referred to above are from an investigation of the model of an ionospheric radio propagation (multiple reflection between the surface and the ionosphere) across the Atlantic. To this end, the potential reception areas for transatlantic beacon F5XAR in North America and the reception areas for the Canadian beacon VE1SMU in Europe were determined. The results make it clear that the observation of a transatlantic double hop propagation appears possible, and not merely from the locations in Newfoundland and Ireland.

It is hoped that more VHF radio amateurs will be encouraged to observe the transatlantic beacons on the basis of this assessment. By laying out the concepts of the reception areas identified in Figs 3 and 4, we may already have encouraged a considerable number of VHF radio amateurs who could contribute to regular observation of transatlantic radio paths.

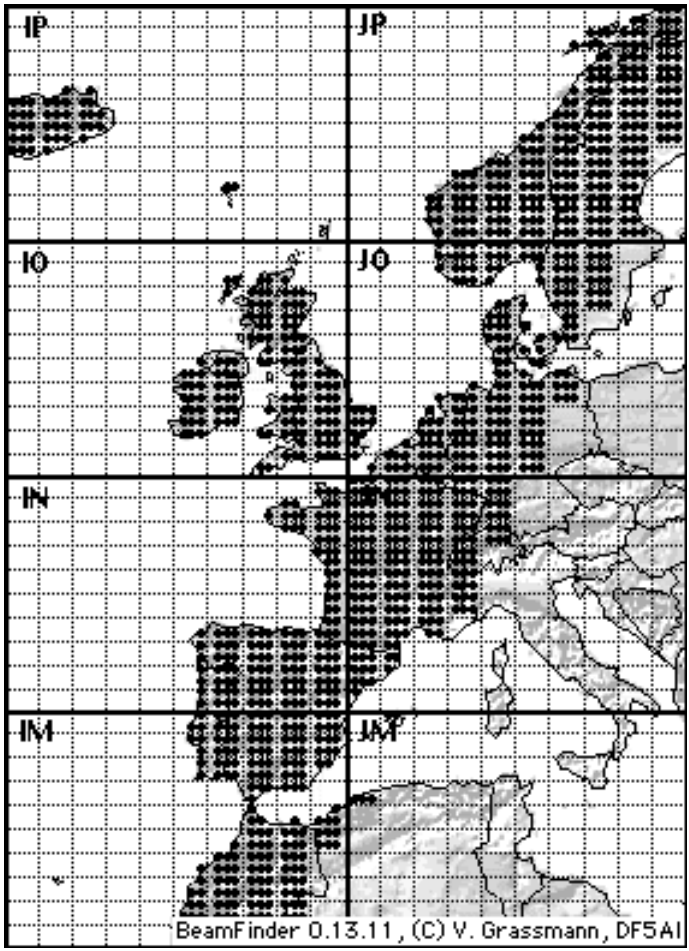

Fig 5: Possible reception areas for a transatlantic beacon at the most eastern point of Newfoundland.

If even one transatlantic beacon was available at the extreme Eastern tip of Newfoundland, even radio amateurs from Africa to Scandinavia would be called up to take an active part in the observations see Fig. 5

Sporadic E double hop contacts are not unknown on the 2m band, but they happen very rarely. But this may also be due to the geographical distribution of VHF radio amateurs. It is presumably comparatively improbable that there would be a chance discovery of a path over 4,000 km by European radio amateurs because at the end of the transmission path, there are usually no receving stations available! So the reports in the "144MHz Toplist" [4] appeared all the more remarkable, as twenty of the 214 European reporters had realised ionospheric long distance contacts from more than 3,000km. away (see column "Es" in [4]), which corresponds to an astonishing proportion of nine per cent.

Thus at the moment we can scarcely even judge whether bridging the Atlantic at

144MHz has failed to date for physical or statistical reasons. The discovery of a transatlantic 2m path is difficult for two reasons:

- For a transatlantic double hop connection, we must have suitable ionospheric conditions at the specified locations (see the reflection areas indicated in Figs 3 and 4). These two conditions considerably limit the observation probability.
- There are not enough observation stations available on either side of the Atlantic so far to guarantee any regular radio monitoring of the North Atlantic.

We are therefore seldom on the lookout but we are expecting the discovery of a rare phenomenon. Our situation perhaps resembles that of the observer of a storm, who opens his or her closed eyes only occasionally, for split seconds, and thus never catches sight of a flash of lightning.

The assessments shown in the diagrams were prepared using the BeamFinder analysis program. The software is available for downloading from the Internet [5].

6. Literature references

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http://www.tesnetwork.cz/ok2kkw/atlantikp.htm

[2] First 2m QSO across the Atlantic!?
Funktelegramm, 4/2002, S. 8

[3] Transatlantic beacon F5XAR
http://f6kpq.ifrance.com/f6kpq/f5xar.htm

[4] 144MHz Toplist
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[5] Amateur Radio Propagation Studies
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