Transatlantic Propagation at 144MHz
Some Thoughts

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This brief, and deliberately rather speculative note considers potential propagation mechanisms which might be employed to make a transatlantic QSO. I'd welcome constructive comments.

A transatlantic QSO on 144MHz has been an unfulfilled dream since the band was first allocated in the late 1940s. If there were an easy, low-loss propagation mechanism, it seems probable that it would have been discovered sometime in the last sixty years. However, despite understandable scepticism from some, there has been a trickle of anecdotal reports of transatlantic propagation above 100MHz covering the whole period. Alternatively, there is a view that there has never been any sustained attempt to break down the path, as suitably located operators prefer to inhabit their comfort zones, beaming towards the interior of their continents, rather than turning their antennas towards the ocean.

Given that the Europe to North America are of the order of 4000km apart at their closest points, it's clear that a special propagation mechanism is needed.

Tropo, Sporadic-E and Meteor Scatter

There have been a handful of tropo QSOs approaching the 4000km mark made in the Atlantic basin, and one report of the reception of the now QRT VE1SMU beacon via tropo in IO70.

Possibly apocryphal stories exist in the aviation community about pilots over Ireland hearing controllers in Newfoundland and vice versa. This suggests that high-level transatlantic ducting may happen, unnoticed by groundlings. It would be interesting to see what an examination of the met. records revealed.

There seems to be considerable unexploited potential for extended tropo between CT and the Carribean, and rumours once circulated about stations in D44 being able to hear repeaters in PY on occasion.

Discounting Tropo and TEP, most extended range propagation at 144MHz involves interactions with ionisation in the region of the E-layer, where the maximum distance for a single 'hop' is geometrically limited to around 2400km. The probability of double-hop propagation at 2m is very small (although not zero!) I believe that I have detected the 82MHz video carrier of a TV transmitter near St.John's, Newfoundland by MS (by the presence of 60Hz related sidebands on the carrier) but the number of bursts, even close to the Perseids maximum, was quite small, and the frequency difference between 82 and 144MHz is significant. Tests run on 144MHz between well equipped and operated, stations in SW England and New Brunswick at the peak of the Perseids in 1978, 1978 and 1980 resulted in signals being heard both ways, but no QSO resulted. The tests involved some very well-known operators, and were reported in the '4–2–70' VHF column of 'Radcom' at the time.

There are a number of reports of transatlantic propagation which have been attributed to multi-hop Sporadic-E in the 88 – 108MHz band.

Mixed Mechanisms

A surprisingly large number of 2m QSOs between EA8 and central Europe at distances of around 3800 – 4000km have been made. Contacts between 4X4 and CT, EA, and F at similar distances have also been reported. There have been some remarkably ingeneous attempts to explain these in terms of double-hop Es, however, it seems more probable that these are examples of 'mixed mode' propagation.

The Atlantic Ocean between EA8 and Iberia (and many other places!) supports very regular, and very strong maritime ducting at 2m, particularly during the summer months. The propagation losses are typically below the free-space loss. Contacts between handheld FM transceivers on the beaches of southern Portugal and the Canaries are by no means unknown. Here in West Wales, some of the strongest signals I've ever received on 2m have come from EA8 stations at around 2800km via maritime ducts... Similar effects occur in the Mediterranean.

Signals propagated by duct mechanisms will launch into free-space at the termination of the duct (in the same way as an open waveguide forms an effective microwave antenna) and during Sporadic-E events could be forward-scattered another 2000+km.

Tropo ducting is often destroyed when the duct meets a frontal system. Anyone who has spent time looking at a pressure chart of the North Atlantic will be aware that there are very few days in the year when there are no weather fronts between Ireland and Newfoundland! However, there are numbers of days when the classic conditions for duct formation occur at one end of the path or another. There is the potential to cover the remainder of the path by either MS or, with some luck, Sporadic-E.

Meteor scatter propagation has some geometric similarities to Sporadic E, and there have been a number of 2m contacts made beyond the 2400km 'limit' by deliberately exploiting a mix of tropo and MS.

At 50MHz multi-hop Auroral forward scatter has been used to make QSOs at up to around 7000km between Europe and North America. There are reliable reports of 2m contacts via single-hop ArEs, and 'double-hop' would be worth looking for during, or after, a major European aurora, particularly one where southern European stations were able to participate.

Mixtures of MS and Sporadic-E, of MS and tropo, or of Sporadic-E and tropo each have potential. Multi-hop MS could work, but needs a major shower to have a reasonable chance of success. A premature return of the Leonids could be very interesting – if it were possible to persuade people to go for real DX, rather than working masses of easy single-hop QSOs!

TEP

Transequatorial Propagation is an established propagation mechanism. It occurs as a consequence of an anomaly in the F2 layer, and has supported single-hop ionospheric propagation between stations at ranges of up to 8000km arranged more-or-less symmetrically around the geomagnetic equator. It was discovered, much to the surprise of professionals in the field, during the 1950s by radioamateurs in 5B4/ZC4 and ZE/Z2. It is apparently fairly common between the Carribean and S.America, and Japan and Australia where relatively low-power stations have made QSOs. The world distance records for terrestrial propagation modes on both 2m and 70cm were made using this mechanism. In the geomagnetic latitudes occupied by the UK, TEP is fairly rare, even at lower VHF frequencies, although it is possible, again(!) that a mixture of tropo into the Atlantic close to the Canaries and TEP could produce results between South America and the littoral of western Europe, maybe as far north as GM and northern EI.

Modulation Schemes and Operating Procedures

Of the potential propagation mechanisms which could result in a Transatlantic QSO, tropo, TEP, Auroral Es, multi-hop Sporadic-E, and Es/Tropo are likely to present the opportunity for casual QSOs using SSB and CW.

Meteor Scatter – even outside showers - is a very reliable form of propagation, and combined with a suitable Tropo Duct or a Sporadic-E opening has the potential to cover the distances involved with reasonable losses. The availability of cheap computing power and the development of software such as K1JT's WSJT suite has extended the thresholds of MS operation, in the senses of the ability to handle shorter bursts and the ability to decode information at smaller signal-to-noise ratios.

Summing-Up

There are potential propagation mechanisms which could support Transatlantic Propagation on 2m. They may require modulation schemes other than conventional SSB/CW.

A major problem, historically, has been a lack of an interest in 'serious' VHF operation in many of the obvious target areas on the Western side of the ocean. That seems to be changing. There has also been an understandable reluctance shown by many keen VHF operators on the edges of both continents to turn their antennas away from their hinterlands. This has not been helped by declarations by some within the amateur radio community that a QSO across the Atlantic on 144MHz is an impossibility, and therefore it's not worth trying.

It is!