

Trans-Atlantic VHF Propagation, What We Do & Do Not Know

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Overview

One of the rarest and most coveted goals of 2-Meter and above operators for that past several decades has been the goal of spanning the Atlantic Ocean from North America continent to the Europe continent. The simple fact remains that this has never been achieved without the need for EME or satellite operations. To motivate the efforts, The Irish Transmitting Society has long offered the Brendan Trophies⁽¹⁾ for individuals or teams on each end of that first 2-way QSO. Since its conception, the Brendan awards have been further expanded to differentiate between digital and traditional modes as well as one-way beacon copy; and the Tri-annual Brendan Medal for the most effort made to try and span the path. This brief paper will cover the technical hurdles that must be overcome, the efforts made thus far by individuals and teams to try and achieve this monumental goal.

Background

It has been several decades since the inception of the original and subsequent gradations of the Brendan Awards. At first review, a basic question is asked by many: Why is this “Holy Grail” of VHF so elusive? Surely significantly farther DX paths and records have been made. So why is it so hard? Is it for lack of effort? It is the path? It is due to lack of effort? These are all valid questions that deserve answers.

The Path

In the author’s mind, the RF path is the greatest hurdle to be overcome and can be viewed as “the great equalizer” when it comes to attempts. This is simply borne out by the fact that the shortest and most often attempted path is from the Canadian Maritime region(s) to the far Western end of the EU. At first, this seems like the most obvious path. It is the shortest, would require the fewest number of correctly aligned Eskip clouds and even the chance for a mixed mode propagation of Eskip and meteor-scatter. In the author’s opinion, this simplest approach may not be the most advantageous choice of paths. When looking at former and existing terrestrial 2m VHF DX records, the propagation modes that have a superior advantage are ones that either involve Trans-Equatorial Propagation (TEP) or ducting over warm sea water; as-is the case with the annual southern California to Hawaii path during the summer. In the case of the latter, warm sea water with its inherent water vapor ducting formations have always proven to be conducive for best VHF DX.

To further exemplify the situation, one needs to look at lower frequency bands as a possible guide. We as hams know that 6m DX to the EU is very common each summer. The common propagation mode is multi-cloud Eskip. When that band is open, not much effort is needed to secure a QSO. In fact the author used his 160m dipole with a tuner and 100w to have an SSB QSO with CT1HZE on 6m. So while large yagis and lots of power is always helpful, even a rather comical station configuration can make the path.

A next obvious question may be: “Is there an upper frequency limit to TA Eskip”? In the author’s opinion, the answer is no if we are below 222MHz based on the evidence to date, however it should never be ruled out. It has been shown in the past decade that on at least two occasions (but not many more than two) Canadian and even US FM broadcast stations have been heard in the Western end of the EU. For this fact alone, we hams in North America should be pressing the envelope to even further explore what is possible. 6m has been well explored and exploited for TA QSOs to Europe from North America, and we need not stop pressing for better DX each year during summer Eskip season.

Can 4m be a guide?

This question has been on the author’s mind for several years now. Not all amateurs in the EU have access to the 4m band for many complex reasons. It also needs to be pointed out that in the US, the 4m band resides in what is

still very active TV Broadcast spectrum and while there is future hope, the fact remains that the likelihood of any near-term amateur access to 70MHz spectrum is but a very thin chance. The TV broadcast industry would first have to discontinue any and all standard high-power TV transmissions on US TV channel 4 as well as shut-down the HUNDREDS of Ch4 local TV translators that populate the US.

Keeping in mind that the FM (or 3m band) has many 10kW and 100kW stations on the air, it would seem rather discouraging of the prospect of a 2m QSO since 2m is even that much higher in frequency. But what about the 70MHz or 4m band? Can that help in any way? The author thinks it very well can be and in fact has already been shown to give us more data points towards the way to a 2m TA QSO.

Starting in 2011 and continuing through today, the author has been able to be granted permission by the Society of Broadcast Engineers (who co-ordinates all US broadcast spectrum in the US) and the FCC Office of Engineering Technology to allow an Experimental Grant under the FCC's Part 5 radio service to operate a 4m Trans-Atlantic beacon on 70.005MHz from a 1280m mountain top site located in FM07fm. This happens to be the same site where its sister 2m signal on 144.285MHz originates from. As many may already know, the callsign of the 4m transmitter is WG2XPN, while the 2m call is that of the author, WA1ZMS.

While the 4m signal has been QRV for over 3 years now, and has been heard in CT-land (Portugal) as well as the islands in and around the Azores, a very rare and unique DX event took place on July 3rd, 2013. On that day, WHILE 6m WAS A COMPLETELY DEAD band for any NA to EU QSOs and it was even limited to NA QSOs as well, a 7000+km reception report of WG2XPN was made by stations in the UK, Germany, and best of all ISO-land that gave the best DX record by far. In fact, this one-way beacon copy was just a few 100km short of the World record for 4m that is currently credited with TEP propagation. The WG2XPN "DX event" was noted in QST and DUBUS. So what if anything can be learned from this so-far one-time event? To the author, it only shows that while lower bands such as 6m are far from open that a propagation path can as has existed on a higher frequency over great distances.

An obvious question is: How can that be? When 6m is wide open, ops tend to migrate to 2m to see what might be heard. Now while that may be true for ducting events, when it relates to Eskip propagation the approach can be counterintuitive to all but the well-seasoned operators. Ask any old timer op with much VHF experience and you may be told that "why 6m goes short, start looking for DX on 2m and higher". To the unseasoned op, what does this mean? The answer is quite simple when it involves Eskip.

An Ecloud (the science of which is beyond the scope of this paper but may be good material for a future paper) that can support 6m propagation can only do so if the vertical sounding frequency is around 10MHz. What that means is that if a 30m signal (or signal in that frequency range) is aimed directly upwards a strong and solid vertical return takes place. At the same time, if an angled or slanted signal strikes the same Ecloud, there will be a strong reflection at a similar radiation angle thus allowing for good DX. When multiple Eclouds along a given path are fortunately aligned, multi-hop Eskip can take place. It is with just such a scenario that 6m DX can take place across the Atlantic. However, if the vertical sounding frequency increases up to the 20MHz or higher range, then even higher VHF bands can use the Ecloud as an excellent "mirror in the sky" to support 6m, 4m, or even 2m propagation. It is very important to understand that as the vertical sounding frequency increases, the reflection angle of bands like 6m becomes greatly reduced. This is the reason why when 6m DX that was 1000km, changes into 300km DX that the astute VHF operator will start listening on 2m for that 1000km potential DX.

This well-documented behavior of Eclouds most likely explains the 4m DX copy of WG2XPN at 7000+km.

As a result, it now begs a serious question: Even when 6m (and 4m) are dead bands to Europe, is that NOT the time when we should be QRV on 2m listening and calling CQ aiming East from here in the US?

This "mystery" is only compounded by the fact that there are no professional scientific vertical sounding stations located in the Atlantic Ocean and the best one on the East Coast of the US is the one located at Wallops Island, VA. However by the time a given Ecloud travels westward and arrives above Wallops Island, it is already too late for East Coast stations to take advantage of that particular cloud is Trans-Atlantic VHF QSOs are your goal.

The attempts thus far

There have been several attempts over the years to try and span the Atlantic by individuals as well as teams. One group that gave a valiant effort in 1996 and will be trying again in July of 2014 is a group of mostly VE1-land amateurs whose effort this year is known as the Brendan Quest. ⁽²⁾ Their attempt again, as in 1996, is for a two-way JT65 QSO but will also have CW & SSB as back-up modes. With an optimized 2m rope yagi, and with the Canadian legal power limit of 750w, their ERP will be around 150kW. Their operation will be from Pouch Cove, Newfoundland, Canada running from July 4th through July 12th, 2014.

The advantage of beacons

One of the most significant tools in the quest to at least have a signal make a one-way crossing over the Atlantic is through the use of reliable beacons. This particular approach has been one that the author has been a strong advocate for and a project that author has personally been undertaking since 2006. It is important to note that while the author's 8kW ERP 2m signal on 144.285MHz has been QRV for some time and while lacking a firm confirmation report, a scant and unconfirmed reception was believed to have been made in Wales back in 2007. Around that same time period and for several years later, both N7BHC and K4MHZ have been operating CW beacons along the Outer Banks of North Carolina. On one occasion, parts of what was a CW signal from N7BCH was copied by CT1HZE yet was too weak and not enough to fully confirm a full callsign copy.

What can we do now or in the future?

It has been suggested recently that a similar type of Trans-Atlantic Award similar to the Brendan Award be created to help promote a strong US team effort as its goal. This is meant to encourage many more operators to aim high for such a feat. With enough East Coast VHF operators, and almost national effort could be established which would not be unlike what was done by the ARRL and others in the 1920's to span the Atlantic on the bands "200m and down". Given a nice water edge QTH along the Outer Banks of NC or even on Cape Cod an array of rope yagis could be set-up and with today's easy 1.5kW SSPAs, ERPs reaching upwards of 600kW could be achieved.

Summary

Due to the author's time limitations and so many details that need to be covered further in depth, this short paper is an attempt to strongly motivate the East Coast VHF Community by opening up thoughts and ideas and mostly discussions on this topic. More information will be presented by the author at the 2014 NEWS Conference with photos and maps to help inspire the project.

(1) – <http://www.irts.ie/cgi/brendan.cgi>

(2) - <http://brendanquest.org/home.html>