Two Interesting Issues Tied to 160-Meter Propagation

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Let's face it – 160-Meters is a tough band. The hop distances are generally short, the hops incur much absorption (loss), noise (both man-made and atmospheric) can be challenging, efficient antennas are generally big and our understanding of what makes 160-Meters tick is limited. Having said all the above, dedicated topband operators just take those issues as challenges to overcome.

Note that I said that these issues were challenges to overcome. It's better to say "challenges to improve on". That's because we can't completely negate these issues. For example, to address short hops with lots of loss, you run legal power with the best transmit antenna you can put up. To address noise, you put up the best low-noise receive antenna system that you can fit on your property. As for propagation, you simply have to be on the band as much as possible to catch as many short-term openings as possible.

Unfortunately, there is one issue that you have very little control over. If you're in the wrong place at the wrong time, you're really behind the eight ball with this issue. This issue is the "wedge of daylight". What it refers to is locations that never get in darkness to the target location – and darkness is what is needed on 160-Meters.

The January/February 2014 FT5ZM DXpedition to Amsterdam Island was a good example of this issue. Figure 1 shows the terminator for FT5ZM sunset on February 1 (the midpoint of the DXpedition). Superimposed on the sunset map is the terminator for FT5ZM sunrise. This figure comes from VE3NEA's DX Atlas software, with FT5ZM the red dot with antenna in the southern Indian Ocean.

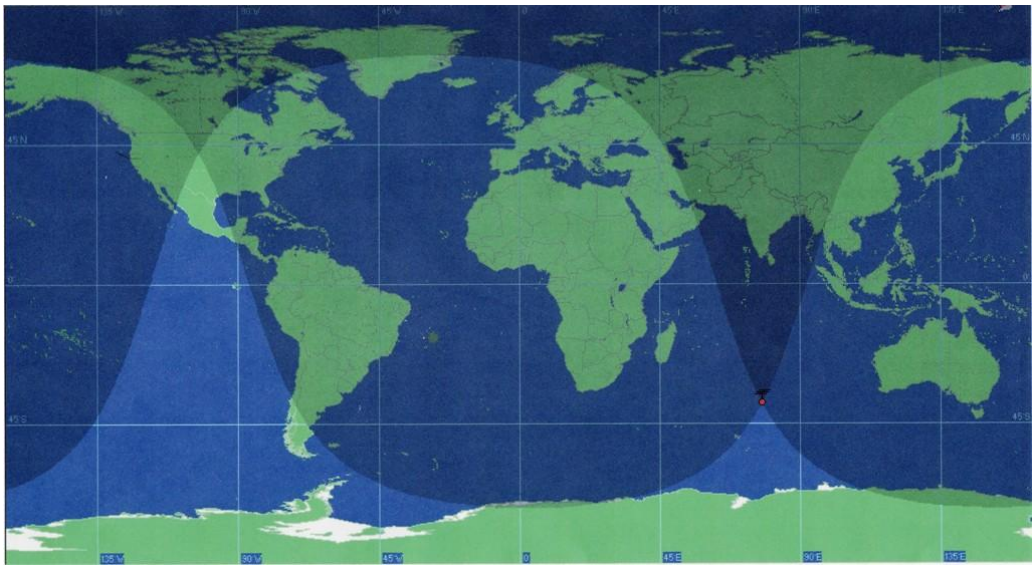

Figure 1 – The Wedge of Daylight for FT5ZM

Note the lighter-shaded triangular-shaped area (a wedge) over the southwest of the United States and much of Mexico. This is an area where the entire path to FT5ZM was never completely in darkness during the FT5ZM DXpedition. Thus working FT5ZM on

160-Meters from this area would be extremely tough – perhaps even impossible for those in the middle of this area. It also applies to 75 and 80-Meters to a lesser extent since 75 and 80-Meters can withstand more absorption. But this dire news has to be tempered with the fact that it doesn't matter what's happening over your QTH – what matters is where your RF encounters (enters) the ionosphere in the first hop and where the RF encounters (exits) the ionosphere in its last hop.

From the fall equinox to the spring equinox the apex of the daylight wedge is north of the FT5ZM antipode and the daylight wedge extends south of the antipode. From the spring equinox to the fall equinox the apex of the daylight wedge is south of the antipode and the daylight wedge extends north of the antipode. Thus if the FT5ZM DXpedition would have been in the northern hemisphere summer, those stations in the US southwest and in Mexico would have had a chance. But June is winter at FT5ZM – that's not a good time to travel in the southern Indian Ocean.

Another interesting issue is the direction from which 160-Meter signals arrive at your QTH. For example, Figure 2 plots the headings (the red arrows) from seventy seven stations who reported receiving FT5ZM. Figure 2 is an expanded view of North America showing great circle paths out of FT5ZM (the black lines) and into the FT5ZM antipode (the x in eastern Colorado).

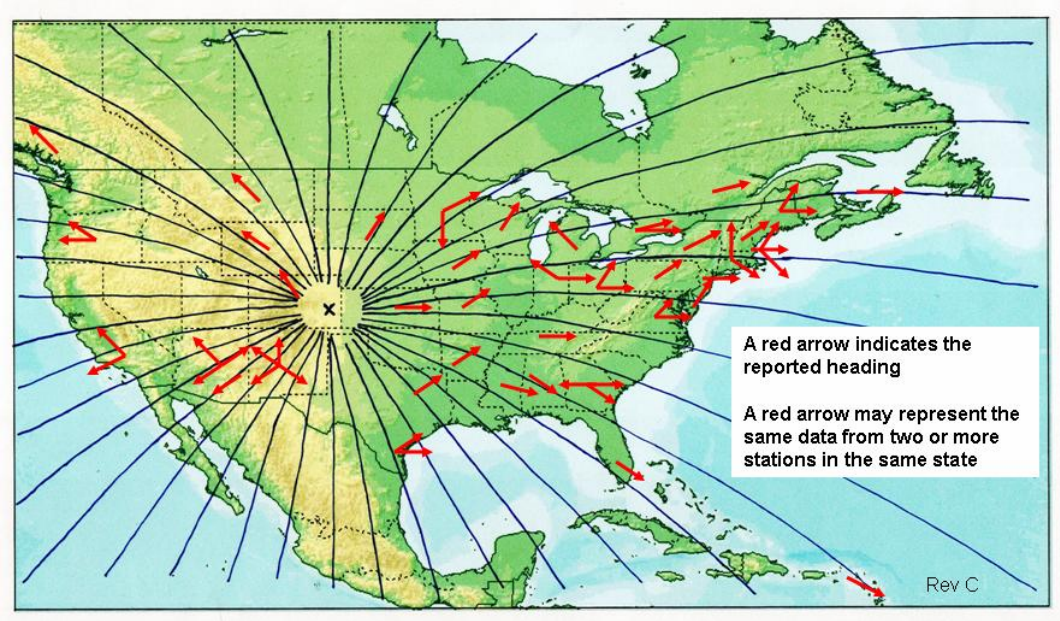

Figure 2 – Direction of Arrival Data

There were 49 reports of what I consider true great circle path reception – that is, reception on a heading within about +/- 20 degrees of the true great circle path – which allows for some antenna beam resolution issues when the antenna isn't pointed exactly along the true great circle path.

That leaves 28 reports of what I consider non-great circle path reception. These were considerably off the true great circle path – some even in the opposite direction. For

example, see the reported headings in Michigan and Indiana. The take-away for this issue is to always check other directions for best SNR (signal-to-noise ratio).

With respect to those 28 reports, I'm not convinced that the FT5ZM signals traveled over the weird paths as suggested by the arrows. Rather, I think they may have comes along the great- circle path (as did the other 48 reports), but the antennas may have been fooled. I think we have to take a deeper look at three issues before making any conclusion about headings: receive antenna pattern resolution (for example, a 4-square only has four broad directions – what if the RF comes in between the two main lobes?), high elevation angles (antennas can lose directivity at high elevation angles) and noise (are we really selecting maximum SNR rather than maximum signal?).

Hopefully being aware of these two issues (the wedge of daylight and checking other directions) will help your 160-Meter activities – or at least advise you that you're in for a tough task in the case of the wedge of daylight.