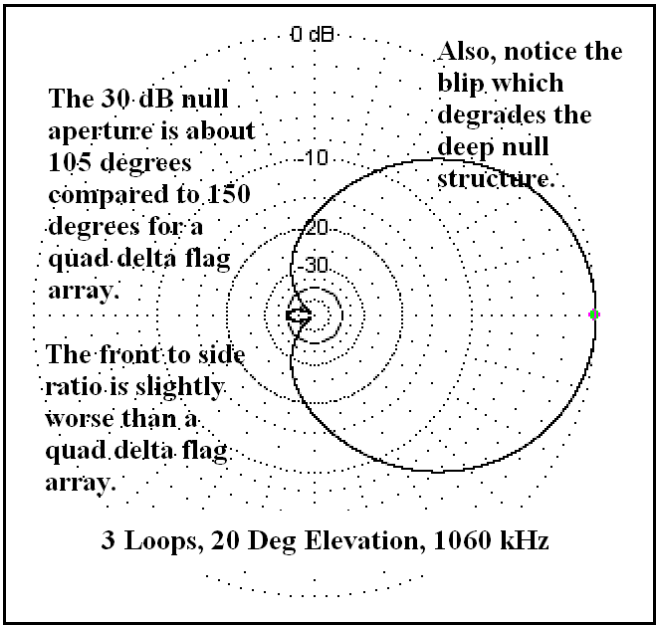
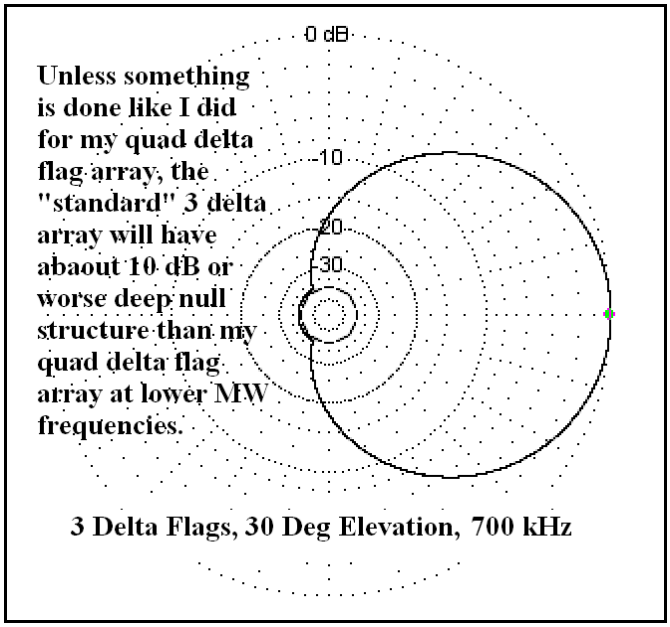
3 Element Arrays Are As Good As Quad Arrays???

Dallas Lankford, 4/28/09

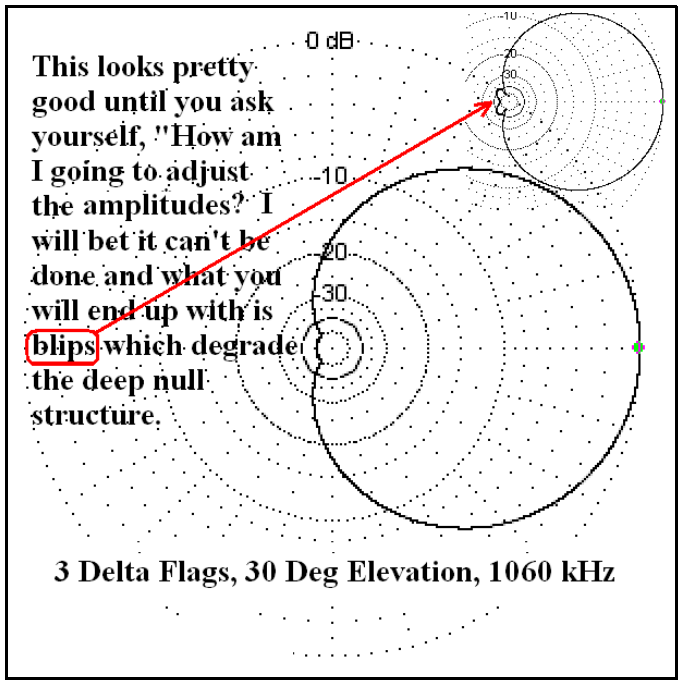
Nope. See the diagrams below which are for 40 meter (~120 feet) spacing.

Using 3 loops (which is not the same thing as using 3 delta flags) produces patterns which are obviously inferior to quad delta flag arrays, even to the casual observer. Using 3 delta flags leads to the same low band null problem which I experienced with the quad delta array, and a similar fix would be required. But the fundamental problem with 3 element arrays seems to be generally not understood. A 3 element delta flag array





is akin to two dual arrays which have been moved very close together along the line of a quad array layout until the two middle elements coincide and the two middle elements almost become a single element, which causes the output of the single middle element to be half the output of two “end” elements. Thus, the amplitude of the single middle element must be somehow changed so that it is twice the amplitude of the two “end” elements. How can this be achieved? It is easy enough to implement the phase shifts with LC delays and a 180 degree phase shift, and then insert a 6 dB attenuator into each path from the end elements followed by a zero phase shift combiner. The output of this combiner would then be combined with the output of the middle element. This is easily said, but may not be so easily done. Furthermore, attenuating the outputs of two of the delta flags does not seem like a good idea to me because the thermal noise floor of a delta flag antenna is not all that low. In other words, this approach has the potential problem of desensitizing the array. If you don't believe that



someone could desensitize an even simpler dual flag array, I can assure you that they have.

But there is more! The elaborate phasing for 3 or 4 element arrays generally introduces additional attenuation of the desired signals. I have not modeled the 3 element case, but models for the 2 and 4 element delta flag arrays are included in my article "Flag Theory" available from The Dallas Files . Whether a model for the 3 element case can be developed remains to be seen.

A second approach would be to insert a 6 dB gain preamplifier at the output of the middle element. But a gain error of even 5% will cause blips like the ones seen in the figure above right. Most hobbyists would find it impossible to adjust the gain of a preamplifier to within, say, 2% or less of 6 dB.

And if you use a null steering phaser as someone has suggested, it is virtually certain that you will degrade the deep null structure of the 3 element array. There is simply no way to correctly adjust the pattern of such an array with a null steering phaser, even if only the amplitude of the middle element is adjusted.

It is highly unlikely that an actual 3 element array with an ideal 3 element pattern can be developed. It is also highly unlikely that a 3 element array with lower MW frequency deep null structure equal to the quad delta flag array can be developed. For all configurations of 3 element arrays which I have simulated, the quad delta flag array will produce audio from weak DX signals in the lower half of the MW band, especially the lower third, where a 3 element array will not.

Some may argue that all of the results of this article are theoretical, and that 3 element delta flag arrays with performance equal to the Grayland quad delta flag array can be implemented. If so, show me your proposed winner. Until I have a proposed 3 element delta flag winner operational and verify its performance, I won't believe it. On the other hand, the performance of quad delta flag arrays has been proved at Grayland far beyond a reasonable doubt. There is a huge difference between day dreaming and reality.