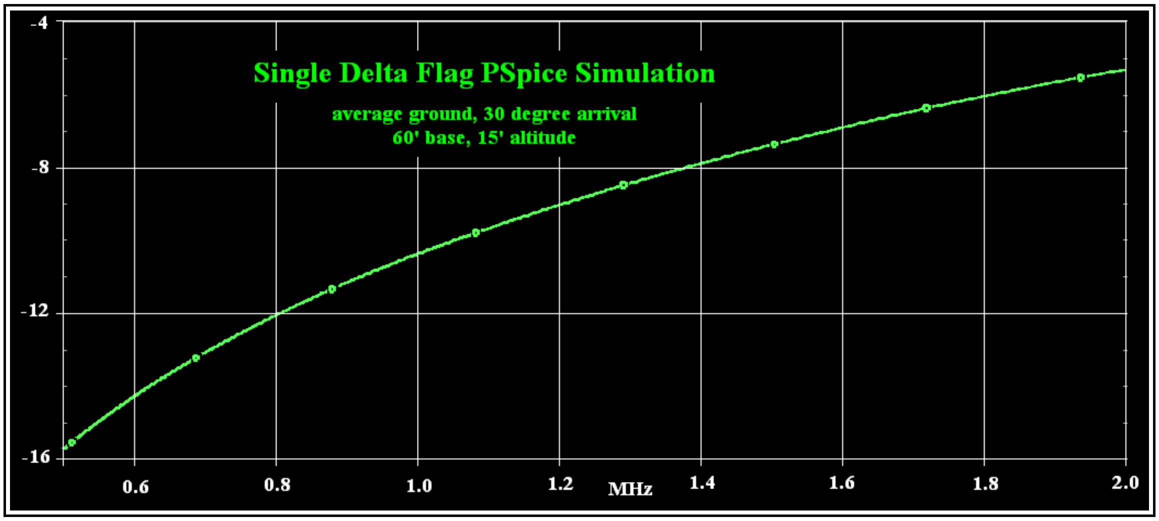
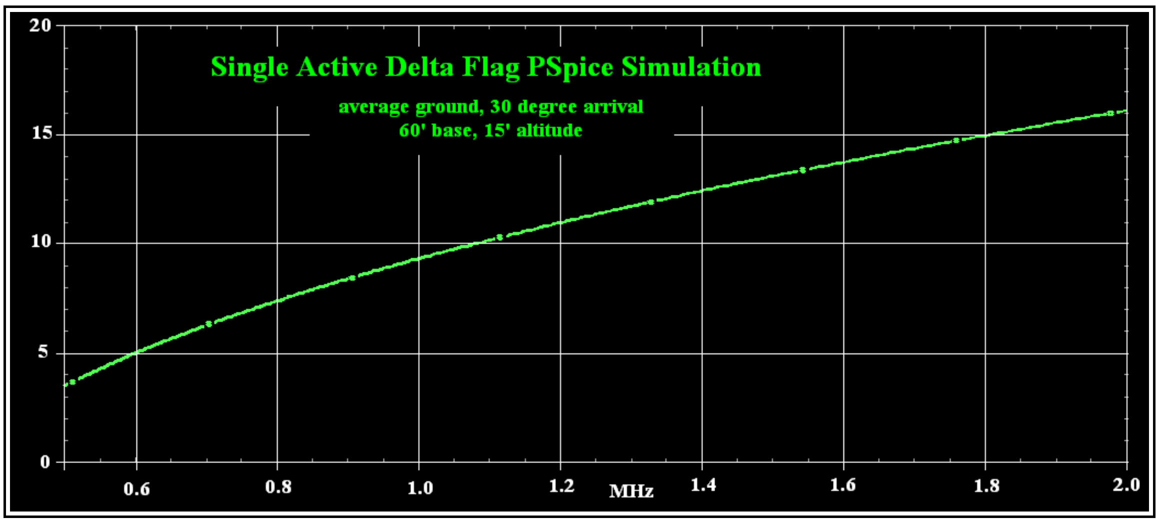
Newer Active Flag And Delta Flag Arrays

Dallas Lankford, 3/13/2012, rev. 5/13/2012

The simulation methods used in this article were developed by me over a year ago in my article Flag Theory IIa which is in the Theory folder of The Dallas Files. These methods have weathered numerous tests and were instrumental in my development of active delta flag arrays which were successfully tested at the Quoddy Head 2011 DXpedition.



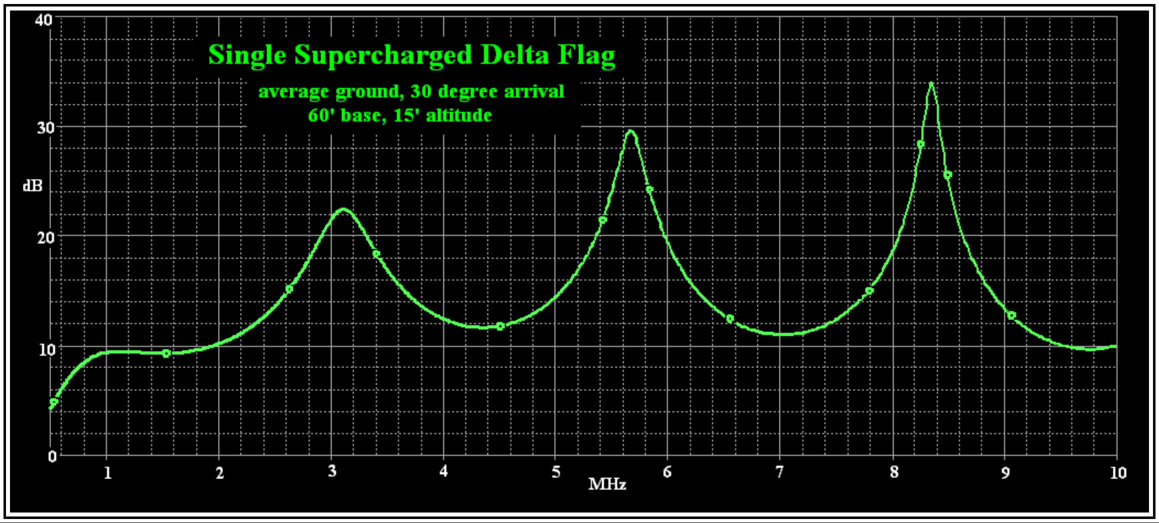
The single delta flag simulation above is for reference. Below is a single active delta flag simulation.

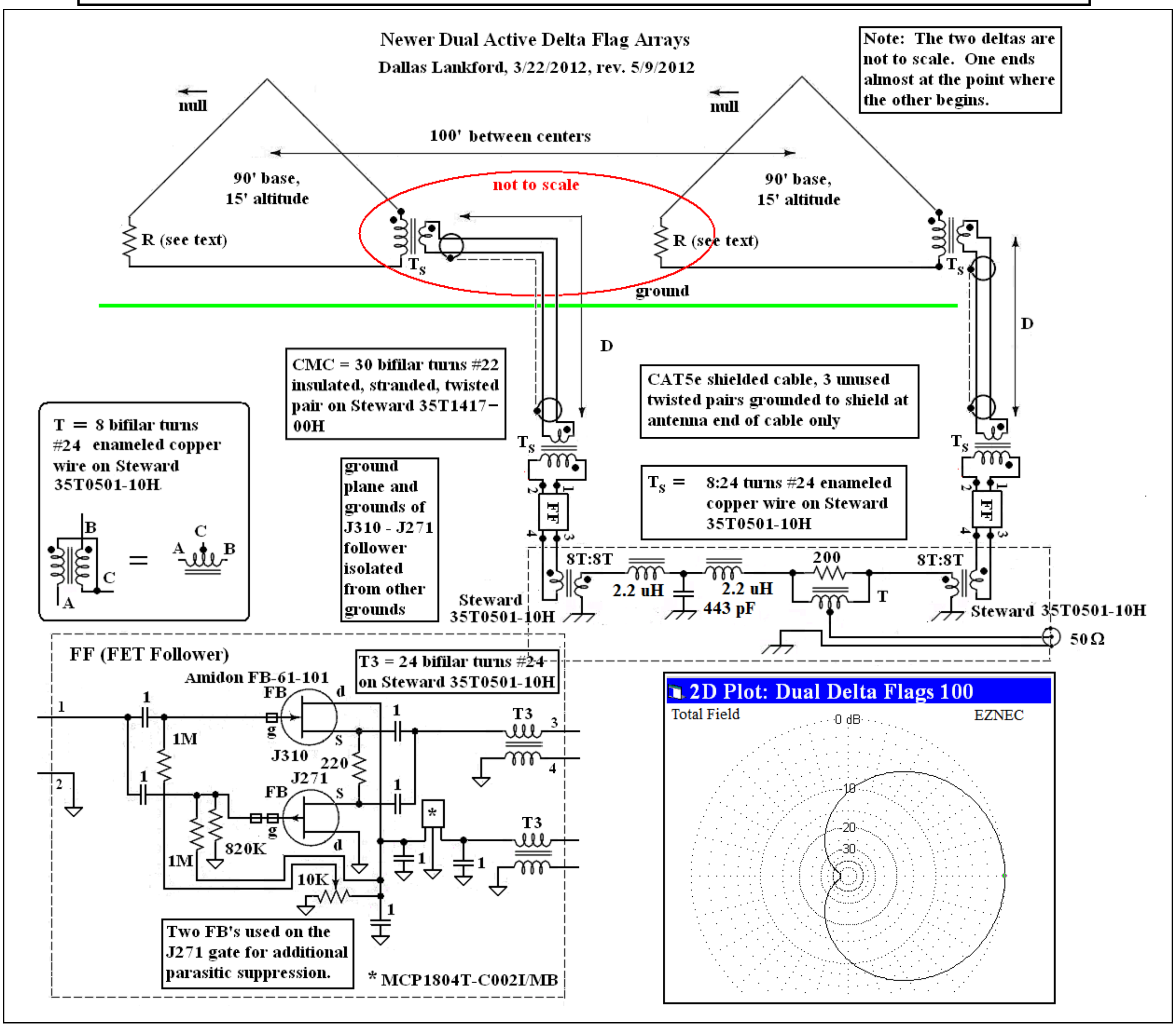


As can be seen, activating a delta flag antenna element with a FET follower is equivalent to adding a 20 dB gain 0 dB noise figure preamplifier. This was verified with repeated tests at my location just outside Ruston, LA in the summer and fall of 2011 and at Quoddy Head in November 2011 with a dual active delta flag array.

For those tests the FET followers were attached directly to the delta flag antenna elements. At that time it was believed that supercharging a FET follower increased its noise figure by the amount of the supercharging (supercharging is a euphemism for a step up transformer). In January 2012 it was determined that this belief was wrong, so naturally it was of great interest to determine if the FET followers could be moved from the antenna elements to the receiver ends of the lead ins. Moving the FET followers out of the weather inside the house would obviously be a significant improvement and simplification of active flag and delta flag arrays. This approach to activating flag and delta flag arrays can be regarded as supercharging the phaser-combiner by placing a FET follower at the input to the phaser-combiner instead of activating the antenna elements.

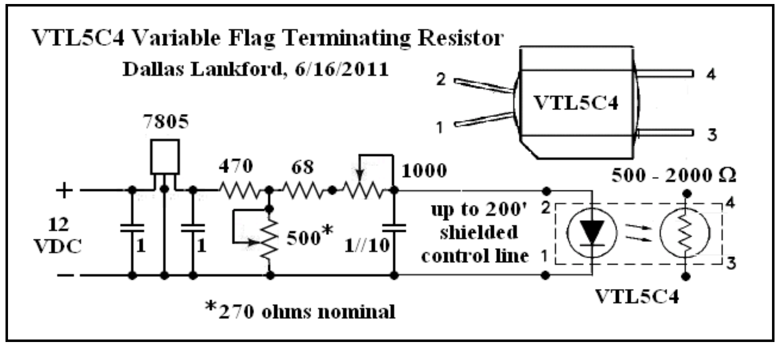
Below is a PSpice simulation and schematic of the supercharging approach. The PSpice simulation shows resonances at higher frequencies which are believed to be due to the ideal transformer models used by PSpice.





The FET follower in the schematic above is now available from Clifton Laboratories here .

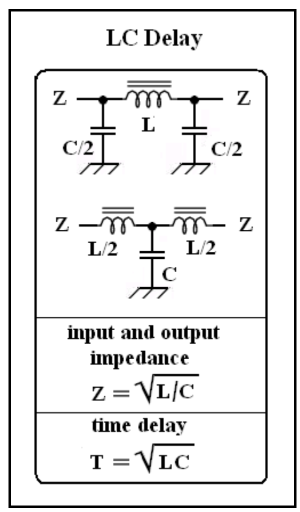
The toroids in the schematic above are specified as Steward toroids. If they are not available, Amidon FT-50-75 or -J may be used. The Amidon toroids should be insulated with plumbers Teflon tape because Amidon toroids are not insulated.



The supercharging approach has been tested with an ultra compact dual array and was found to have excellent signal levels. For the smaller array the nulls were also excellent provided the terminating resistors R were adjusted for best nulls. This can be done, if necessary, either with pots in place of fixed terminating resistors or with remote variable VACTROL's as described at right and below. It is presently unknown whether the values of the terminating resistors must be adjusted for best nulls.

The optimum values of the terminating resistors may depend on antenna placement, especially on ground conductivity Consequently, it may be desirable to make the terminating resistors remotely variable. Above right is a remote variable resistor which I developed and used with my active dual delta flag arrays when I tested them in the summer and fall of 2011. I did not take the remote variable resistors with me to Quoddy Head in November 2011 because at that time I did not find it necessary to fine tune the terminating resistors for full size delta flag arrays. However, Kazuhiro Gosui who used his variation of my active dual delta flag array at a Japanese coastal MW DX site also implemented and used a variation of my remote VACTROL's. He told me recently that the variable remote VACTROL's were easily used to improve nulls before sunset and after sunrise, but that they were more difficult to use after sunset and before sunrise. Until he told me, I was unaware that remotely variable VACTROL's could be used to improve pre sunset and post sunrise nulls. This alone makes remotely variable VACTROL's attractive because exceptional DX may be heard around sunset and sunrise by what is often called “dusk enhancement” and “dawn enhancement.”   I have found that for best adjustment after sunset one must wait some time, at least an hour, and often several hours, until “sunset transition” is completely finished before the VACTROL's can be easily adjusted for optimum nulls. One should probably select a station about 300 or 400 miles away and near the middle of the MW band with frequency around 1100 kHz. It is difficult, perhaps impossible, to find values for the VACTROL's which are uniformly good throughout the entire MW band. It seems to me that there are slight variations from one frequency to another regardless of how carefully you adjust the VACTROL's. Also, it appears that null depths of a given signal are not uniformly deep with respect to time. What causes these variations is presently unknown and may remain unknown.

LC Delay Formulas



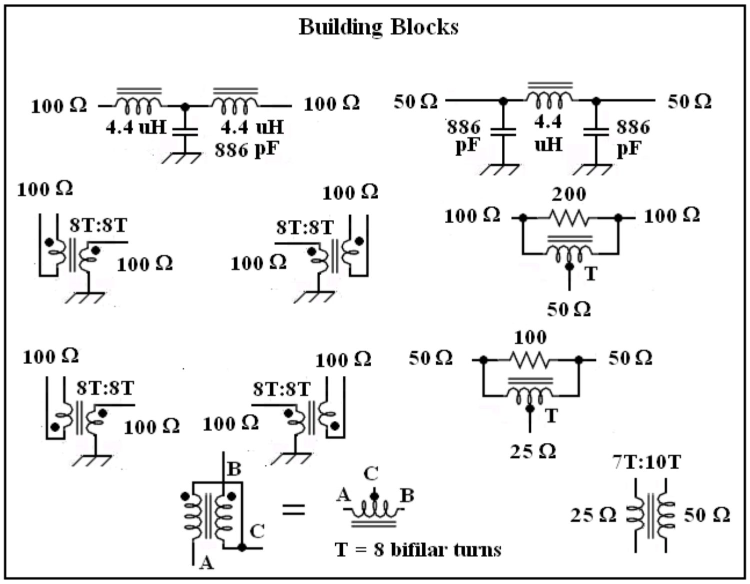
The LC delay formulas below are included for completeness. In the arrays of this article I have used the T form of the LC delay because it simplifies the phaser-combiner. Also, the T form allows the use of a variable capacitor for continuous (limited) change of delay (at the expense of impedance mismatch). However, I have not found this variable phaser to be of any use because it has little, if any, effect on null depth or null aperture. And as I have said many times before, using a variable phaser with an array that has a deep and wide null aperture is a mistake. Anyway, if you insist on using a variable phaser, this is not the one to use. Use my modified Misek phaser. It is head an shoulders above all the rest.

Common Mode Chokes

Common Mode chokes should be used at each end of the twinax.

Building Blocks

If it is assumed that 100 ohm twin-lead is always used, and the FET follower output impedance is always 100 ohms (not exactly, but reasonably accurate). Below is a summary of the formulas and building blocks used for the receiving antenna arrays that I have designed. See the article “LC Delay Phaser-Combiners” in The Dallas Files for more detailed information about the formulas and building blocks.



All transformers are wound on Steward 35T0501-10H.

All delays are for 100 foot spacing between centers.