NCJ Reviews: MultiNEC 2.0

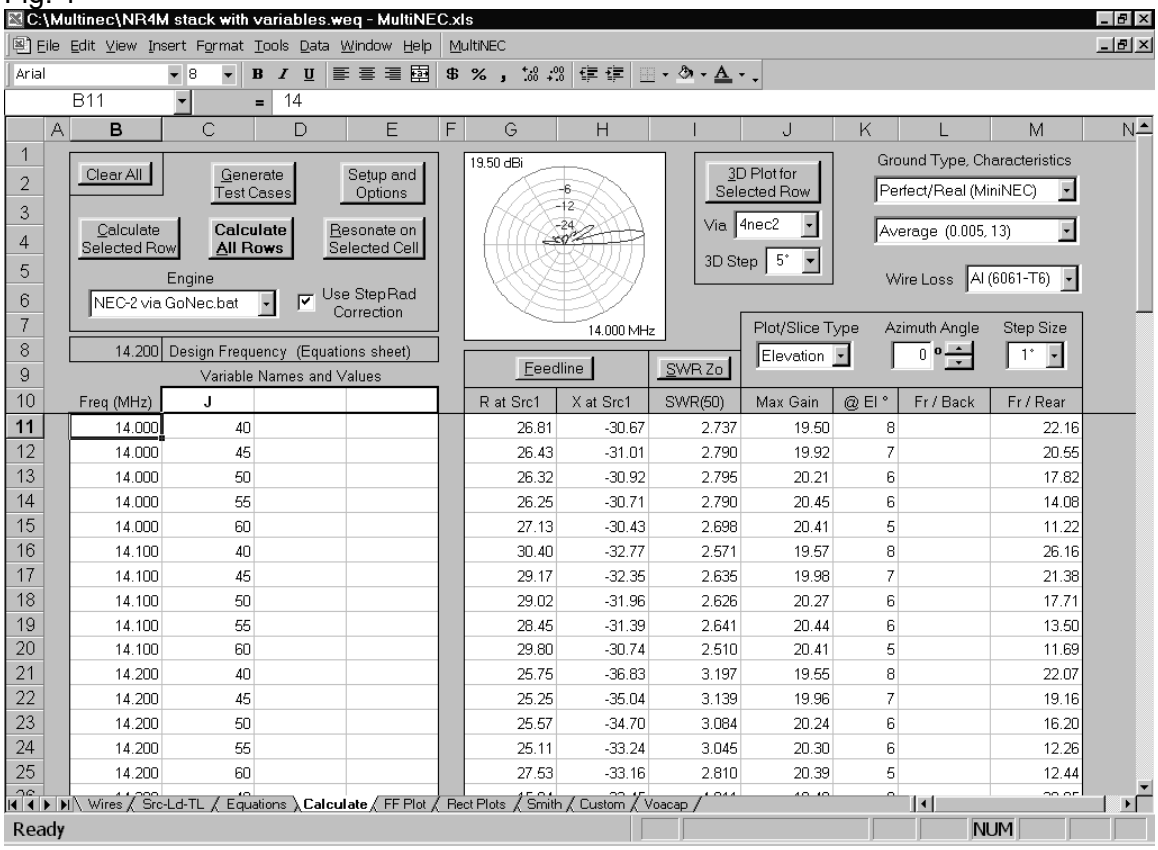
The most useful program I use for both antenna modeling and propagation prediction is not a program at all. It's also the only shareware for which I eagerly paid the registration fee the very first day I had it, but it's still not a program. What?

MultiNEC 2.0, by Dan Maguire, AC6LA, is a Microsoft Excel[1] application – that is, an extensive and integrated set of "macros" (pre-programmed Excel routines) that are run on top of Excel (97 or any later version). That means you must have Excel already on your PC, as well as some other freeware programs, but when you do, the fun begins.

For those of you who have spent a lot of time with the amateur versions of various antenna modeling software, my reasons for recommending MultiNEC will ring bells, I think. It combines the ease of use of a standard Windows graphical interface with the full power of the underlying NEC modeling software, and adds the ability to easily do multiple simulation runs of an antenna while changing one or more aspects of the model in each run, viewing the results in a number of formats. And just as frosting on the cake, there is a whole module devoted to linking MultiNEC with the VOACAP propagation prediction software, making it a snap to model propagation using real antennas under ham radio conditions.

To use MultiNEC, you start Excel and then load the workbook titled MultiNEC.xls. You'll probably spend most of your time at the nerve center of MultiNEC, the "calculate" worksheet (figure 1).

Fig. 1



To build a model, you go to the “wires” worksheet, where you can either load modeling files produced by a number of other programs (NEC-2 or –4, EZNEC, ELNEC, NEC-WIN and its variants, MMANA, AO, NEC-Wires, and Antenna Model), or type in your own. Sources, Loads and Transmission Lines are specified on the Src-Ld-TL worksheet. If you want to use variables to specify a model, so that you can easily change one or more and see the effects, you then go to the Equations worksheet and enter simple or complex variables. You use Excel’s “formula” function to enter the variables in your model.

Once all this is done, MultiNEC is ready to go. In the example shown in Figure 1, I was modeling a 4-high stack of 6-element OWA yagis on 20 meters. I wanted to explore, given the classic 1X/2X/3X/4X height and spacing, which spacing would be best, and how performance of such a stack would vary across the band. To do this, I set the height of the lowest antenna and the spacing between antennas equal to the variable J. Then, by clicking on the “Generate Test Cases” button on the Calculate worksheet, I told MultiNEC to try each potential spacing from 40 to 60 feet across the entire band, and report the results.

You can readily view the results of a modeling run in a number of formats. FF Plot lets you examine the pattern in detail under each set of modeling conditions. Rect Plots graphs the data in a variety of useful ways, with the horizontal axis always being the last variable specified on the Calculate page. The Smith worksheet plots the feedpoint data on a Smith chart, and lets you add real-world feedlines, to examine the effect on the VSWR at the other end of the line. Custom permits you to graph parts of the data or select various variables to graph against each other.

So far, most of the functions I’ve described are also in one or another modeling program (except the Generate Test Cases button, which I believe is uniquely useful). Maguire acknowledges, for example, that the modeling by equation function in MultiNEC is very similar to the excellent capability of NEC-Win Plus+ in that respect. So why bother? Well, for one thing, MultiNEC permits using public-domain NEC-2 engines that are available free and can handle up to 5000 segments, where the most-popular amateur modeling program is limited to just 500, and even the most accommodating only allows 1500. If you have ever tried to model your entire station, looking for interaction among antennas and structures at relatively high frequencies, you can appreciate what this means. For example, my relatively simple single-tower station requires 2806 segments for reasonable modeling accuracy at 28 MHz. I could not model this before MultiNEC came along. While only a 1500-segment version of NEC-2 ships with MultiNEC, you can get all the bigger versions as freeware at http://www.qsl.net/wb6tpu/swindex.html, the Unofficial NEC-2 Archives. Be aware, however, that some NEC-2 executables do not use virtual (disk) memory; the 5000 segment version of one of these will probably require 512 Mb of RAM.

MultiNEC also uses the power of Excel to automate many functions that are uniquely useful and were not available before. For example, you can simulate turning one antenna in a stack relative to the other(s) simply by specifying the degree of relative rotation as a variable, then running a series of simulations with different values of that variable, specified through the Generate Test Case function. The results can be displayed graphically, or in a table of values, or as a set of Far Field plots. Laying down

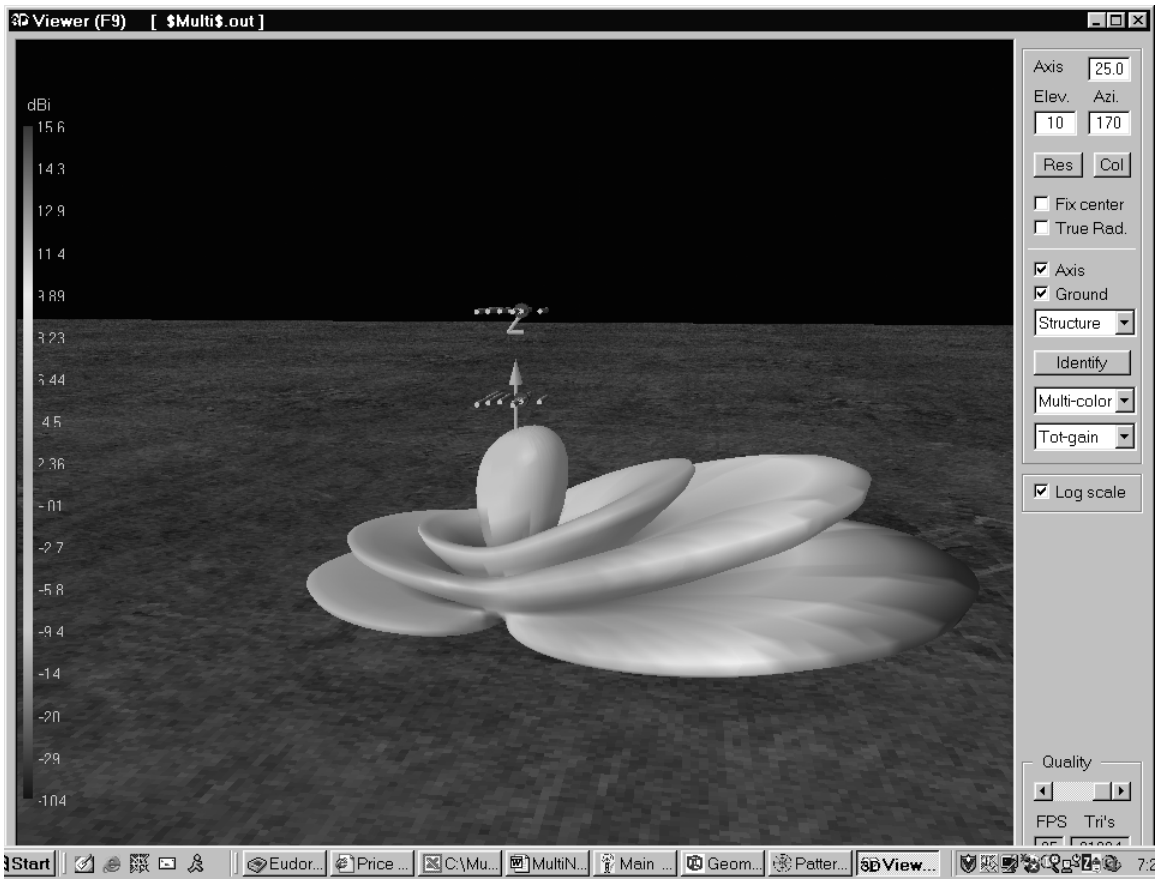
a field of radials, or scaling a model to a different frequency, or resegmenting a model to test for convergence are all just a mouse-click away.

I began this review by saying that MultiNEC isn't really a program. In practical terms, that matters very little. You need to get used to using the function buttons within MultiNEC, rather than using the Excel menu functions that are arrayed across the top of the screen. For example, instead of using Excel's File|Open command, you need to use MultiNEC's Open Model File button. I found I very quickly became accustomed to this. Even if you screw up MultiNEC, since it is "just" a worksheet file and a bunch of Excel macros, you can readily restore it from the download and be back in business quickly.

In his introduction to MultiNEC, Maguire makes the point that it is not a stand-alone modeling program. For example, it does not include its own 3-D viewer for visualizing model geometry and antenna patterns. If you have any Windows version of EZNEC, any of the Nittany Scientific NEC-based programs, or Antenna Model, you can use their viewer seamlessly with MultiNEC. But even if you don't have any of these, you're not in trouble, because MultiNEC can also use the viewers that are part of an excellent NEC-2 "front-end" called 4NEC2, which is distributed as freeware by Arie Voors and available (along with the "big" NEC-2 engines and various other goodies) from the Unofficial NEC-2 Archives.

Similar caveats apply to geometry-checking, and to current visualization; you need another program for those. However, I find 4NEC2 very easy to use with MultiNEC, and its viewers for antenna geometry, 3-D antenna patterns and currents are very well-done, so there's really no problem. Figure 2 is an example of what I mean (it looks a lot better in color).

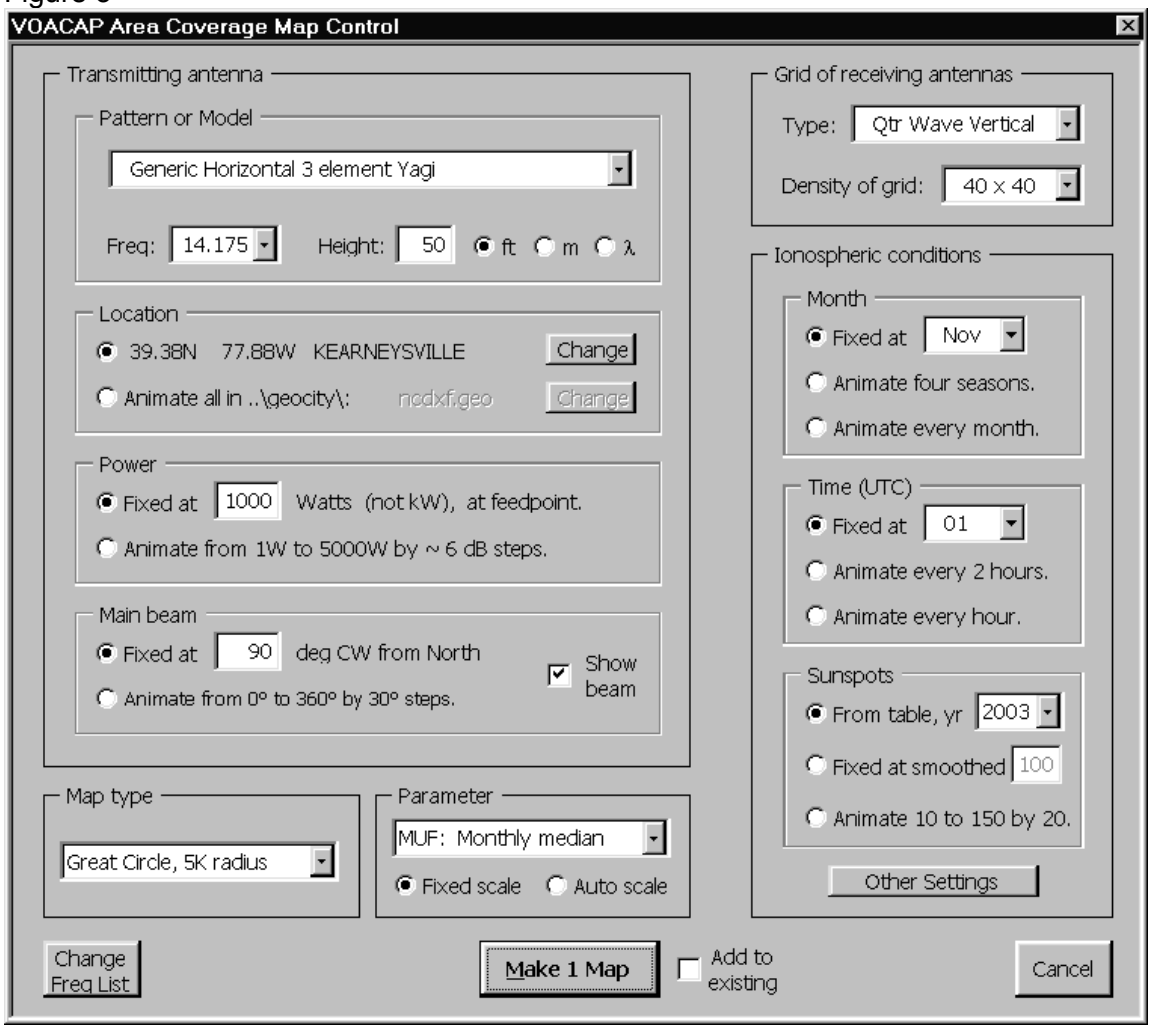
Figure 2



Another feature not included in MultiNEC is stepped-diameter correction, which is used to enable modeling of antennas built from telescoping aluminum tubing, a situation that NEC-2 doesn't handle accurately. EZNEC automatically applies the Leeson correction regardless of antenna pointing. If you are have EZNEC but are using MultiNEC, you can use the EZNEC calculating engine (which imposes the 500-segment limitation) and get these automatic corrections. An alternative is to use the StepRad module that is supplied with the demo version of NEC-Win Plus+. This module's corrections are only accurate when the antenna is pointed directly along the X or Y axes, but most modeling is done under those conditions anyway.

Finally, let's turn to a truly unique feature of MultiNEC, what Dan Maguire calls the MultiProp module. While working in MultiNEC, click the VOACAP tab at the bottom of the screen, and you are transported into what is virtually a separate program. Dan has simplified and automated the user interface of the popular freeware VOACAP propagation program to offer a wide range of fascinating and convenient propagation modeling capabilities (figure 3).

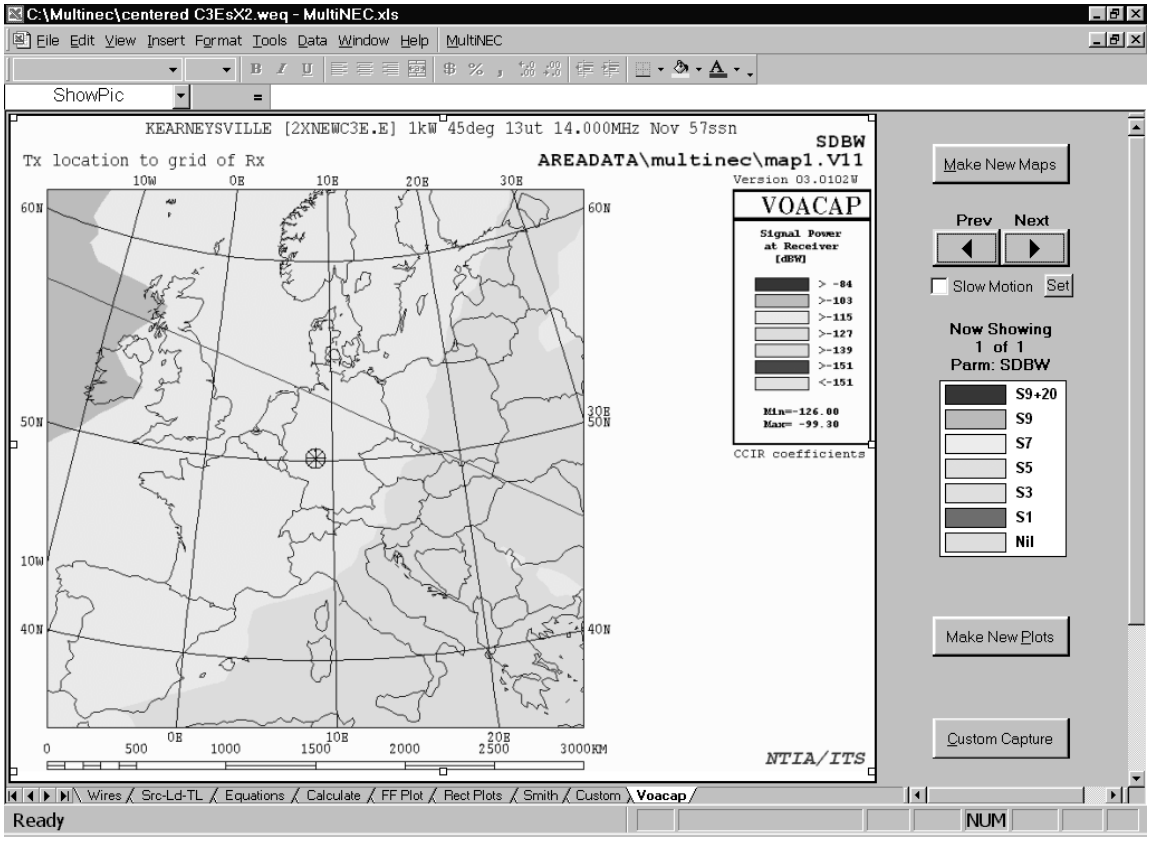
Figure 3



Once you have downloaded VOACAP from http://elbert.its.bldrdoc.gov/hf.html and installed it on your PC, you can map MUF worldwide, visualize the predicted strength of your signal in a target area such as Europe through an entire opening, and even plot signal strength versus time and propagation mode to see the sunrise peak on the low bands with your own eyes. There are so many possibilities that Dan has produced an entire manual just for MultiProp. One of the best parts is that you can easily use the pattern of your real antenna, calculated by MultiNEC, as an input to VOACAP.

Here's an example (figure 4) of the sort of output you can get from MultiProp. Here I'm looking at how well my tribander stack will get into Europe on 20M next November, during the CQWW CW contest. Again, color makes things stand out much better than on a black and white page.

Figure 4



Seamless and really simple to use, with all the tricky terminology clarified for you, MultiProp has really improved my ability to use and understand VOACAP predictions. Now if it could only do something about the sunspot cycle!

MultiNEC is available by download (with an extensive manual) from www.qsl.net/ac6la. The free demo version is complete in every respect, so you can try all the features of the package before you register. Registration is $39, payable by credit card via the PayPal service. Quite a bargain, when you consider everything it does. Registering will encourage Dan to keep adding features and capabilities, so MultiNEC gets even better.

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