

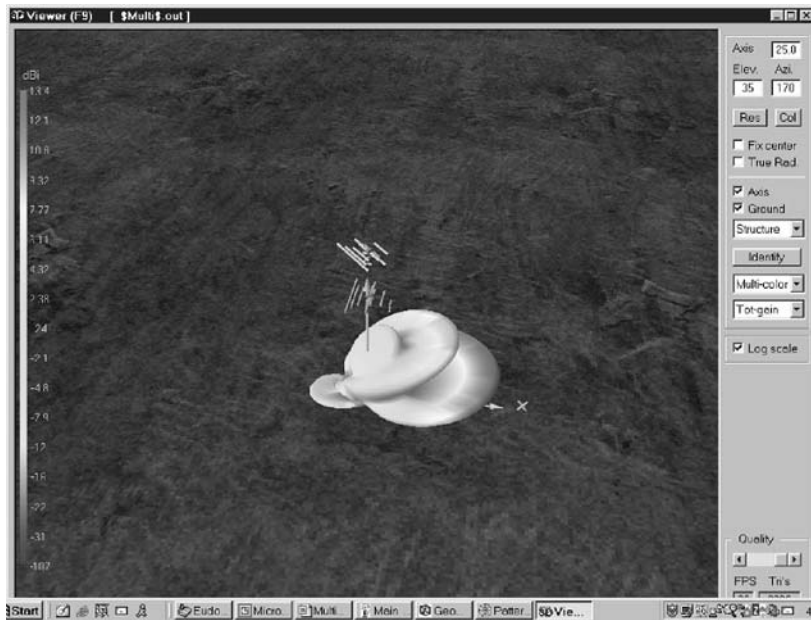
## “This Changes Everything”

Remember the TV commercial a few years ago, whose tagline was “This Changes Everything”? I can’t even recall what product it was advertising, but the other day, while looking out over the beach, I was reflecting on the software tools we take for granted today, and thinking back to the days BC – Before Computers. Things have now progressed to the point where there are some very nice synergies to be realized by using different software packages together. I did a presentation at Dayton several years ago on this subject, but was squeezed for time, so I thought the topic might be worth revisiting.

Antenna modeling is probably a good place to start. Like most folks, I began my modeling career with W7EL’s *ELNEC*, and later with his *EZNEC*, which used the more-powerful NEC-2 engine. Since NEC-4 was (and is) very expensive, while NEC-2 is in the public domain, this is as far as I have gone.

The reason I no longer use *EZNEC* is that I wanted to be able to model my entire single-tower station as one entity, and *EZNEC* was limited to 500 segments, which was inadequate to the task at higher frequencies. That set me looking for an inexpensive *Windows* front-end for NEC-2, as well as for versions of the engine that would handle up to 2500 segments.

My search led me to an invaluable resource, the Unofficial NEC Archives at <http://www.si-list.org/swindex2.html>, which pointed me in turn to two critical additions to my software arsenal. The first is *4NEC2*, a breathtakingly-powerful *Windows* front-end, available as freeware from <http://home.ict.nl/~arivoors/index.html>. Ari Voors’ program, in its latest form, uses NEC and *EZNEC* input files directly, and has so many features I can’t claim to have even tried them all. Two are particularly noteworthy to me – the only NEC-2 based antenna optimizers for the ham market, and an absolutely gorgeous *Direct-X* viewer for antenna patterns. Figure 1 is an example, but you really have to see it in color to fully appreciate how much information is in a single pattern.



From my perspective, as a non-engineer, the only drawback to *4NEC2* is that it is *very* complicated to use well, although that has improved significantly as the software has evolved. At the time, though (several years ago), that sent me back to the archive, where I discovered *MultiNEC* by Dan Maguire, AC6LA. I reviewed *MultiNEC* for NCJ (September/October 2003) but for those who missed that, it is an Excel-based Visual Basic program that combines a powerful modeling front-end with an interface to *VOACAP* (more about that below). *MultiNEC* is easy to use, relatively, and adds all sorts of capabilities to the basic NEC package, such as the ability to run multiple cases in one pass, use variables such as antenna height in my models, and model the pattern of stacks with the antennas not pointed in the same direction, to list just a few. For the first time in ham software, *MultiNEC* makes it easy to use your real antennas in *VOACAP* propagation forecasting. It also interfaces to the *DirectX* pattern viewer in *4NEC2*, so I don't have to sacrifice that to take advantage of *MultiNEC*'s intuitive user interface. Not long after I got into antenna modeling, I became aware that simply modeling antennas over a featureless plane would not be enough; while I live in a relatively flat area, many hams find themselves surrounded by complex terrain that can affect their HF antenna patterns in unexpected ways. Fortunately, in the mid-1990s K6STI and N6BV came out with *TA* and *YT* (Terrain Analysis and Yagi Terrain, respectively), both of which applied 2-dimensional reflection and refraction analysis to understanding the effects of terrain on antenna patterns. While K6STI is now out of the ham software business, Dean Straw (N6BV) has developed *YT* into *HFTA*, a Windows-based application that is bundled with recent editions of the Antenna Book. *HFTA* is powerful and fast, and also incorporates a unique figure of merit for antennas, which I call weighted relative gain. N6BV has used thousands of *IONCAP* runs to develop statistics for the arrival angle of signals at hundreds of locations around the world. By mathematically matching those arrival angles with the radiation pattern of various antenna systems, *HFTA* lets you directly compare the performance of those

antennas over a particular path – North Carolina to Europe, for example, or Connecticut to Japan. Want to know why you're the king of propagation to LU on 15, or why you are getting stomped on 20? This is a great tool for finding out. You may discover that at your site, higher is not better on some bands.

*HFTA* is not perfect – it uses point-source approximations of antennas, rather than real models, works only for horizontal polarization, and cuts off below about .75 degree take-off angle, because of problems with modeling artifacts. Since it is 2-dimensional, it may not adequately portray the effects of foregrounds that slope across the direction of your transmission. As Dean himself points out, relying on computed figure of merit differences of 1 dB or less for decision-making is probably unwise.

Meanwhile, what about propagation? For many years, *IONCAP* was the government standard. Once it was ported to the IBM PC, many hams began to use it for predicting maximum usable frequencies, leading to the famous QST How's DX graphs of the 90's. Meanwhile, the Voice of America funded the development of a Windows front end, and the first *VOACAP* was released in 1996. Greg Hand of the Institute of Telecommunications Sciences (part of the Department of Commerce – your tax dollars at work) and George Lane at VOA were the godfathers of the project, and both have continued their involvement after retirement, continuing to develop and document use of the software.

The best place to start with *VOACAP* is probably at Jari Perkiömäki, OH6BG's *Quick Guide to VOACAP*, found at <http://lipas.uwasa.fi/~jpe/voacap/index.html>. Jari has done his best to make *VOACAP* comprehensible to laymen, for which we owe him a special vote of thanks. For those (like me) who still find it difficult to fathom, don't despair – there are a couple of options. *MultiNEC* provides an easy-to-manage interface with *VOACAP* that lets you run multiple cases easily and produce "movies" of the propagation from your real antennas to locations anywhere in the world throughout a typical day, any time of year, under any sunspot conditions. For an even simpler user interface, Alex Shovkoplyas, VE3NEA has developed *HamCAP*, an inexpensive front-end for *VOACAP* that does away with most of the complications. You can find out more about it at <http://www.dxatlas.com/HamCap/>.

While we're on the subject of propagation, I recommend everyone also take a look at *IonoProbe* by VE3NEA, which integrates with his *DXAtlas* to provide near real-time ionospheric maps, and *FAROS*, his brand new software for monitoring the NCDXF beacon network. Some freeware, some shareware, all of these are very reasonably priced for what they do. For some more detail, and some color illustrations, you can go to [http://www.pvrc.org/powerpoint/N4ZR\\_files/can/can.htm](http://www.pvrc.org/powerpoint/N4ZR_files/can/can.htm).

So what's the bottom line? The personal computer has revolutionized the way we approach station design and operations, and it's only beginning. Who will have the next great idea? Write and tell me about it – [n4zr@contesting.com](mailto:n4zr@contesting.com).

