Natural Radio

News, Comments and Letters About Natural Radio

June 2003

Lightning and Summer Projects – I never tire of watching thunderstorms; they are fascinating and one of the blessings of summer. Sitting on the front porch the other night watching an approaching storm, sub-consciously counting off the seconds to estimate the distance of the lightning flash, I wondered if different types of lightning strokes produced different types of sferics. Did the killer tornados that moved through the South that week produce unique sounding sferics? I wished I had a small loop type receiver to monitor the storm as putting up an E-Field antenna during a thunderstorm would not be prudent, as I had a near miss with lightning a few years ago and I have developed more respect for it since then.

At that time, several years ago I was on our screened-in porch when lightning hit a sycamore tree about 15 feet from where I was standing. I had my back to the tree and after the deafening crash I turned around just in time to see a bug zapper that was hanging in the tree descend in a ball of flames. After the storm had passed, I observed that a hosta plant at the base of the tree exploded and there were tiny bits of leaves everywhere. Strangely the tree was no worse for the wear. The pulse took out the front end transistor in two radios and zapped a computer in the house. I was fortunate – our screened-in porch is aluminum and shielded me, just as an automobile would.

A few years ago, Dan Levit, my predecessor as editor of this column, wrote about some experiments he had done with optical sensing of lightning. The sensor was simple – A photocell hooked up to the input of an audio amplifier. Point it at a storm and you could hear the results of the light energy from the lightning flash – they sound just like Sferics. I built a similar unit using a little radio shack audio amplifier and played with it for a month or so, but it has been sitting on the shelf since then. Maybe it's time to dust it off, replace the battery and give it new life.

I've been toying with the idea of sferics research for some time. Research has been done associating sferics like sounds with meteors and earthquakes. (See Feb 2002 and Sep 2002 Natural Radio columns in *The Lowdown*) Also, lightning strokes that produce Red Sprites have a characteristic VLF signature, so maybe it is time to design a few experiments.

Sferics have been the poor stepchild of Natural Radio. They are so common, and really a nuisance in our pursuit of whistlers, but they are a two-edged sword as lightning is the source of tweeks and whistlers that we want to hear. Lightning is also the driving force behind the Schumann Resonance.

For the casual listener, the good part of that is that they are in abundant supply and they can be easily observed from home. This is an opportunity for those who are unable to make frequent trips to a quiet area in the predawn hours to hunt whistlers and chorus.

Let's start with a little information about lightning. Lightning discharges are divided into three types. Intra-cloud discharges are lightning flashes between different points within a cloud. These are the most common type of discharge. Cloud-to-Ground discharges are

lightning flashes between the cloud and ground, and are probably the best studied flashes. Inter-cloud discharges are lightning flashes through clear air between two clouds. These happen relatively rarely.

Cloud-to-ground discharges can either be positive or negative, although most are negative. Sprites are produced by positive discharges, although not all positive discharges produce sprites. Positive discharges tend to be more energetic.

Cloud-to-ground lightning begins with a relatively low amperage leader stroke that comes down from the cloud, when this stroke contacts an object on the ground, a high-amperage return stroke happens which produces the sferic. These both happen in a few thousandths of a second. There may be several strokes in a single lightning flash.

Intra-cloud discharges are slower and don't have a separate leader and return stroke and should produce a different sounding sferic.

It might be an interesting experiment to analyze and categorize sferics in a similar manner to the way we analyze whistlers and other Natural Radio phenomenon. That is to look at the waveform and try to relate a sferic to its generating source. Down the road, this information might be useful to determine which type of sferics are more likely to cause whistlers, which sferic type signals might not be coming from lightning and so on.

A way to begin this research could be to use a stereo recorder and plug the optical sensor into one channel and the sferics receiver (ideally with a small loop antenna) into the other channel. Then, from a safe location, record a storm where lightning is visible. Identify each stroke as cloud-to-ground, inter-cloud, or intra-cloud by voice announcements on the tape after the stroke.

Later, by looking at the stereo waveforms in an editing program, you can verify that the sferic is related to the optical discharge observed. With enough observations, it should be possible to draw some general conclusions about which type of lightning produces which type of sferic, and maybe start looking as sferics as something more than just noise.

This project could add a little interest to your summer thunderstorm watching, although watching the storms is beautiful and awe-inspiring in its own right. A ferrite loop hooked to the recorder input might be a sufficient antenna for the observation of nearby thunderstorms,

Just a reminder here, and I almost feel silly bringing this up, but sometimes we get careless in our eagerness and familiarity with electrical storms. Lightning is the second leading cause of weather related deaths in the US. Only floods kill more people. Many more die from lightning strikes than hurricanes and tornados combined, with approximately 100 people killed by lightning each year, and many more injured. Know the safety rules and don't do anything stupid in your observations. For a review of lightning safety go to the National Weather Service site at http://www.lightningsafety.noaa.gov/overview.htm

A good starting point for more information on lightning is the Global Hydrology and Climate Center of NASA at http://thunder.msfc.nasa.gov/. This site offers an excellent primer on lightning as well as various datasets, links to the various satellite lightning observation experiments and reference information.

For a near real-time look at lightning distribution in the U.S. visit the NLDN site at http://www.lightningstorm.com/ls2/gpg/lex1/mapdisplay_free.jsp. For a look at lightning in Europe visit http://129.13.102.67/pics/Rsfloc.gif

The GP-1 Lightning locator from Penn State is a rather sophisticated unit for locating lightning and features a computer mapped display. Construction information is at http://bub2.meteo.psu.edu/default.htm. Circuit boards are also available.

Lightning detectors and other interesting items are available at http://www.stormwise.com/. This is the former McCallie Manufacturing site.

For historical information of the monthly distribution of thunderstorms throughout the world, see the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS) maps at http://thunder.msfc.nasa.gov/ols/.

Write For The Lowdown - With the advent of web-based mail lists for VLF and Natural Radio the number of articles and correspondence submitted to *The Lowdown* has dropped considerably. Mail list and discussion board resources are quite useful for exchanging immediate information and getting questions answered, but using them for research is difficult. To go back and refer to a discussion board months later is not an easy task. Pulling out a stack of old *Lowdowns* and looking for that project article that you now need is much easier and usually more fruitful.

There is still a need for well thought out articles to be published here, especially when all the bits of information passed back and forth in discussion groups solidifies into a working project. So, if you have knowledge on a topic, please consider writing an article for the *Lowdown.*

Compact Natural Radio Receiver - Brian Lucas wrote an article on building an *Atmospherics Monitor* for the April issue of *Practical Electronics*. This Natural Radio receiver uses a ferrite antenna and has a strength meter. Detailed construction plans are given. This is a nice compact receiver and the ferrite antenna won't act like lightning rod when storms are nearby!

Ferrite Rod Source- In doing research for this column, I discovered that Stormwise sells gigantic ferrite rods. They are available in the following lengths -- 12, 24, 37 and 49 inches. All are 1 1/8" in diameter. The rods are encased in PVC pipe to avoid breakage and provide for weatherproof operation. Check out the site at http://www.stormwise.com/