

# Natural Radio

*News, Comments and Letters About Natural Radio*

**January 2006**

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It seems like we went from summer to winter in a matter of a couple weeks. About half of the trees had leaves at the end of October. Then the rains came and the temperature quickly dropped below freezing, creating a solid frozen mass of late fallen leaves to clog gutters and cover the lawn. We've had snow cover almost all of December, and Christmas will definitely be white.

Since it's hard to do yard work with snow on the ground, I've had some more guilt-free time to spend in the workshop and in the process of assembling a fixed Natural Radio receiver using re-purposed pro audio gear. The heart of the system is a Roland hum and noise filter that I acquired on EBay several years ago, driven by a vacuum tube microphone preamp that I no longer needed at work. I have done a quick test of the system using my vertical HF antenna as a source and the hum was cleaned up enough to hear sferics and tweeks, but definitely not good enough for whistlers. Of course the vertical is only 50 feet or so from the 25 kV power lines in the back yard.

The next phase will be to erect an E-Field antenna in the front yard or to try using the spruce in the front yard as a "tree antenna". I'll report on the whole system in detail if I can get some acceptable reception of whistlers or chorus.

***Re-release of Helliwell Book*** – Robert Helliwell's classic book, *Whistlers and Related Ionospheric Phenomena* is being reprinted as a paperback. The release date is February 13 of this year and is available from Amazon for \$16.50.

***Solar Minimum*** – In spite of a flurry of sunspot activity earlier this month, we are approaching the solar minimum. Current predictions indicate that the minimum and beginning of Solar Cycle 24 will occur in the second half of 2006. The next solar max is predicted for 2010. This is based on Jan Alvestad's Solar-Terrestrial Activity Report, and seems to agree with what NOAA is saying. However, there are many other reports, models and papers with wildly different predictions. I wonder what the Farmer's Almanac has to say?

***Chronology of Natural Radio*** – It seems that the holidays and New Year are the time of chronologies, genealogies and lists. By the time you read this, it will be too late for New Year's resolutions and I have probably broken mine by now, so what I'd like to offer this month is a chronology of the important events in Natural Radio.

1859 or earlier – A geomagnetic storm in 1859 induced currents on long telegraph lines so high the coils at the receiving side burst in flames, or the operators received electric shocks. In other instances, the current induced by the geomagnetic storm led to diminishing of the signal, when subtracted from the battery polarity, or to overly strong and spurious signals when added to it.

Operators in such cases learned to disconnect the battery and rely on the induced current as their power source. Other than Aurora, this was probably the first sensing of the effects of a geomagnetic storm. (Wouldn't it be great to have a long antenna like that and absolutely no hum!)

1886 – Helliwell mentions that the first reports of whistlers came from a 22 km telegraph line in Austria with a telephone receiver connected. This is probably the first reception of a radio signal by humankind.

1894 – During an auroral display in the month of March, British observers connected telephone receivers to telegraph lines and were able to hear tweeks and possibly whistlers and chorus.

1899 – At his research facility in Colorado Springs, CO, Nikola Tesla reported hearing the voices of Martians as he conducted experiments on locating lightning. In a 1989 column in *The Lowdown*, Michael Mideke speculated that what he heard may have been Natural Radio sounds. That is still indeed a very interesting speculation.

1919 – During World War I, vacuum tube amplifiers connected to widely separated ground rods were used to eavesdrop on the telephone conversations of the other side by picking up ground currents induced by the field telephones. H. Barkhausen's paper mentioned that at certain times strange whistling sounds could be heard on these devices. Those monitoring these units would report, "You can hear the grenades fly." Barkhausen suggested that these strange sounds might correlate with meteorological disturbances. He even considered that the amplifiers themselves might be causing the sounds, but despite extensive testing, was never able to reproduce the phenomenon in the laboratory. He finally concluded that the sounds were of unknown origin.

1925 - 1929 – T. L. Eckersley published a series of papers and postulated the existence of a dispersive medium. His observations indicated that whistlers were associated with magnetic storms.

1930 – In this paper, Barkhausen offered two possible explanations for whistlers. The first, which is caused by a series of multiple reflections between the earth and the ionosphere, is the same method that produces tweeks. In the second, Barkhausen introduced the idea of a dispersive medium. He indicated that a remote lightning stroke, a direct current impulse that contains all frequencies, was the initiating event. He was at a loss, however, to explain the long duration and low amount of attenuation in whistlers. He concluded that more observation would be needed.

In the period from 1931 to 1951, there was almost no Natural Radio research being done. This was mostly due to WWII. It is interesting to note that until the 1950s only about 15 papers had been published regarding Natural Radio phenomena.

Research surged ahead in the '50s due to the end of the war and aided by the invention of the tape recorder which made the capture and detailed study of these signals possible.

1950s – L.R.O. Storey, in Cambridge, England, begins a serious study of the nature and origin of whistlers. Through his observations of whistlers, he formed the basis

of the “magneto-ionic” theory of their origin, and also of a magnetic storm’s effect on whistlers. Storey’s research made an important contribution to the growing body of knowledge about whistlers by showing that whistlers followed the earth’s magnetic field lines.

1950s – Sometime in the 1950s, Emory Cook released several Natural Radio recordings on disk. One of them, *Out of This World*, featured sounds of whistlers, tweeks and the dawn chorus.

1957 – The International Geophysical Year (IGY) was a pivotal event for Natural Radio, with over 50 receiving stations set up worldwide. A receiving station and transmitter were set up at Siple Station in Antarctica, and thus began a very intense period of whistler and geomagnetic research,

1958 – Several articles appeared in *Popular Electronics* in the late fifties that introduced readers to Natural Radio sounds and gave plans for simple whistler receivers. There was even a Carl & Jerry story about whistlers.

1960 – The launching of several satellites carrying VLF receivers in the early 1960s (Allouette, IEEE-1, Injun) allowed the detailed study of whistlers in the ionosphere which greatly built on the body of knowledge from the IGY.

1965 – Robert Helliwell, a professor and researcher from Stanford University, publishes the book, *Whistlers and Related Ionospheric Phenomenon*. This book is still the “bible” for Natural Radio listeners. It presents a formal theory for whistler propagation and details much of the research done during the IGY.

By the 1970s there was explosion of research into space weather and the related Natural Radio signals, as being able to understand the phenomena was essential to keep the growing number of satellites in healthy condition.

It is impossible to list all the significant research papers and studies, but the body of knowledge grows daily, as well as our ability to predict the effects of solar activity on Earth and the associated space weather conditions.

1975 – The LWCA is founded and *The Lowdown* is published in California by W. R. McIntosh. The publication at that time was an 8 ½” x 11” mimeographed bulletin.

1980 – Sometime in the 1980s, the GOES satellites, which sit in geostationary orbits and have a primary mission of producing weather photos of earth, began carrying sensing instruments to measure space weather.

1981 – W. R. McIntosh becomes too ill to continue publishing and Bill Oliver takes over *The Lowdown* and the publication assumes its present form.

1988 – The HSGS (High School Ground Station) was established by Bill Taylor of NASA; Bill Pine, a high school physics teacher; and two amateur scientists, Michael Mideke and Jim Ericson. ACTIVE/HSGS was a test bed project which involved 100 high schools making observations of transmissions from the Soviet ACTIVE satellite.

1989 – Michael Mideke coins the term “Natural Radio” and becomes the first Natural Radio Editor of *The Lowdown*.

1990s – The Internet. The arrival and growth of the Internet facilitated exchange of information between Natural Radio hobbyists and eventually made real time solar and geomagnetic information available to everyone. It's hard to imagine this hobby without the instant access to GOES and ACE data as well as all the excellent articles and discussion groups on the net.

1991 – Steve McGreevey and Frank Cathell create the WR-3 handheld whistler receiver and began selling it on a casual basis.

1991 – Following the proof of concept demonstrated through HSGS, INSPIRE was formally organized and incorporated. “INSPIRE is a non-profit scientific, educational corporation whose objective is to bring the excitement of observing natural and manmade radio waves in the audio region to high school students.”

1994 – Dan Levit becomes the second Natural Radio Editor of *The Lowdown* in October.

1995 – SOHO, Solar & Heliospheric Observatory, was launched on December 2, 1995, for what was originally planned as a two-year mission. Ten years later, it's still going strong. SOHO was designed to study the internal structure of the Sun, its extensive outer atmosphere and the origin of the solar wind, the stream of highly ionized gas that blows continuously outward through the Solar System.

1997 – The Advanced Composition Explorer, ACE, was launched on August 25, 1997 from the Kennedy Space Center in Florida. ACE orbits the L1 libration point which is a point of Earth-Sun gravitational equilibrium about 1.5 million km from Earth. ACE performs measurements over a wide range of energy and nuclear mass, under all solar wind flow conditions and during both large and small particle events including solar flares. ACE provides near-real-time solar wind information over short time periods. When reporting space weather ACE can provide an advance warning (about one hour) of geomagnetic storms that can overload power grids, disrupt communications on Earth, and present a hazard to astronauts.

1999 – Mark Karney becomes the third Natural Radio Editor of *The Lowdown* in December.

2001 – Shawn Korgan forms the VLF\_Group on Yahoo. The Natural Radio VLF group is a discussion group dedicated to those who enjoy monitoring radio frequencies in the VLF radio spectrum and slightly below the VLF (very low frequency) spectrum (3-30 KHz). Mark Karney takes over ownership of the group in 2002.

2006 – Robert Helliwell's book, *Whistlers and Related Ionospheric Phenomena* is re-released as a paperback, 40 years after the original publication.

This list is by no means complete and I invite you to submit events that you think should be added to this list.