The INSPIRE Journal

Volume 11 Number 2

April 2003

The VLF3 is (Finally) Here!

The final wrinkles in the production process of the VLF3 receiver have been ironed out and we now have kits in stock and ready to ship. The order form for the VLF3 can be found on Pages 52 and 53.

Also in this issue:

- Articles on the VLF3 from Bob Bennett and Shawn Korgan.
- An article from Bob Hand on trees as antennas.
- Two articles from Flavio Gori on his experiences in the Hessdalen Valley of Norway.
- Coordinated Observations planned for April 26 and 27.
- A report on Field Observations since last fall.

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Volume 11 Number 2
April 2003

The INSPIRE Journal is a publication of The INSPIRE Project, Inc., a nonprofit educational/scientific corporation of the State of California. The purpose of the INSPIRE Project, Inc., is to promote and support the involvement of students in space science research. All officers and directors of the corporation serve as volunteers with no financial compensation. The INSPIRE Project, Inc., has received both federal and state tax-exempt status (FEIN 95-4418628). The *Journal* is published two times per year: November 1 and April 1.
Submission deadlines: October 1 and March 1

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Field Observations are a Way to Participate!

Everyone is invited to participate in Field Observations. Field Observations offer an opportunity to record natural radio and have the results published in the *INSPIRE Journal.* The twice-yearly Coordinated Observations will still be held on the third weekend of November and the last weekend of April. Field observations may be made any time. All reports received by next March 1 will be included in the next *Journal.*

Subscription Information Included on the Address Label

You can determine the status of your subscription to *The INSPIRE Journal* by looking at the address label. In the upper right corner of the label is a 2-digit number that indicates the year your subscription will expire. All subscriptions expire with the November issue. If your label shows "02", then this issue will be the last under this subscription. If your label shows "03", then your subscription is good through the November 2003 issue. If you have any questions or if you feel that the information shown is incorrect, please contact the editor.

Write for *The INSPIRE Journal*

The procedure for contributing articles for *The INSPIRE Journal* could not be simpler! Just send it in! Any format is acceptable. Electronic format is easier to work with. A Word file on disk for either the PC or Mac platform is preferred. An email message will work, too. If that does not work for you, a paper copy will do. Any diagrams or figures can be scanned in.

What about topics? Anything that interests you will probably interest most INSPIRE participants. As long as the topic is related to natural radio or the equipment used, it will get printed. The deadlines for submissions are March 1 for the spring edition and October 1 for the fall edition. Don't worry about the deadlines, though. If you miss a deadline, you will just be very early for the next edition!

We at INSPIRE are looking forward to hearing from you.

USING THE VLF-3 RECEIVER

Robert Bennett
Las Cruces, NM

I have been monitoring and recording natural radio and other VLF signals for over 15 years. I have used several receivers including the BBB-4, the Palomar converter, the INSPIRE RS-4 and VLF-2 and two home made receivers. I had the opportunity to obtain a prototype of the new INSPIRE VLF-3 and have been using it for about eight months. The VLF-3 is a very good receiver, one of the best I have tried. I am quiet pleased with the performance of the VLF-3 but have noticed several idiosyncrasies. I thought that some of my experiences might be of interest to other INSPIRE members.

BACKGROUND

Before I start giving my lessons learned, I believe that the reader needs to appreciate the conditions under which I monitor. I live in Las Cruces, New Mexico USA, which is a desert region in the Southwestern part of the country about 50 miles north of the US-Mexico International Border. The elevation is about 4000 feet ASL; the climate is hot, dry, usually a little dusty and with large temperature swings between day and night.

What this means to monitoring is that there is no vegetation to shield one from the sun, static electricity is a constant problem and it is often too hot in the daytime to monitor inside a vehicle (can't use air conditioning due to ignition noise). This means one has to set up either outside and take precautions to keep dust and blowing sand out of equipment or operate from inside a tent. The high daytime temperature (sometimes over 110 degrees) can result in equipment and operator over heating. The large temperature swings will sometimes result in moisture condensation on equipment. Also, the desert has many flying insects that will introduce "insect noise" into the VLF receiving setup (besides biting or stinging the unwary).
My "quiet" site is located in a remote area northeast of Las Cruces on the Jordana Experimental Range. Most of the range is closed to the public and special permission is required to access its remote regions.

I carefully selected my site based on minimum man-made noise levels. The site is 6 miles from the nearest AC power line, 4 miles from the closest road (which is infrequently used), about 10 miles from the nearest dwelling, and one has to traverse over 15 miles of unimproved dirt roads to get to the site. Due to the remoteness of the site, one has to take precautions for safety's sake. The more important being taking extra drinking water, suitable clothing, sunscreen, and a reliable means of communications (I use a ham radio transceiver, cell phones are not reliable on the range due to poor coverage).

My preferred times to monitor are in the early morning from about 0500 to about 0900 Local Time. After 0900, the more interesting natural radio emissions become infrequent. The second period is from just after sunset to about midnight local time.

The early morning period is usually great for dense tweaks, sferics and frequent whistlers. The evening period will produce an occasional whistlers and lots of tweaks. I also monitor at night to catalog the navigation and communication signals between 10 and 20 KHZ and search for other interesting transmissions in the VLF and LF bands. I follow this schedule all year except during our rainy period July through September. During this period, we normally have thunderstorms every evening and I don't normally monitor from my quiet site.

One effect of using these times is that equipment must be set up and disassembled in the dark so I give careful consideration to organization, layout and packing of my equipment. I normally either set up my monitoring equipment on a small folding table or else in the bed of my truck (which is covered by a camper shell). I use a Marantz PM430 Stereo recorder along with the VLF-3 and a portable receiver to receive WWV (I use either a Yupiteru MVT-7100 or an AOR AR8000). My main antenna for natural radio reception is a simple vertical monopole (e-field probe). I will occasionally use a long wire and in the future I hope to modify the VLF-3 so it can also accept a loop antenna (H-field probe).

My site has almost no 60 cycle related interference from the power grid and the only significant source of interference is a LORAN transmitter about 40 miles away. Many of the tips on using the VLF-3 which follow are to minimize LORAN and other undesired signal pickup, cope with static electricity, high temperatures and keeping sand and dust out of the equipment.

LESSONS LEARNED

Undesired signal pick-up

The VLF-3, being designed for a short vertical whip antenna, is more sensitive that most natural radio receivers. Hence, the receiver is susceptible to feedback and pick-up of undesired signals. (I am not talking about LORAN here. LORAN will be discussed later).

I have found that the positions of the equipment in relation to the operator and to each other on the operating table can have an effect on performance. I found that feedback and recorder motor whine pick-up can result if the recorder is too close to (less than about 12 inches from) the VLF-3 receiver. Feedback also occurs if the VLF-3 antenna input wire is too close to the data output cable. This is especially true when the VLF-3 is operated at maximum gain, which is my normal gain setting. Also, WWV audio bleed through will occur if the WWV receiver's audio output cable is allowed to come too close to the VLF-3's antenna connection. I solved this problem by separating the VLF-3, the recorder and the WWV receiver as far apart as I can. Also insure that good quality shielded audio cable is used. Some of the cheap stuff is not well shielded and will make the feedback problem worse.

I find that operator movement, even minor movement, around the VLF-3, its antenna lead-in wire or the antenna proper will result in the pick up of static discharges. I noticed that even when being very still at the operating table and just moving my arm to the VLF-3 to switch to the WWV position results in a slight popping on the tape when I touch the receiver. I have not cured this problem but touching a grounded object before touching the receiver can minimize it.

Some thought needs to be given to VLF-3 antenna placement. This is very important if people are going to be walking near the antenna, its feed line or the operating table. The antenna needs to be mounted two or three feet above ground level to minimize 60 cycle pick-up. (Even at my quite site, I will get 60-cycle pick-up if I place the antenna or its lead-in wire on the ground). This also means that if an unshielded wire is used to connect the VLF-3 to the antenna, then the wire also needs to be supported above ground level, routed away from where people are going to be and not allowed to touch the ground or anything else. Even if the lead-in wire is well insulated, noise pick-up will still result if the wire is allowed to touch anything or flex in the wind.

I have found that connecting the antenna to the VLF-3 using RG-59 Coax cable helps reduce these problems. I use either a 10-foot or 30-foot length of cable and locate the antenna about 8 or 30 feet from the operating table. I will have more to say about Coax antenna lead-in later.

Another undesired signal pickup problem could result from ancillary equipment that is allowed to get too close to the VLF-3. I use a Radio Shack 63-878 timer to alert me to place timing marks on the tape. I found that if the timer is allowed to be closer than about 6 inches to the VLF-3 then pulses from the timer are recorded on the tape. I have observed the same type of undesired pickup from cell phones, ham radio transceivers and scanning radios. The bottom line is to keep all these potential sources of interference several feet away from the VLF-3.

Finally on the subject of feedback, I must say a few words about amplified speakers. I normally use headphones to monitor the recorded audio via the recorder's monitor feature. Sometimes I will monitor the audio output of the VLF-3 directly using a headset. If the audio from the VLF-3 is directly monitored, then one has to be careful to keep the headset cord well away from the antenna connector, otherwise feedback will occur. Infrequently, I will use amplified speakers connected to the VLF-3 to provide audio for other people to listen to. I find that I will always get feedback with this arrangement unless I separate the speakers from the VLF-3 by at least 2 feet and also direct the sound from the speakers away from the receiver.

Grounding

The second thing I will discuss is proper equipment grounding. I have found that improper grounding leads to noisy recordings, excess LORAN pick-up and sometimes equipment upset caused by static discharge. I use a driven ground rod that I planted at my site and left there. The ground stake is an Aluminum bar 2 inches wide and 0.25 thick by 3 feet long. I pointed one end to make it easy to drive into the ground and drilled a hole in the top to attach a cable. I interconnect the ground stake, VLF-3, recorder, and WWV receiver with copper braid that has lugs soldered to it at the proper places. I connect the ground strap to the VLF-3 using its ground terminal, connect the braid to the WWV receiver's outer shell of the antenna BNC connector using an alligator clip, and connect to the recorder case using a handy screw that holds the case together (the Marantz has a metal case).

When I power the VLF-3 from an external battery, I also connect the battery negative to the common ground. Note, before you do this, you need to test for possible current loops. Interconnect all three units with shielded audio cables, turn everything on and then test for voltage differences between the VLF-3 ground terminal, the recorder case and the BNC connector shell on the WWV receiver. There should not be a voltage difference. If there is, then either replace the offending item or investigate and fix the problem before proceeding. If no voltage differences exist, there is no need to repeat this test again and the ground cable can be safely connected.

Antenna Lead-in

The VLF-3 has a BNC connector that can be used for testing the receiver and to connect the antenna to the radio using coax cable. A word of warning is necessary here. The input impedance of the BNC connector is NOT 50 Ohms as one might expect but is high impedance, on the order of megohms.

If a coax cable is connected to the BNC jack, then receiver sensitivity can be decreased. This is caused by two factors. First, coax has capacitance to ground and the longer the cable the larger the capacitance. For instance, common RG-59 cable has 21 PF per foot capacitance. This capacitance is in parallel with the input of the receiver and forms a capacitative voltage divider. The end result is that a frequency dependent voltage divider is formed that attenuates higher frequencies more than lower frequencies. The second factor is that the characteristic impedance of cable is normally low, 50 or 75 Ohms. This means that the cable will cause a mismatch, which attenuates all the signals going to the receiver.

The above is not all bad. I have used the above effects to reduce LORAN interference, although it requires experimenting with the length of the cable to achieve LORAN suppression with minimal natural radio signal attenuation.

The BNC connector on the receiver can be used to test the receiver with a signal generator, but not without some major modifications. The main problem is the plastic case of the receiver. It allows just too much 60-cycle pick up when the receiver is operated on a workbench in a lab. I significantly reduced the pick up by remounting the receiver in a tight fitting metal box. After the metal box is fitted, the input impedance of the receiver still needs to be considered. I use a purpose built adapter to convert the radio high impedance to 50 Ohms for connection to a signal generator. The device was made by HP and is called a dummy antenna. It consists of a small metal box with a BNC connector on each end. The connector for the signal generator has a 50-Ohm resistor to ground and a small capacitor connects between the two connectors.

Most users of the VLF-3 probably do not need to remount the receiver in a metal case unless they intend to experiment with it near AC power lines.

Antenna Attenuator

The VLF-3 has a slide switch near the antenna connector that can be used to attenuate all signals into the receiver. The switch also adds a small capacitor between the antenna connector and ground thus reducing the high frequency response of the receiver. This attenuator is very helpful in reducing or eliminating intermodulation interference and overload caused by strong near-by transmitters. I find the attenuator to be very effective at eliminating LORAN interference. However, the attenuator places a large resistor in series with the antenna and this causes additional random noise to be generated in the receiver. This effect is easy to observe. Simply disconnect the antenna from the receiver and listen to the output with and without the attenuator in the circuit. This extra noise decreases receiver sensitivity some but for me, it is an acceptable trade-off to get rid of LORAN interference.

VLF-3 External Battery Connector

The receiver has a connector to allow the use of an external battery. I find this feature very helpful. By using an external battery, I do not have to disassemble the radio case to install or change batteries. I do not install the internal battery and use the external battery exclusively. I constructed a 9 VDC battery pack by using two Radio Shack 9V transistor battery holders wired in parallel and fitted with the appropriate plug for the radio. The two parallel batteries will last a long time and can be easily changed if necessary.

I have also experimented with a 12 VDC Lead-Acid Gel Cell (RS part number 23-289). The 12-volt battery works fine and also provides slightly more gain in the receiver than does the 9-volt battery. However, I prefer the 9-volt battery pack described above, that way I don't have to worry about recharging the Gel Cell.

Data Level Control

The data level control on the receiver is connected after the last stage of amplification and filtering, its wiper contact goes directly to the data output jack. This means that this control can in no way effect the receiver output signal-to-noise ratio. It can only impact bleed-through and intermodulation products if they are substantially weaker than the desired signals.
In most cases I find that adjusting the data level has no impact on my major undesired signal (e.g. LORAN). I just set it at near maximum and then use the recorder gain control to produce an acceptable level into the recorder.

Last summer I did have occasion to use the data level control in a beneficial fashion. I was monitoring from a site other than my normal place (roads were too muddy to get to my quiet site) and was experiencing AM broadcast station bleed-through. I found that by adjusting the data level control and the recorder gain control, I could eliminate the AM station and not degrade the natural radio signals. I decreased the receiver's data output level using the data level control until the AM station was no longer audible and then increased the recorder gain until I reached a level suitable for recording.

Receiver Over Heating

At my quiet monitoring location, my equipment is normally fully exposed to the sun and subject to solar thermal loading. Daytime temperature for about 5 months of the year will usually exceed 90 degrees and for one or two months will often exceed 100 degrees. I have observed what appears to be overheating of the VLF-3 under theses conditions. This is not unique to the VLF-3; I have observed the same effect with two different VLF-2 receivers. Basically, as the receiver heats up, a point will be reached at which the output level of the receiver starts to decrease, slowly at first then very rapidly. The first time this occurred, I thought that the receiver battery had failed. I replaced the battery with a new one and turned the radio on again. The output went from max to zero in under a minute.

I found a work around to the thermal problem. I simply placed the receiver in a soft-sided plastic drink cooler and closed its lid to keep the sun off the radio. While using this expedient during summer daytime monitoring, I never experienced overheating again.

Dust and Sand

One of the disadvantages of living in the desert is the constant battle with blowing sand and airborne dust. When setting up sensitive equipment in the open in the desert, one has to address this issue. I only monitor when it is calm or only slight breezes are blowing. If the wind picks up or a sand storm starts, then I pack up my gear and go home. Even on calm days, after two or three hours in the open, if one were to rub the surface of the operating table with their hand and examine it, a layer of fine dust would be evident. This dust tends to get inside of everything. I use rubber bands and thin plastic wrap (the kind used to cover food) to cover the speaker grill and any other openings on my radios. After a session in the desert, I always carefully clean all my equipment.

The recorder is a special problem. The dust and fine sand are murder on moving mechanical parts. When I bought the recorder I also purchased the custom case that goes with it and I always leave the case on the recorder when out in the desert. During operation, I keep a terry cloth towel over the recorder to provide extra protection. Even with these precautions, I have had to send the recorder back to the factory for repair due to sand damage.

I also keep all tapes in zip lock plastic bags for protection and keep them out of the sun in a dark plastic storage box. I found out the hard way that the plastic cases of the cassette tape would be damaged by exposure to the sun.

The VLF-3 Receiver and

VLF Listening in General

Notes and Comments

Shawn Korgan
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INSPIRE Team I-01

Many have worked long and hard on the design of a new VLF receiver for the INSPIRE project. Foremost would be John Kohus (the kit designer), along with Bill Taylor and Bill Pine. I was fortunate (along with several other INSPIRE participants, in particular Bob Bennett) to be part of the design and testing phase of the VLF-3 receiver.

In designing the new receiver, we have attempted to take every type of user into consideration. Due to the simple fact that INSPIRE receivers are most commonly used with short, vertical E-field antennas, we decided that the sensitivity of the new receiver could be improved for this type of user.

Several improvements have been introduced to the front-end circuitry to eliminate as much of the unwanted thermal noise as possible and to greatly improve performance and sensitivity to natural VLF radio signals. These changes will easily allow activity to be monitored that was not capable of being received on previous INSPIRE receivers with the same antenna.

The increased sensitivity of the VLF-3 receiver may make it slightly more prone to overload and out of band interference for long wire antenna users. For this reason, we have selected to also include a new feature on the VLF-3 receiver. This new feature is a simple filter which can be engaged or disengaged by the flip of a switch. If overload or interference is experienced, a person has simply to flip on the filter to eliminate it!

While on the discussion of antenna types, this is a good time to discuss the two main types of E-field antennas. The first type of antenna is the short, vertical whip antenna (generally 1-3 meters in length). The second type of antenna is the long wire antenna.

Over the course of the past several years, I have spent a considerable amount of time listening to VLF and testing different antenna types. I have used everything from a 1500' long wire antenna atop a 12,000' mountain, to a 100' vertical antenna lifted by a helium balloon, to a couple of simple 8' antennas on the prairies of northeastern Colorado.

What I have discovered over this course of time is that a simple 8' vertical antenna can work just as well as a long wire antenna when a receiver is designed to be extra sensitive! This was the plan and purpose for designing the VLF-3 receiver with greatly improved sensitivity.

What comes to mind when you visualize a "long wire antenna?" All too often, the imagination visualizes a long wire laid horizontally along the ground or slightly above the ground, or perhaps a long wire strung across the tops of short trees or bushes. Rarely if ever does the thought of a long wire antenna trigger the thought of a "vertical" antenna stretching toward the sky. I bring this up for one simple reason and that is the fact that long wire "vertical" antennas provide much greater signal strength over the conventional long wire "horizontal" antennas.

In fact, I have found that a 50' long wire "vertical" antenna provides about the same amount of signal as a 1000' long wire "horizontal" antenna. A simple 8' "vertical" antenna provides about the same amount of signal as does a 100' "horizontal" antenna.

When it comes to antenna length, after all experiments have been done, I have come to the simple conclusion that the longest antenna, either vertical or horizontal, that a person needs on a VLF receiver is the one that is just long enough to provide the cleanest sounding signal without overloading the receiver with unwanted interference. For long wire antenna users, this may mean either lengthening or shortening the antenna to achieve the best possible reception.

On very sensitive receivers (such as the VLF-3), a shorter antenna will accomplish what only a longer antenna would be capable of accomplishing on less sensitive VLF receivers. This brings to light the fact that the more sensitive a person can make a receiver, the less antenna length will be required to hear the same great activity! Down this same line of thought, the worst VLF receiver that comes to mind would likely be an ordinary speaker from a home stereo system. A simple 8-ohm speaker would require hundreds of miles of wire to begin to receive the signals that can easily be monitored on the VLF-3 receiver with just a simple, short vertical antenna. Whistlers were actually first heard on telegraph lines without amplification! In summary, the least sensitive receivers will require the longest antenna lengths and the most sensitive receivers will require the shortest antenna lengths to accomplish the same results.

When it comes to which antenna receives the least amount of power line interference, I have yet to fully answer this question in my own mind. This will be at least somewhat dependent upon the particular recording location and antenna orientation. A long wire horizontal antenna should be laid out so as to minimize power line interference. This will require running the antenna perpendicular (instead of parallel) to the nearest power lines. The wave electric field of the power line interference will be parallel to the power line, so orienting the antenna perpendicular will induce the smallest amount of signal into the antenna.

Vertical antennas are perpendicular to the electric field of power line interference, since power lines are primarily horizontal. This should theoretically help prevent vertical antennas from receiving power line interference and may also give them the leading edge over long wire horizontal antennas, at least when it comes to receiving the least amount of power line interference.

I personally have chosen to use either two or four 8' vertical whip antennas (electrically tied together) when I monitor VLF activity. I have found this type of setup to be the simplest and best system overall for monitoring VLF. My setup utilizes two 8' antennas mounted on the rear bumper of my car and the capability of adding two additional 8' antennas on the front bumper of my car when deemed necessary. Why four antennas? One antenna works great, but two work better. And again, two work great, but four work even better. Beyond four 8' vertical antennas, I did not notice anything in the way of improvement to natural VLF signal strengths. The only thing that was improving beyond four 8' antennas was interference!

The increased sensitivity of the VLF-3 receiver will allow it to receive everything with greater strength. This will include whistlers, chorus, tweeks, sferics and, yes, power lines, too!

While trying the new VLF-3 receiver for the first time, try this simple test. Switch the filter off and on. This will not only turn the filter off and on but it will also give a rough idea between the difference in receiving capabilities between the VLF-2/RS-4 receivers (filter on) and the VLF-3 receiver (filter off). I'm sure everyone will easily notice the great improvement in sensitivity that the VLF-3 receiver has to offer. This will especially apply to short, vertical antenna users! From the above experiment, it will be noticed that what is really occurring is that a lot of the remaining noise (what is termed "thermal noise" in electronic design) is being eliminated from the VLF signal. By eliminating this noise, a lot more signal will be received in the way of fascinating VLF activity!

Another point of interest to many VLF listeners is the selection of a listening location. Here are three points to keep in mind when choosing a listening location for E-field receivers such as the VLF-3 receiver: 1.) Try to locate a listening spot as far as possible from power lines. (This will not only reduce the amount of power line interference received but will also increase reception of weak natural VLF signals). 2.) Try to select a site that is as high as possible above the surrounding terrain. An example may be the top of a tall hill or a mountain top. 3.) And finally, try to avoid setting up a listening site near trees, buildings, other nearby structures or busy roadways. These will all reduce the reception of natural VLF signals.

The VLF-3 receiver is truly an amazing piece of electronic design. It has been the goal of all connected with designing the latest INSPIRE receiver to make a receiver that would clearly outperform previous receivers and one that would also be very versatile for users of both short whip antennas and long wire antennas.

Enjoy!

Trees as Antennas

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The article in the November 2002 issue of Inspire entitled, "A Natural VLF Antenna" by Shawn Korgan reminded me of some experimenting with the idea that I did in the mid 70's. What sparked the interest in the idea was the work that was done by the U.S. Army during the Vietnam War. I still have four of the reports that were published on the topic. The reports were released to the public from the United States Army Electronics Command (ECOM), and are listed below.

1. "The Effects of Foliation on Transmission from a Toroid-coupled Tree", ECOM Report No. 3473, September 1971

2. "Signal Propagation at 400 kHz using an Oak Tree with a HEMAC as an Antenna", ECOM Report No. 3504, November 1971

3. "Performance of Trees as Radio Antennas in Tropical Jungle Forests", ECOM Report No. 3534, February 1972

4. "Utilization as RF-Antennas of Live and of Lifeless Structures in Natural and in Man Made Jungles", ECOM Report No. 4133, June 1973

It is worth noting that the Army found that the trees seemed to be less sensitive to static than a vertical whip, so the signal to noise ratio might be favorable even if the signal was not higher amplitude. Also, Report #4 above concluded that a lifeless structure (telephone pole for instance) was generally superior in signal level to a live tree or the military whip antenna. Most of us would probably never have thought to try a pole.

If you want to experiment with these structures, for use say on the ham bands, you might plan on putting some effort into some sort of matching network. The Army used a toroid wrapped around the tree with some success. This technique is worth trying if you want to transmit from the tree. If you just want to receive VLF, the problem should not be quite so difficult. The tree or telephone pole looks like a pure reactance at low frequencies so don't worry about matching to the normal 50 ohm impedance. For receive you might try a movable tap (move the nail up and down the tree) and a differential capacitor network coupling the tree to a very high impedance receiver, like the VLF-3. Be careful that you do not drive a copper or copper plated nail into a tree and leave it there, it may kill your tree. A stainless screw about 3 inches long would be a better choice. As I recall, that sort of configuration seemed to work quite well. I used a tunable Krohnite high pass/low pass filter and a good preamp designed for piezoelectric phono cartridges as a VLF receiver with some success. I would combine any system with the grounding advice given by Shawn Korgan. I hope anyone who tries trees and poles will report what they did and the results they got to the group. As I recall, there were more reports on this topic issued by ECOM. Does anyone have them?

Hessdalen 2002 Embla Mission: The I.C.P.H. Radio Experience.

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Abstract.

The third I.C.P.H. (Italian Committee for Project Hessdalen) Hessdalen Mission, within the EMBLA Project, has produced interesting data to analyse in the VLF/ELF radio waves fields and beyond. As stated in the 2001 SCEB hypothesis, we give our data and hypothesis to be validated or not to the international scientific community involved in the Hessdalen and research on similar phenomena.

Riassunto.

La terza Missione a Hessdalen (Norvegia), organizzata con il contributo del Comitato Italiano per il Progetto Hessdalen (CIPH), si è svolta nel corso della scorsa estate, all'interno di EMBLA 2002, un progetto congiunto fra ricercatori italiani del CNR/IRA, Radio Osservatorio di Medicina (Bologna), e norvegesi dell'Østfold College di Sarpsborg. Nella ricerca svolta nel campo radio VLF/ELF (Very Low Frequency, Extremely Low Frequency), si trattava in particolare di verificare l'ipotesi affiorata lo scorso anno e relativa alla rilevazione per via indiretta delle SCEB (Self Contained Energy Bag) - (2) - sacche di energia entrocontenuta che si suppone possa essere una sorta di proto-Hessdalen Phenomena, non visibile ai nostri occhi ma in grado di influenzare il campo elettro-magnetico locale. Allo stesso tempo si trattava di meglio determinare il sistema di acquizione dei dati radio-atmosferici e la sua localizzazione geografica, allo scopo di aumentare il numero dei dati da analizzare, nei mesi a venire, anche con l'ausilio di un sistema di trasmissione dati via Internet, in relazione ai fenomeni luminosi che si hanno nella bassa atmosfera di Hessdalen (Norvegia centro-meridionale). Come nel report della scorsa Missione, i nostri dati e le nostre proposte sono messe a disposizione della comunità scientifica internazionale.

Since 1999 VLF (Very Low Frequency) radio waves research has been part of the Project Hessdalen, in order to contribute to shedding a light on the Phenomena (4). In summer 2000, researchers, engineers and technicians from the Radio Observatory at Medicina (near Bologna, Italy) set up the very first VLF/ELF (Extremely Low Frequency) base station in the Hessdalen Valley (1).

This was for studying the many natural phenomena arising in the Earth's atmosphere, that can be detected in the radio field even if apparently not connected with low radio frequency. We want to sample the natural electromagnetic noise in the local ELF/VLF field, in order to understand what may be defined as "normal situation" to determine any kind of change that may arise when Hessdalen Phenomena appear (2a).

In 2001, the second VLF Mission in the Valley gave us a hypothesis to be validated: to see if VLF field research may help in order to detect optically invisible "energy bags" flying very close to our antenna, disturbing the very local electromagnetic field, the so called SCEB (Self Contained Energy Bags) hypothesis (2). In order to better evaluate data recorded during the 2000 and 2001 VLF Missions, ICPH (Italian Committee for Project Hessdalen) organized a 2002 Mission joining the Optical and the Physical components (The EMBLA 2002 Mission) (3). During the 2001 Mission analysis, a main part was about the SCEB hypothesis and the way to detect them. The very important point is to check out that hypothesis at the moment the Hessdalen Phenomena might turn visible (from SCEB status breaking the "bag" and releasing its energy in the visible field). This condition is not so easy to verify: we need optical instruments as well as ELF/VLF receivers detecting the same phenomena in the same time at a very short distance from our VLF antenna. We suppose that ELF/VLF antennas have to be very close to the phenomena in order to observe any possibly small influence or perturbation that may be created in the background natural VLF/ELF electromagnetic noise by SCEB.

As stated in the 2001 Report, the ELF/VLF receiver (ELFO) made by Electronic Engineers at Radio Observatory at CNR Medicina, was working inside the BluBox, where are stored optics instruments as well as computers working with the optical tools.

During the 2002 Mission a strong 3.5 kHz noise was recorded in the ELFO received emissions, likely due to local manmade noise conditions. In order to determine which kind of noise we are experiencing, ELFO is now at Medicina Observatory to be carefully tested.

As a very first attempt to sample the 2002 summer valley ELF/VLF condition in various geographical sites, the very portable WR3 receiver and its whip antenna were used. Recording places were Aspaskjolen (63° 78' North-11°17' East), Mr. Peder Skogaas' summer farm (62.72078 North and 11.00015 East) and the vicinity of the BluBox (a few hundred meters south from Aspaskjolen). Inside the BluBox we experienced a very high noise level, enough to invalidate VLF recording. WR3 worked well below 12 kHz, though a strong noise around 18 kHz did create noise in a vertical way, down to few kHz. It was likely due to the antenna/laptop display connection. Moreover, the BluBox is sited quite close to light power lines. During the 2002 Mission, these power lines were strong enough to put a lot of manmade noise in our recorded files. The Hessdalen Valley is a remote area (5) where you can find places without the 50 Hz noise, though you'll get another problem: how to provide power to use our tools for long periods.

Though much harder to find out, still during the 2002 Mission, the spectrogram frequencies free from noise were enough to analyze data, comparing them with the ones recorded during the 2001 Mission (2 and 5). In the spectrograms for both years we found Doppler perturbation (fuzzy emissions) that did lead us to elaborate the so called SCEB (Self Contained Energy Bags) hypothesis and the way to detect them, as before reported (2). We did not experience any Hessdalen Phenomena during our VLF recording sessions, at least not close enough to our antennas to discover any connection between radio waves and optical phenomena.

Regarding the field operations, during the 2002 Mission we recorded about 500 Mb in our laptop in addition to contacting a small group of people having personal sightings of the phenomena (7). In our opinion, they gave us a lot of reliable information. These reports drove us to think about a VLF/ELF receiving station as close as possible to the Hessdalen stream Hesja, running down from the Aspaskjolen to the Oyungen lake, flowing close to the school where we lived during our summer stay there. As already reported, such a stream flows both above and below the ground surface, likely bringing to the open air some minerals and, I guess, gases usually staying well below the ground surface. In order to better establish the Hessdalen Valley low frequency electromagnetic conditions, we'd like to investigate in a global way, as a primary project. though secondary projects still under development may be used.

The Next VLF/ELF Mission.

As a Primary Project we should establish 4 VLF receiving stations following the Hesja stream and very close to its waters: two at ground level (Aspaskjiolen in the north and the school site in the south) and two on flying balloons, just over the ground stations, say 500 meters high from the ground surface at open air. Each station has to have (beside the VLF receiving system) a VHF radio, in order to transmit data to the master station. Each station has to send its data, a total of 4 channels, to the master station for later analysis. If we can relocate the BluBox to a higher geographical and quieter position (farther from the 50 Hz beacon noise), we could observe through the video and still cameras mounted on the BluBox, all the stream area under observation by the radio receivers. This would be a very good condition to investigate the Hessdalen Phenomena, even in the infrared field.

Secondary projects may use one station, likely sited around the middle position between Aspaskjolen and the School. Being a remote location, its data must be sent to a master station anyway, where we could store instruments and data for analysis.

Leaving for a while the VLF radio field, I will give a very short report about a very interesting instrument created and operated by Eng Stelio Montebugnoli, Head of I.R.A. Medicina Radio Observatory: a radar working in a frequency of 400 MHz (6). During his two weeks of field research in the valley, Eng. Montebugnoli's radar detected some interesting "objects" that apparently (being invisible) were flying in the valley at low altitude, at various distances, even beyond 10 kilometers away. Could those spikes in the display instrument be caused by SCEBs?

In order to better evaluate this possibility as well as use each instrument in its best way, we now propose to establish a joint experiment during the next Mission: while one station (say VLF/ELF) will stay in a given site, the Radar instrument will be at least 400 meters away, to take advantage of its own characteristics (radar operates beyond 400m). Likely the best position for radar will be the Aspaskjolen site that permits it to "see" a wide open landscape, while the VLF/ELF Station will operate around a middle site position between Aspaskjolen and the school, though at a site visible to the radar. In this way we'll take all the opportunities to determine if VLF/ELF Station can detect locally the same phenomena that Radar Station will detect at a given distance. This is not an easy evaluation to perform when the two Stations operate from the same place.

During the 2001 Mission I asked Valley inhabitants if any kind of radio or TV interference coming from the presence of HP had been reported by the inhabitants. No one was. In the 2001/2002 winter something has changed and one evening one resident reported a sharp interference during a TV transmission, when an HP did fly between the transmitter and his antenna just over his house. Such interference was not confirmed by the man living in the house close to the first one and listening to a medium wavelength radio transmission. It is important to underline that the TV witness was watching a satellite emission, likely around 11 GHz. This statement should give importance to another research field to better validate the report: the TV satellite broadcasting frequency range. One more research field to monitor the Hessdalen Phenomena may arise with the field experience. Montebugnoli's radar, with a different receiving system, may permit one more look at the lower atmosphere even at that high frequency. In this case we could get radio waves in three different radio ranges, ELF/VLF, 400 MHz and 11 GHz in order to observe different views of the same phenomena: SCEBs and HP.

It should be an important target for the 2003 Embla Mission: three radio wave views of a phenomena in the same time. It will give us more data to analyse and, maybe, correlate. It should be a step towards understanding the Hessdalen Phenomena.

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Aknowledgements.

I'd like to thank all the people who helped me to be in the Hessdalen Valley as well as the ones who spent their time to discuss my hypothesis. Here they are:
Renzo Cabassi and ICPH/CIPH (Italian Committee for Project Hessdalen or Comitato Italiano per il Progetto Hessdalen), for their friendship, assistance and financial support to let me be in Hessdalen;
Matteo Leone a very friendly mate and great field researcher;
Stelio Montebugnoli for his great radar instruments and very precious advice and help;
Gloria Nobili and Massimo Teodorani for their scientific discussion and advice;
Marsha Adams of Times Research Inc., a great researcher, involved in a lot of fields: VLF, chemical, optics and radon;
Erling Strand, leader of Project Hessdalen, for the information he gave me during my days in the valley;
Marco Poloni, Nicoletta Laschi, Bjorn Gitle Hauge, Simona Righini and Andrea Orlati for scientific conversations at the school;
Dennis Gallagher from NASA Marshall Space Flight Center for his scientific advice;
William Taylor and William Pine from the NASA-INSPIRE Project, Goddard Space Flight Center for their scientific assistance during data analysis;
Stanislav Klimov, I.K.I., Russian Space Research Institute, for his scientific advice;
The Skogaas family for their lovely friendship and important help to coordinate our work with the inhabitants, a very important item;
Jonathan Tisdall AFTENPOSTEN daily Journalist, for his help in finding out news about the Valley and Norway;
Ellin Brattas with her husband Birger and Bjiorne Lillevold with his wife Hallfrid, Ruth Mary Moe and her daughter Randi, Hessdalen Valley residents, for giving us so much information about lights in the Valley and how inhabitants feel about them, even in previous times.

All the Norwegian people greeting us during our time in the valley.

Hessdalen 2002: Electron Connections

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Abstract.

Hessdalen Phenomena (HP) is recognised as a sort of enigma, since it has usually shown a very particular behavior, apparently with no possible connection with other known physical phenomena. This was since 1984, when Norwegian Researcher Erling Strand began his scientific research in the Hessdalen Valley (15). Now we are analyzing a possible data connection: in the northern hemisphere around the winter solstice we have higher electron density in the plasmasphere (7) and, at the same time, higher HP sightings reported by witnesses (1a). Around the summer solstice we have the lower electron density in the higher ionosphere (7) as well as fewer Hessdalen lights reported. Is this electron density change playing an important role in the so called HP?

Some very powerful man-made radio wave injections in the atmosphere near Hessdalen are reported in order to evaluate if and how such emissions may play any role (though unexpected) in the triggering of the Phenomena, even during the low electron density season. Powerful radio injections might add energy to the atmosphere in order to trigger such phenomena. Reported times of the radio experiments appear to be in the 1980s and 1990s. This is just the time HP became known worldwide because the number of sightings reached its higher value.

Whatever HP and its origin may be, it seems that electron density in the Earth ionosphere, as well as its fluctuations in short times, has something to share with it and its triggering cause, to turn SCEBs (2) into the optical phenomena we are investigating.

It is known that very low frequency (VLF) waves, which have frequencies in the radio range from 3 to 30 kHz, are emitted, among other sources, by natural phenomena both earth- and space-based connected through the atmosphere and by very powerful man-made VLF transmitters. In the last twenty years arose the capability to generate VLF/ELF waves using powerful ground-based HF (High Frequency) radar. This is to modulate the intense auroral electroject currents that flow in the D and E ionospheric regions, causing natural currents to radiate ELF/VLF waves from an altitude range of 70-100 kilometers, though these altitude are strictly depending upon the HF frequency used (6). A number of such experiments were carried out near the Norwegian town of Tromsø, around 700 kilometers northwest from the Hessdalen Valley, during the 1980s and 1990s and later years (6a).

Below we list the most important features of these experiments, as shown in the PARS Project article by Inan and Bell at Star Lab, Stanford University (6a):

1) The Tromsø HF ionospheric heating facility successfully produced electromagnetic waves in the 200 Hz to 6.5 kHz frequency range with an amplitude of approximately 1 pT as measured on the ground. The ELF/VLF wave amplitude was roughly constant between 2–6 kHz, but dropped by 3 dB at the lower end of the frequency range.

2) The HF heater frequency generally lay within the three frequency bands: 2.75 - 4 MHz, 3.85 - 5.6 MHz, and 5.5 - 8 MHz, and the HF signal was generally 100% amplitude modulated with a square wave.

3) The HF radiated power was approximately 1 MW, and the effective radiated power (ERP) generally lay in the range of 200 to 300 MW.

4) It was generally found that X-mode polarization of the HF signal resulted in a more intense radiated ELF/VLF signal than O-mode polarization.

5) The ELF/VLF signal strength was highly correlated with magnetic activity and significantly more intense ELF/VLF waves were produced during periods of moderate geomagnetic disturbance with Kp~ 3.

6) The amplitude of the ELF waves was essentially independent of the ERP of the HF signal, but depended only on the total HF power delivered to the ionosphere.

7) The ratio of heating to cooling time constants ranged from 1 at 510 Hz to 0.3 at 6 kHz.

The Tromsø facility was also used to excite ULF waves in the 1.67 - 700 mHz frequency range [Stubbe and Kopka, 1981; Stubbe et al., 1985; Maul et al., 1990]. A variety of HF modulation schemes were attempted. The amplitude of the excited ULF waves were of the order of 100 - 10,000 pT (6a).

Once the VLF waves are sent out, they travel up through the ionosphere to the Earth's magnetosphere. Because of this disturbance, they cause many natural emissions such as whistlers, which are waves in the audio range. The electrons caught in the whistlers spiral along the lines of force in the Earth's magnetic field until they reach the opposite hemisphere, at the magnetic conjugate point. When they reach the magnetic pole and hit the Earth's atmosphere, they precipitate into the atmosphere. This phenomenon of electron precipitation is similar to what causes the aurora borealis or Northern Lights.

Physical Data Analogies.

Northern Lights are an astonishing natural phenomena, showing a number of colors in the atmosphere, at about the same geographical and magnetical coordinates as the Hessdalen Valley, worldwide. But we are experiencing Hessdalen Phenomena only in that Norwegian area. Moreover Northern Lights appear to be slow motion or even an almost stationary phenomena, compared to the very fast changing and moving Hessdalen Lights. Even though the Northern Lights are very different phenomena from the Hessdalen Lights, they may have composition or triggering causes in common.

In this perspective we should take in account the ongoing influence of a high speed solar wind stream, the I.M.F., in order to understand the magnetic field based influence in the Hessdalen area.

Following information from the Valley as well as statistical studies (1a), data from observations in the Hessdalen Valley refer to a fall-winter time as the higher sightings season (the months around the Winter Solstice). In particular it seems that October to February is the most important sightings season, while June to July, and maybe first week of August too, is the minor one (the months around the Summer Solstice). It also may be due to the most dark and light seasons through the year in that northern region (15). In addition to these two periods, the reported peak time during the day, around midnight (1-1a-3-15), correlates well with electron density through the seasons in the ionospheric F-layer and beyond in the plasmasphere.

In the October-March season, according the reported sources, we measure the highest electron density per cubic meter with a peak in the beginning of January. In the June to July season we experienced the lowest density rate.

These data did appear since the observations of R.A. Helliwell at Stanford University in the '60s (7) as shown in various sources (9-14-16), though it is not possible to collect electronic density data over just the Hessdalen area, since there is no observatory in the Valley. For this reason we have used the Ny Alesund Observatory. Though it is far North from Hessdalen (11.8700 East; 78.9200 North), it is the only Norwegian Electron Observatory available to provide this data. Though the F-layer is the highest ionospheric region and the plasmasphere is even higher, a strong electric field builds up on the ground whose polarity is most often such that it pushes the F-layer aside allowing energetic electrons from the higher ionospheric layers to penetrate to lower levels. This may be connected with the very high electricity reported in the very low atmosphere, during all the EMBLA Missions (1–2 and 2b), as well as L.E.P. phenomena (11-12) and, on the other hand, the whistler propagation path (7), reaching the lower atmospheric layers and the ground itself. Electrical ducts can actually push particles downward as well.

In the PARS Project, Authors Inan and Bell (StarLab at Stanford University) proposing possible accompanying ionospheric effects due to induced precipitation of energetic electrons, generated by HAARP HF emissions, able to stimulate ELF/VLF signals as well as such ionospheric effects (6a). Though it is unexpected to do so, manmade activity may excite the needed overall condition in ionosphere and atmosphere to get the condition usually created by nature, to induce higher electron temperature and precipitation of energetic electrons toward the lower ionospheric as well as atmospheric layers.

This situation may induce electron fluctuations, able to produce a favorable condition to trigger optical phenomena in the low atmosphere, breaking SCEBs, with no (or partial) need of natural seasonal connections.

Electron Density Hypothesis:

Final Remarks.

As I stated earlier, information from the Valley inhabitants leads us to consider the possibilities that Hessdalen Phenomena tend to appear most during the fall-winter season, while during summer we experience the fewest reports (1a). This may come from the long darkness of winter days as well as the long daylight of summer days, of course. Since this is strong statistical evidence, we should take care to determine if something may arise around the solstices (winter and summer).

For this purpose we can consider weather connections (temperature, pressure, humidity and connected electricity in the atmosphere) as it is done in many important papers from Russian scientists in the Ball Lighting (BL) theories (17 - 18). In some cases it seems that BL hypothesis shows good connections with the Hessdalen Phenomena.

Around the winter and summer solstices we are experiencing another interesting situation related to electron density. It may be important to take into account one more possibility: very powerful HF radio injections in the ionosphere from ground based stations. One of these is located at Trømso, a Norwegian town about 700 km north of the Hessdalen valley. This last factor may give an unexpected contribution to create the atmospheric condition (electron precipitation) able to trigger optical phenomena at various distances, depending the HF radio frequency used, even when the natural conditions are not the ideal ones. At the same time, powerful radio HF emissions are likely able to boost favourable natural conditions in order to increase electron temperature and precipitation to the lower ionospheric regions. Riometer measurement may give an important cross-reference in order to confirm this hypothesis, since cosmic natural noise from space should get higher after electrons missing the higher ionosphere layers. Since many worldwide stations are used to put very powerful radio emission in the ionosphere, this one may be a good way to understand the so called Hessdalen-like-Phenomena even in other world regions.

It is my will to propose a research path that appears to be promising though lacking very close Hessdalen Valley-based research. As in my previous work about this subject, I have used observations in the ionospheric electron field, worldwide, in order to better describe measured data from scientific observatories. These data are easily available through the Reference section at the end of my work. I use them for HP research purposes, asking for deeper research in this field, in order to give a new perspective to the Hessdalen Phenomena. Moreover I propose scientific and technical ways to realize my hypothesis through analysis of existing data.

A Point of View.

Using the reported (19) analogies, we'll speculate a little bit more, hypothesising that the phenomena triggering the Hessdalen Lights may be in some way connected to the electron density in the plasmasphere, down to lower atmosphere layers, through the reported means. We could maybe say that the SCEBs transforming to be visible is related to the electron quantity found along their path, as if the SCEB inner composition elements would break apart due to such high electron density.

The electron density (ED) as well as electron irregularities, or fluctuations, in the channel driving electrons down toward the very low atmosphere might trigger optical phenomena. High electron density or fast electron fluctuations may break SCEBs, providing energy for their optical phenomena and lights, as well as their apparent erratic movement that may be induced by following electronic currents in the lower atmosphere. Considering the highest or the lowest ED, SCEBs-then-lights-(HP) may vary direction and speed and acceleration, according the ED ratio between the area where they are at a given time and one of the closest areas reporting highest electron density. A particular ED ratio around a given area can give variation of direction towards the area reporting higher ED at that moment. Acceleration will change according with the ED ratio between the place where SCEBs/HP are on a given time and the closest one with highest ED (i.e. acceleration toward that area, as if highest Electron Density difference acts as an attraction machine for SCEB and/or HP). Even a 90° turn may be observable if the ED ratio offers favorable conditions (great attraction strength based upon very high density difference between contiguous areas) in that direction. On the other hand, an ED equilibrium on a given region (more contiguous areas), may give SCEB/HP slow motion (more or less depending on that ED balance and reduction in the region) or remaining stationary as long as this equilibrium persists. If no zone prevails, the SCEBs/HP may remain still until its energy will go shining and rolling down to the ground if and when gravitational forces will prevail.

Otherwise, lights will disappear in the air as soon as the mix is burned off (i.e. inside energy ends after the Self Contained Energy Bag is broken). On the other hand, one more electron channel coming from ionosphere may perturb our area, inducing SCEB/Light to re-start again with an acceleration according with the electron density difference between the old (almost zero) and the new area. This new electron duct should improve the HP brightness and its colors in a proportional way with the original particles still inside SCEB/HP.

Summing up: If one area on a given electronic current will prevail, we'll observe the light accelerate toward that direction with acceleration in close relationship to the ED ratio between the different currents in different directions.

The relationship is the one between the channel (with its electron density) where light exists at a given time and all adjacent channels (with their own electron density). Looking at Electron Density as HP fuel we can even say that when they exhaust the fuel in their vicinity, they drift toward regions with more.

Optical phenomena will move itself accordingly with electron fluctuation actually found in the areas where it will travel.

Confirming such a hypothesis may be possible using the technique of measuring the ED or Total Electron Content (TEC) per square-meter to monitor ionospheric irregularities in the Hessdalen region (around 63° 78' North-11°17' East). Anyway, until now, little data is available for ED or TEC in that specific area (16). Just TEC from Tromsø (69.6600 North - 18.9400 East) and Ny

Alesund (78.9200 North -11.8700 East) are available on a regular basis, though Tromsø public information has suffered severe discontinuities lately (16). More good information may arise from Riometer in the Scandinavian region, for the reported electrons missing in the higher ionosphere regions, by natural and manmade activity.

Research done in 1997 in the southern hemisphere by Yue-Jin Wang, P. Wilkinson and J. Caruana at IPS Radio and Space Services, gave interesting results. GPS satellites orbit with semi-synchronous periods, their position is repeated from one day to the next with roughly four minutes shift due to sidereal motion. In this way we can observe that the most severe phase TEC fluctuations occurred at a latitude approximately the same as the station (63°S Dip latitude), lasting for more than one hour (9).

That Latitude is in good accord with the Hessdalen one, though on the opposite hemisphere, and the time TEC phase fluctuations last may resemble some of the longer, in time, Hessdalen phenomena.

Southern data as well as northern data from Trømso (two radar frequency: 931 MHz and 2.800 Hz) (13) and Ny Alesund, Far Northern Norway, (16), seems to confirm that ED in higher quantity and Hessdalen Phenomena have something to share with the winter solstice.

It may be a starting point, since HP has always been a complex phenomena to investigate with useful comparisons with other physical events and data.

Now it seems we have a path to follow comparing data from ED, powerful manmade HF radar emission, SCEBs and HP. It is important to measure electron temperature and precipitation induced by very powerful emission from ground stations worldwide, Norway included. Transmitting stations may create the needed electron situation (temperature, precipitation, fluctuations and higher charge) for breaking SCEBs and triggering HP. Any season may be the right one, when powerful manmade emissions are working, though the more successful, are likely the ones done around the winter solstice. A joint activity: natural and manmade. But the very focal point should be Electron Density/SCEB relationship: is this the triggering subject?

Just food for thought.

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Aknowledgements.

Renzo Cabassi and ICPH/CIPH (Italian Commitee for Projetc Hessdalen or Comitato Italiano per il Progetto Hessdalen), for their friendship, assistance and financial support to let me be in Hessdalen;

Matteo Leone a very friendly mate and great on the field researcher;

Stelio Montebugnoli for his radar instrument and very precious advises;

Gloria Nobili and Massimo Teodorani for their scientific discussion and advises;

Marsha Adams of Times Research Inc., a great researcher, involved in a lot of fields: VLF, chemical, optics and radon;

Erling Strand, leader of Hessdalen Project, for the informations he gave me during my days in the valley and during data analysis.

Luciano Cianchi, Luigi Ciraolo and Paolo Moretti, all from CNR-IROE-Firenze; as well as Cesare Tagliabue, I5TGC; for their scientific support before and after my Hessdalen times;

Dennis Gallagher from NASA Marshall Space Flight Center for his scientific advises;

William Taylor and William Pine from NASA-INSPIRE Project, Goddard Space Flight Center for their scientifical assistance during data analysis;

Stanislav Klimov, I.K.I., Russian Space Research Institute, for his scientific advises;

Peder and Sig Skogaas for their lovely friendship and important help to coordinate our work with the inhabitants, a very important item;

Jonathan Tisdall AFTENPOSTEN daily Journalist, for his help in find out news about the valley and Norway;

Ellin and Birger Brattas, Bjiorne and Hallfrid Lillevold, Ruth Mary Moe with her daughter Randi, Hessdalen valley residents, for giving us so many informations about lights in the valley and how inhabitants feel about, even in the previous times.

All the Norwegian people greeting us during our time in the valley.

Coordinated Observation Schedule April 2003

By Bill Pine Ontario, CA

The Coordinated Observations for April/2003 will be held on April 26 and 27. All data is welcome and should be submitted even if the conditions are quiet. It is not required that you observe on both days. Any data you can contribute is valuable. The procedure to use for Coordinated Observations will be as follows:

1. Use the Data Cover Sheet and Data Log forms found at the end of the *Journal.* (Make copies as needed.)
2. Put a voice introduction at the start of each session indicating your name, your INSPIRE Team name (and number, if assigned), the date, local time and UT time.
3. Record for 12 minutes at the start of each hour that you can monitor on the specified days. Keep a detailed written log of all signals that you hear and indicate any items of interest. When you submit your tapes, spectrograms will be made of any parts of the tape that you indicate.
4. Place a time mark on the tape on the hour and each two minutes for the next 12 minutes. Use Coordinated Universal Time (UTC) for all time marks.
5. Record at 8 AM and 9 AM **LOCAL** time.
6. In addition, record on other hours to compare results with those in neighboring time zones. For example, an observer in the Central Time Zone might record at 7 AM (8 AM EDT), at 8 and 9 AM CDT and at 10 AM (9 AM MDT).
7. Use 60 minute tapes (30 minutes per side) with two sessions per side. It is preferred that you record on one side of the audio tape only.
8. Label all tapes and logs to indicate the sessions monitored and send to:

   Bill Pine
   Chaffey High School
   1245 N. Euclid Avenue
   Ontario, CA 91762

9. Your tapes will be returned with spectrograms of your data. An article reporting on the results will appear in the next *Journal.*
10. SPECIAL NOTE: If you are hearing whistlers, replace the data tape after 12 minutes with a "Whistler" tape and continue recording with time marks every two minutes. If we get whistlers, this would be a good opportunity to try to determine the "footprint" of a whistler (the "footprint" is the geographical area where a whistler can be detected).

Specified Coordinated Observation Dates for April/2003:

Saturday, April 26

Sunday, April 27

INSPIRE FIELD OBSERVERS

November/2002

New to the roster of observers is Bill Combs, Team S-7.

(Unless noted otherwise, all longitudes are West and latitudes are North.)

Team #	Observer	Location	Longitude/Latitude
S-1	Kathryn Robinson. O'Connor High School	Helotes, TX	98° 47' / 29° 35'
S-2	Mark Mueller Brown Deer High School	Brown Deer, WI	87° 56' / 43° 10'
S-3	Elizabeth Quick John Marshall High School	San Antonio, TX	98° 72' / 29° 54'
S-4	Bill Pine Chaffey High School	Ontario, CA	117° 41' / 34° 14'
S-5	Jim Hoback John Jay High School	San Antonio, TX	
S-6	Loren Lund La Salle High School	Union Gap, WA	120° 30' / 46° 33'
S-7	Bill Combs Crawfordsville High School	Crawfordsville, IN	86.9075° / 40.0219°
I-1	Shawn Korgan	Gilcrest, CO	104° 67' / 40° 22'
I-2	Linden Lundback	Watrous, Sask,	105° 22' / 51° 41'
I-3	Robert Bennett	Las Cruces, NM	106° 44' / 32° 36'
I-4	Mitchell Lee	San Jose, CA	120° 40' / 39° 16'

Report on Field Observations 5/2002-11/2002

By Bill Pine
Ontario, California

This report includes all observations made and submitted since the last issue of the Journal. All INSPIRE participants are encouraged to make observations and send their data tapes and logs in for analysis.

The guidelines for observations are:

1. Fill out a log cover sheet and data sheets for each observation.
2. Place a voice introduction on each tape indicating team, date and start time.
3. Insert a time mark every two minutes during the observations.
4. Submit the data as indicated on the Coordinated Observation page.

The observations in this report will be given in chronological order and will include the Coordinated Observation sessions. The convention for naming files is the following:

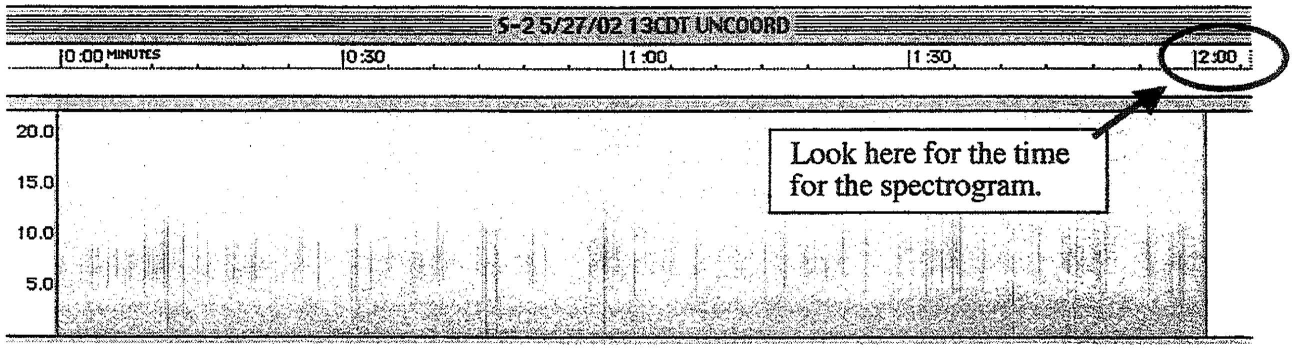
I-3 11/23/02 06CST 13UT

Team Number Date Start Time Local Start Time UT.

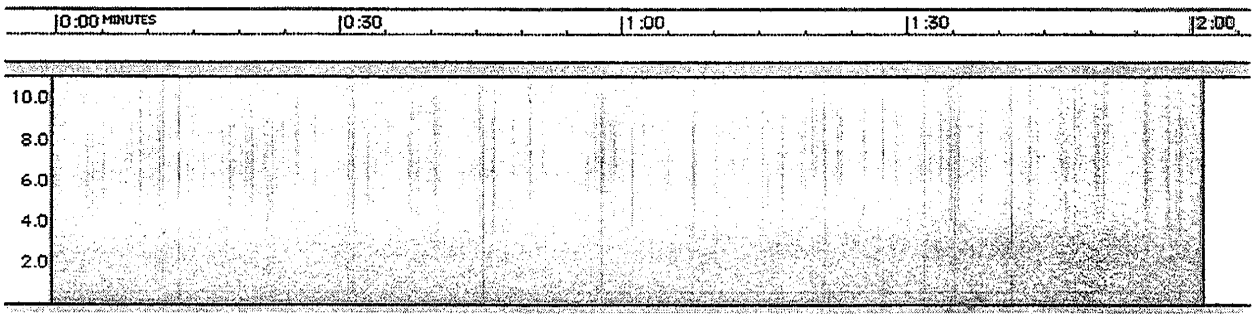
Spectrograms made for data analysis include the first 2 minutes 0-22 kHz range; the first 2 minutes 0-11 kHz range; the first minute 0-11 kHz range and the first 30 seconds 0-11 kHz range. Spectrograms are also made of any portions of the tape requested by the observer.

5/27/2002 Team S-2 Mark Mueller, Brown Deer High School, Brown Deer, WI

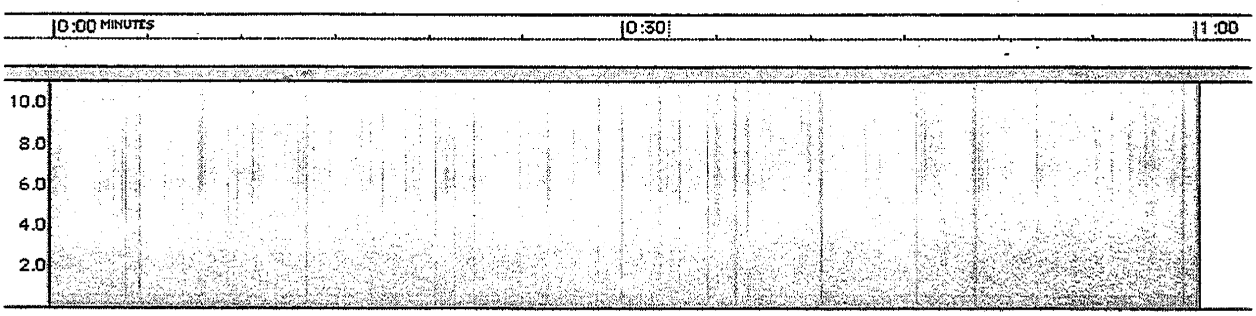
Starting off this report is an "uncoordinated observation" session from last May. This data was submitted before the last Journal, but the tapes were misplaced (perhaps in the vast INSPIRE archive storage area – my garage!). Mark is a long time contributor and this data consists of good quality signal with a very low 60 hertz hum level.

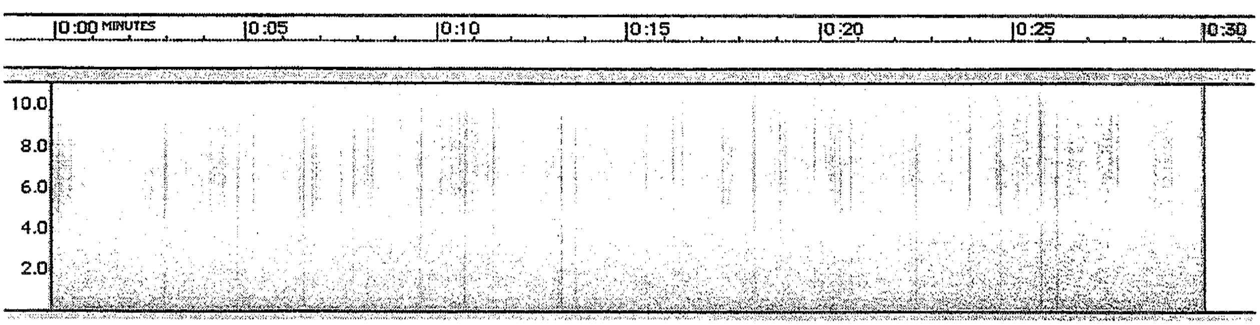


The two minutes starting at 1300 CDT. The vertical lines are strong sferics with medium density.



At 0-11 kHz, the sferics extend to the top of the display.





A density of about 2 strong sferics per second.