The INSPIRE Journal

Volume 10 Number 2

April 2002

The Newly Redesigned INSPIRE Receiver is Coming!

The design phase of the INSPIRE VLF3 receiver is nearing its end. This process has included input from our kit supplier John Kohus, veteran INSPIRE observers and INSPIRE organizers with suggestions about new features and effective ways to increase the performance of the receiver. Once the new design is finalized, the first 100 kits will be ordered. The price will be determined after the components are identified and priced. The availability of the new receiver will be publicized on the INSPIRE web site:

http://image.gsfc.nasa.gov/poetry/inspire

A description of the new receiver will appear in the next *Journal*.

In this issue Robert Bennett reports on his efforts to monitor the signals from the IMAGE satellite, Flavio Gori brings us up to date on his investigations of the "HessDalen Lights" of Norway and Jill Marshall describes how the INSPIRE receiver picks up AM radio stations.

Table of Contents

The INSPIRE Journal
Volume 10 Number 2
April 2002

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

Contributions to the *Journal* may be sent to:

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

email: pine@mail630.gsfc.nasa.gov
billpine@earthlink.net
Fax: 909 931 0392

UNCoordinated Observations are a Way to Participate!

Everyone is invited to participate in "uncoordinated observations" Unlike coordinated observations, which are scheduled as an opportunity for observers to record data at the same times, uncoordinated observations may be made at any time. Simply follow the instructions for time marks and logging found in the article on the April/2002 Coordinated Observations found on Page 4 of this issue of the *Journal* and send in your data tapes. You will receive spectrograms of your data and a commentary. A report will appear in the next edition of the *Journal*.

The INSPIRE VLF3 Receiver is STILL on its Way!

The redesign process is underway for the new VLF3. This will represent a major change in design and performance. The price of the VLF3 has not been established, so there is no way to order early. Watch the INSPIRE web site for an announcement, but it is not expected that the VLF3 will be ready before summer 2002.

INSPIRE VLF2 Receivers No Longer Available

Our supply of assembled VLF2 receivers has been exhausted and this product will no longer be offered. Our limited number of VLF2 kits will be all sold by the time you receive this *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 next November's 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.

Coordinated Observation Schedule
April 2002

By Bill Pine Ontario, CA

The Coordinated Observations for April/2002 will be held on April 27 and 28. 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/2002:

Saturday, April 27

Sunday, April 28

INSPIRE COORDINATED OBSERVERS

November/2001

New to the roster of observers is Mitchell Lee, Team I-1

(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	
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'

IMAGE Satellite VLF to Ground Propagation Experiment
Monitoring Results

Robert Bennett
Las Cruces, New Mexico
9 December 2001

PURPOSE This note summarizes my attempt to intercept the VLF to Ground transmissions from the IMAGE Satellite during the period 21 November to 4 December 2001. In this note, I briefly cover the background of the experiment, monitoring equipment set-up, data analysis techniques, and finally the results obtained.

BACKGROUND The background, purpose and the schedule of events for the experiments are well covered in an email message by Dr. Taylor from NASA dated 15 Nov 2001. Basically, the IMAGE Satellite carries the Radio Plasma Imager instrument capable of emitting radio signals in the VLF, LF, and HF frequency bands (3 kHz to 30 MHz). The instrument was turned on during the satellite's approach toward perigee. Two different experiments were conducted.

The first was the VLF satellite to ground tests. These occurred on every orbit, starting when the satellite crossed 50° North Latitude and continued until the satellite was four minutes from the South Pole. The transmission consisted of 0.125 seconds of transmitter-on then 0.375 seconds of transmitter-off. The first transmission was on 5 kHz, and each succeeding transmission 2 kHz higher in frequency. 12 seconds after the first transmission, the last one occurred on 15 kHz. This pattern repeated for approximately 35 minutes. The frequencies used were 5, 7, 9, 11,13, and 15 kHz.

The second experiment started when the satellite was four minutes from the South Pole and lasted until the satellite was four minutes past the South Pole. The same transmission on-off pattern was used and the transmission frequencies were 130 and 380 kHz.

BOTTOM LINE The overall results of my effort are disappointing. I do not believe that I detected any IMAGE transmissions. The IMAGE transmission could be on the tapes but below the noise level. If this is the case, then autocorrelation and cross correlation techniques will be required to pull the signal out of the noise. I plan to explore this when time permits.

EQUIPMENT SET-UP I attempted to intercept both the VLF and the LF transmissions over the South Pole. I used two different sets of equipment.

For the VLF transmissions, I operated from a relatively RF quite remote area on the Jornada Experimental Range about 20 miles northeast of my home. The experimental range is operated by the US Government and is used to study various desert conservation issues. The range is mostly devoid of houses, power lines, roads and other sources of radio noise. My receivers were the INSPIRE VLF-2 and the older RS-4. I recorded the receiver output on a stereo cassette recorder, placing the VLF signals on the left channel and a WWV time marker on the right. I used a 120-foot sloping long wire antenna for most of the missions. I attempted to orient the antenna toward the satellite ground track. On two of the missions, strong winds didn't permit me to erect the long wire so I used a six foot long vertical whip elevated about three feet above the ground.

I made three attempts to intercept the 130 and 380 kHz transmissions. For these, I operated from home and used two receivers, a Drake R-8 and a vintage RCA AR-88. I drove both receivers through a multicoupler from a common 240 foot dipole orientated approximately North-South. One receiver was tuned to 130 kHz (the RCA) and the other to 380 kHz. Again I recorded the receiver outputs on a cassette recorder.

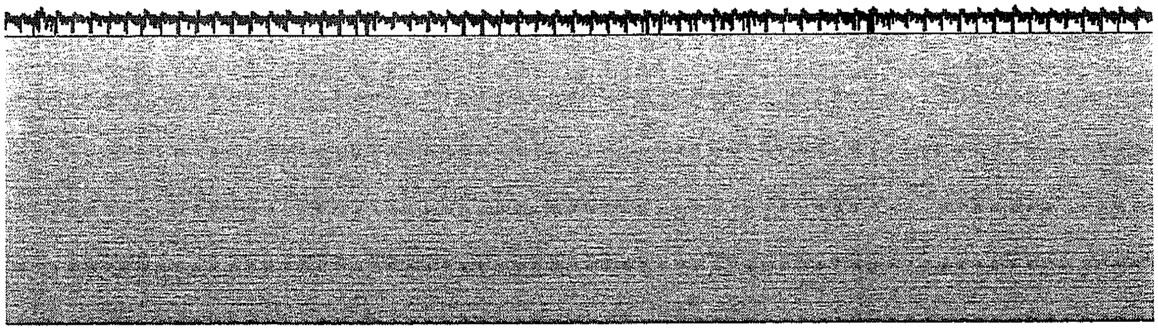
ANALYSIS I used a three-step procedure to analyze the collected data (audio tapes). During each mission, I kept careful notes of everything of interest I heard, including such things as whistlers and other natural radio signals. The first step in the analysis was to play back each tape and compare with my logs to insure that I didn't miss anything and make sure that I had noted the recorder counter setting for all the WWV timing marks. Next, I used a commercial spectrum analysis program called SpectraPlus by Pioneer Hill Software. I used the software in the real-time mode and processed the whole 45-minute recording from the VLF receiver. I carefully watched the evolving spectra for any signal lines on 7, 9, 11, 13 or 15 kHz. I was hoping to see spectral lines on some or all these frequencies emerge from the background, increase in magnitude and then fade away. Such a pattern would indicate that I might have detected the satellite. If I observed such a pattern, I would then analyze the segment in detail using the Gram shareware program. In the resulting Gram spectrogram, I would look at the spectral lines I observed in the Spectraplus program and see if they exhibit the on-off pattern of 0.125/0.375 seconds and the frequency stair step. If the signal had this period, I could then be reasonably sure I had detected the satellite.

RESULTS The following table shows the IMAGE missions I was able to monitor. The missions labeled VLF indicate that I attempted the 5/7/9/11/13/15 kHz transmissions. Those labeled LF indicate that I attempted the 130/380 kHz transmissions. Note that two start times are given. The first is the projected start time and is the time I started data collection. The second time is the actual time the transmission start.

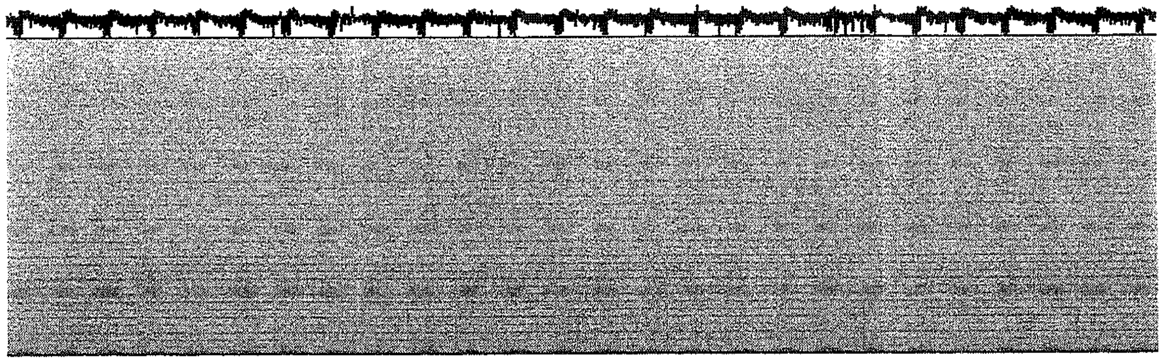
MISSION	DATE	Start Time (Z) Estimated	Transmission	Start Time (Z) Actual
330-A	26 Nov 2001	0120	VLF	0118
330-B	26 Nov 2001	1534	VLF	1532
331	27 Nov 2001	2001	VLF	2000
333-A	29 Nov 2001	0029	VLF	0027
333-B	29 Nov 2001	1529	LF	1531
*334-A	30 Nov 2001	0457	VLF	0455
334-B	30 Nov 2001	1910	VLF	1909
336	2 Dec 2001	0024	LF	0023
*337-A	3 Dec 2001	0406	VLF	?
337-B	3 Dec 2001	1820	VLF	?
338	4 Dec 2001	2334	LF	2334

The mission numbers with an asterisk in front of them were the ones closest to my location and hence I had the best chance of detecting the satellite. The following paragraphs summarize my observations and things I found interesting.

ALL LF ATTEMPTS I observed consistent results on every attempt at intercepting the South Pole LF transmissions. The 130 kHz frequency had heavy interference on it from Loran. Gram spectrograms of 130 kHz (see following figures) only show the strong dashed lines indicative of Loran. *(Possibly a little explanation is in order here. Detection of the LORAN carrier, one of its harmonics or a heterodyne would result in a horizontal line on the Gram chart. The line would be dashed, as the LORAN signal is pulse modulated. The spectrum of the LORAN signal has a SIN (X)/X envelope and is comprised of discrete spectral lines spaced above and below the carrier with the distance between the lines being the reciprocal of the pulse repletion interval, which is 1 kHz. However, none of the receivers I used were tuned close enough to the 100 kHz LORAN carrier frequency to receive it. In the case of 130 kHz, the receiver is detecting some LORAN spectral components, which appear on Gram as short vertical dashes at multiples of 1 kHz).* The 380 kHz frequency has several navigation beacons within 6 kHz of it. The Gram plots didn't show any on/off periodic signal. I usually detected 3 or 4 beacons, two of which were strong enough to read their CW ID. I saw no indication of the IMAGE signal.

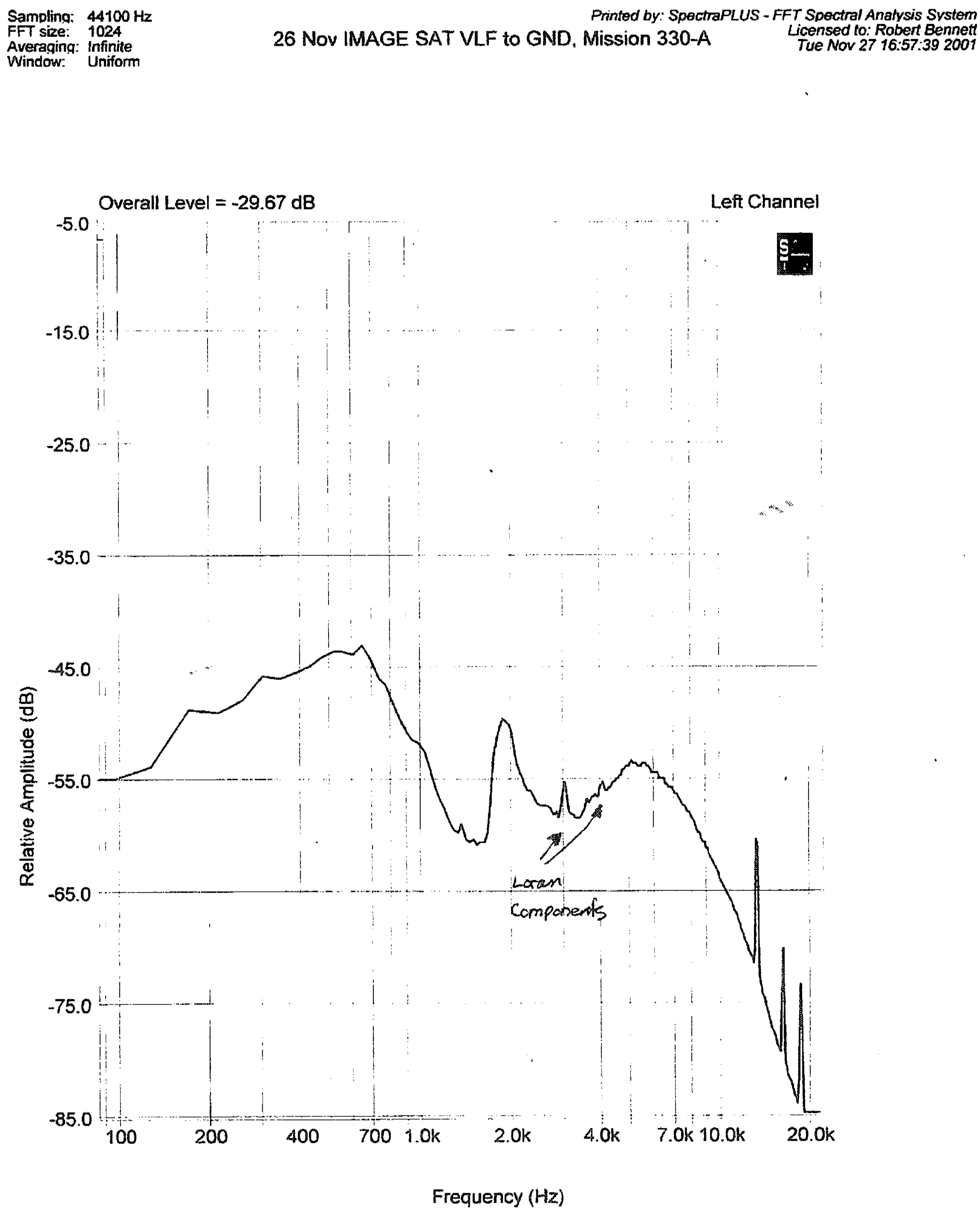


Spectrogram of 130 kHz using a resolution of 10 MS. The individual LORAN pulses are resolved.

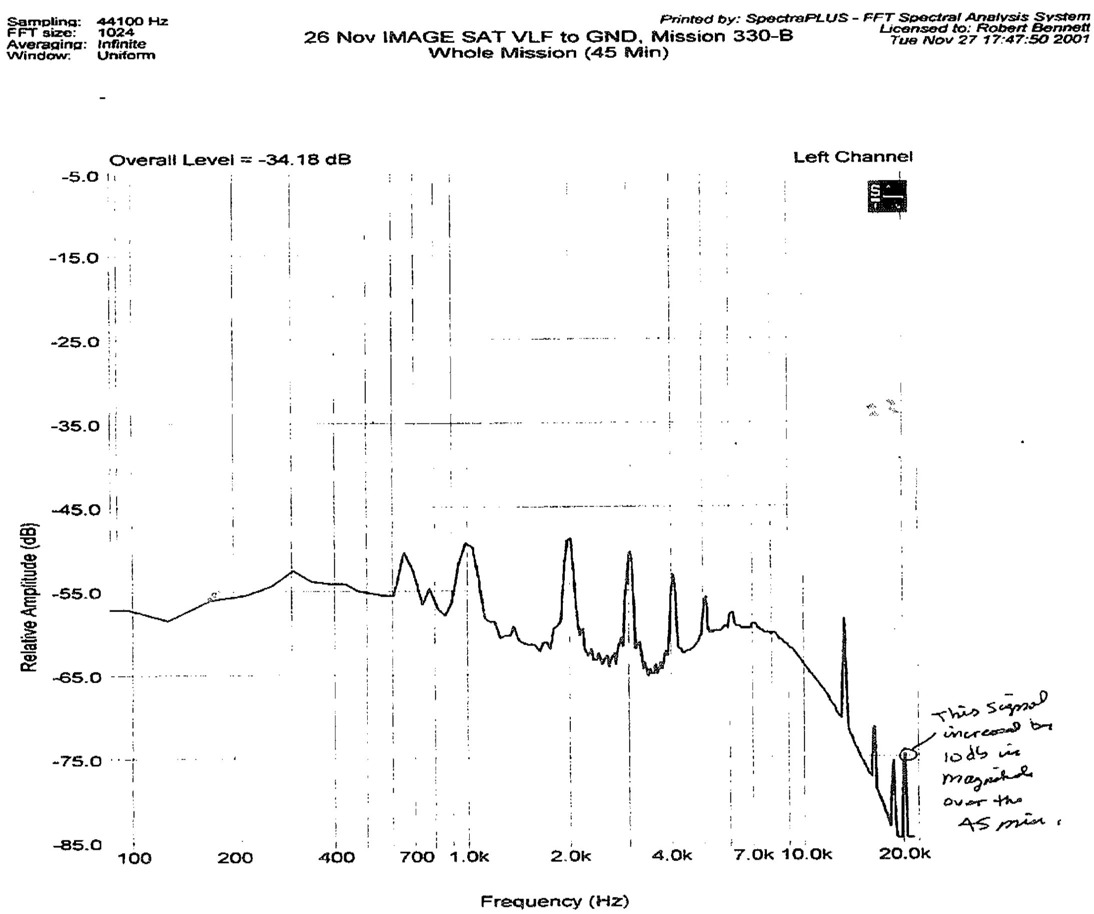


Spectrogram of 130 kHz using a resolution of 100 ms. the individual pulses cannot be resolved but the pulse groups can be. The pulse group repletion is about 2.2 seconds. Each group contains 11 pulses.

MISSION 330-A I used the 120-foot long wire antenna oriented toward the West. A copy of the spectrum plot follows. I noted that the usually strong Loran signal was much weaker than normal. This might indicate that abnormal propagation existed. Also, I was receiving much stronger than normal 60~ odd-harmonic interference. I noted a lot of strong tweeks, strong dense sferics and one whistler. The three strong signals between 10 and 20 kHz (13.155, 16.262 and 18.511 kHz) are communication signals.

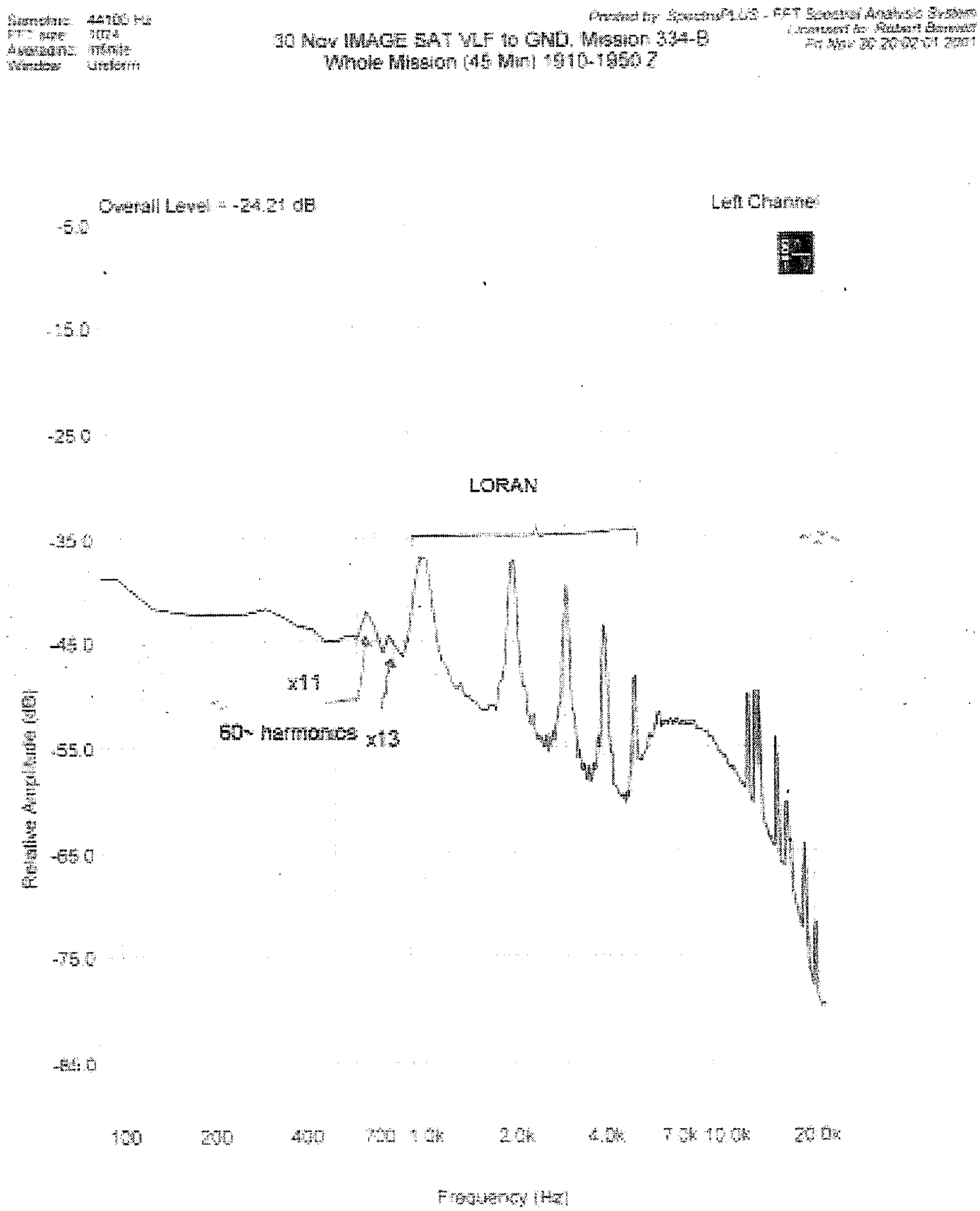


MISSION 330-B I used a 6-foot vertical antenna on this mission. Not much in the way of natural radio signals were detected. The following figure shows the spectrum. The 60~ interference was much less than in Mission 330-A (this can be seen by comparing the 100 to 1000 Hz areas of the two charts). Also, the Loran signal was about its normal value. LORAN components are at multiples of one kHz and are caused by LORAN overload and nonlinear response of the VLF-3 detecting the envelope of the LORAN signal. My monitoring site is about 30 miles from a 500 kW LORAN transmitter. I noted that the communications signal at about 20 kHz increased in magnitude by 8 – 10 dB over the 45 minutes of monitoring. The magnitude of the other communications signals did not change. This implies that the source is either moving toward me and usually implies an airborne emitter or else is increasing its output power.

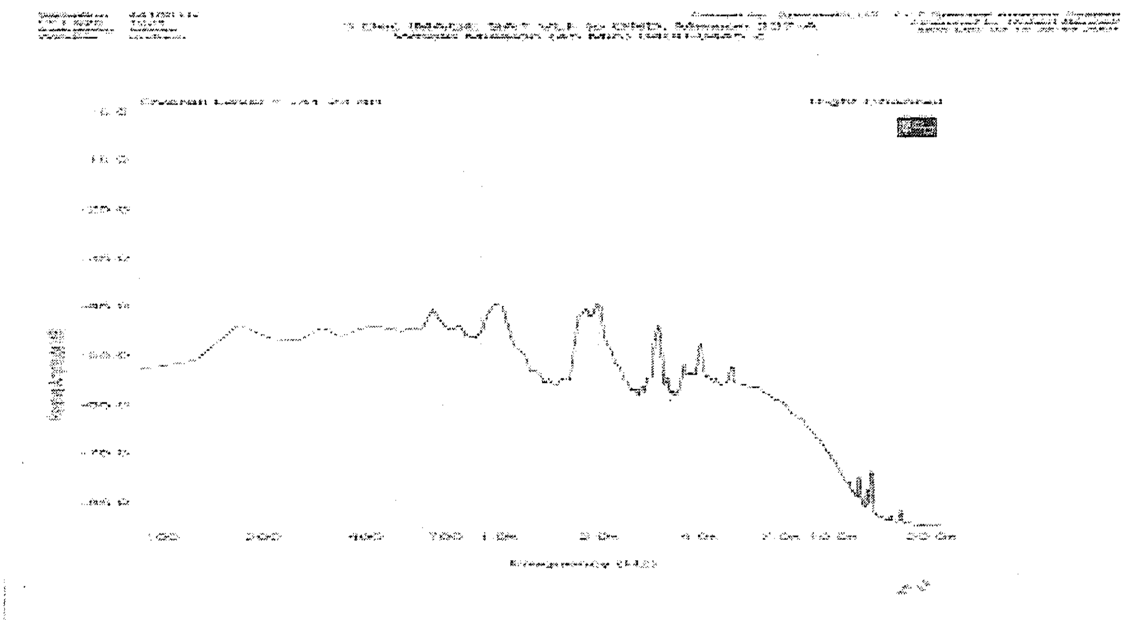


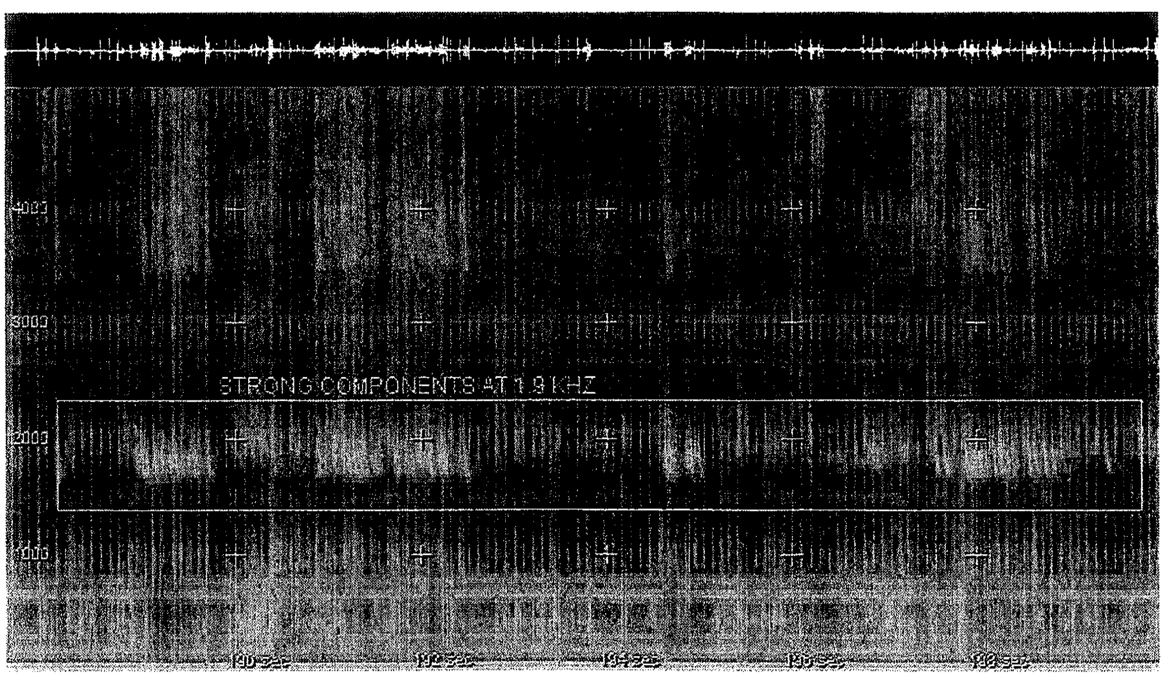
MISSION 334-A The 120-foot long wire antenna oriented to the west was used. This was a very good night for natural radio signals. I detected 15 whistlers, several whistler echoes, and observed many strong tweeks along with dense sferics. I also detected several communication signals between 10 and 20 kHz. The spectrum plots didn't reveal much and are not included.

MISSION 334-B I used the 6-foot whip during this mission. This mission took place at noon local time. I didn't observe any natural radio signals at all. The Loran signal was the strongest that I have ever I seen it. The following spectrum plot shows that signal. Note that the Loran components are 15-20 dB above background.

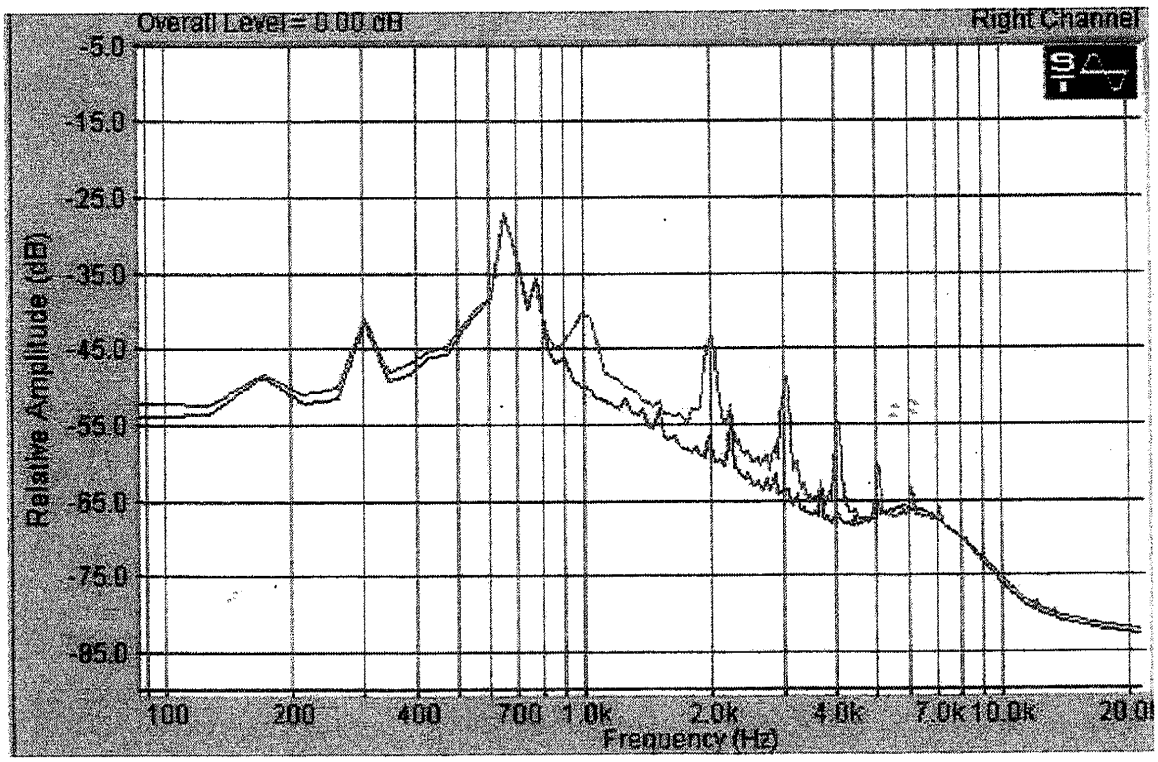


MISSION 337-A I used the 120-foot long wire antenna with a westward orientation. In this mission I used the RS-4 INSPIRE receiver. I detected a lot of very strong tweeks. The spectrum is shown in the following figure. Note the twin peaks at approximately 2 kHz. The first at 1.9 kHz is caused by the strong tweeks while the second at 2 kHz is a Loran component. The tweek energy is better represented in the Gram spectrograph, which follows. Note the strong component at about 1.9 kHz.





MISSION 337-B This is a daytime mission and I used the 120-foot long wire oriented toward the north. I didn't detect any interesting natural radio signals except for infrequent tweeks. In this mission, I experimented with the effect that the longwire/whip setting on the RS-4 has on the recorded signal. The following figure shows the result. The figure shows two traces, the top one is with the RS-4 set for whip (but a long wire antenna was used) and the lower one is for longwire setting. Note the major impact on the Loran signal! Also, there are signals present at 2.1 and 3.7 kHz (origin unknown) that are very clear on the lower trace (long wire setting) and all but disappear on the upper trace. The RS-4 circuit diagram indicates that setting the switch to longwire places a 470Kohm resistor in series with the antenna. This simple experiment indicates that the long wire antenna is coupling sufficient LORAN signal energy into the receiver to overload the input FET stage producing rectification and detection of the LORAN signal envelope. I will have to do some more experimentation on this.



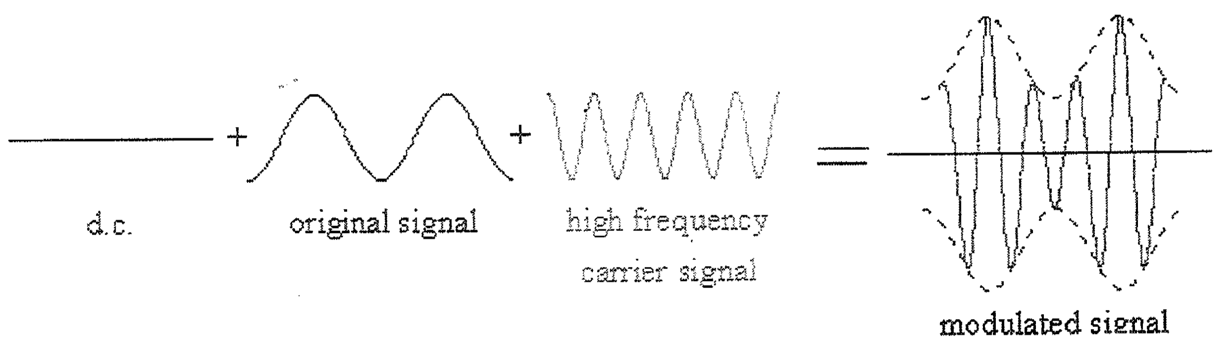
ACKNOWLEDGEMENT: I would like to thank Mr. Pine and Dr. Taylor for their review of this article and the useful comments they provided.

INSPIRE Radios as AM Receivers?

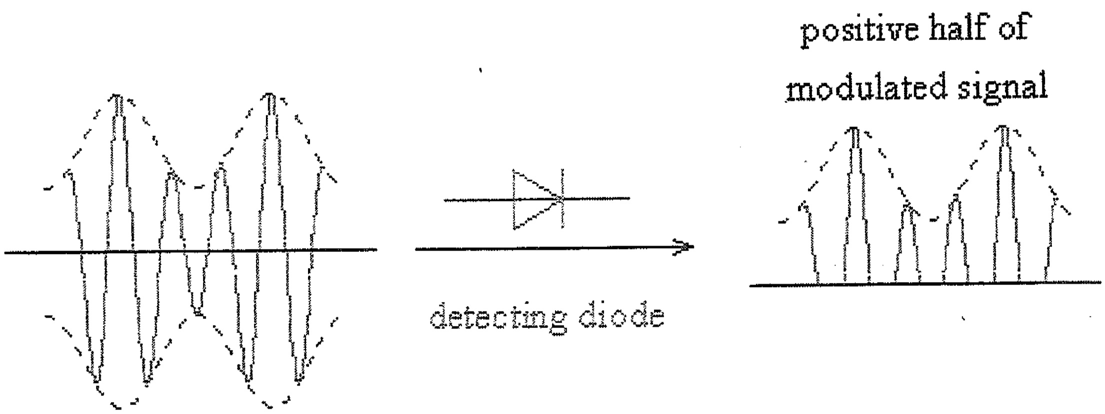
By Jill Marshall
Austin, Texas

In February of 2001, a group of Central Texas physics teachers participated in an INSPIRE workshop. The group had taken an INSPIRE receiver into the hill country near Helotes, Texas, at then end of the day expecting to hear tweeks and whistlers, or sferics at the very least. What we heard instead was a surprise to some of us: an AM radio station. Knowing that AM frequencies were well above the range of the INSPIRE receiver, we wondered how it was that the VLF2 was receiving the Hit Parade. Then someone made a comment to the effect of "It must be the same way that a crystal radio does it", and that seemed to make sense. But how would this work exactly? We thought some of the other INSPIRE participants might have had the same experience and wondered the same thing.

The answer lies in the way AM (amplitude modulated) signals are constructed and how AM receivers (the VLF2 and crystal radios included) work. As its name implies, an AM signal modulates the amplitude of a wave of a given (constant) carrier frequency to encode the sound wave produced by the DJs voice or music. For example, the amplitude of a 1000 kHz carrier wave (the station frequency) is varied at the lower audio frequency of the sound being transmitted. In the following diagram a 10 kHz sound (in the middle of the audio range) is shwon modulating the 100 kHz carrier. (The waves are not drawn to scale.)



Electrons in the antenna of your VLF2 are stimulated to oscillate according to this modulated wave, producing a modulated, oscillating input current to the receiver. The receiver, as we all know, is simply not fast enough to pick up on the high frequency oscillations of the carrier wave. These are averaged out over time by the capacitor in the circuit so that the incoming signal varied with the original modulation only. If the complete signal is averaged over time, the symmetric positive and negative peaks will cancel out to zero amplitude, as will any sine wave. This is where the diode in your VLF2 circuit comes in. This device transmits only positive current (only the positive half of the wave form) as shown in the following diagram. (That's why the orientation of the diode in the circuit was so important!)



When the positive portion of the wave is averaged over time, it reproduces the original sound wave that the radio station used to modulate its carrier frequency wave. If it is strong enough, that wave can drive a speaker or recording device just as any incoming radio wave in the audio range would.

You might ask how the receiver is tuned to a particular AM station. The answer is: it isn't. The VLF2 will only pick up very nearby stations, which are strong enough to drive the circuit directly. So, you can listen in with the VLF2, but you won't get your choice of stations.

HESSDALEN EMBLA 2001

VLF Radio Report and Some Further Proposals for the Next Missions

By: Flavio Gori
INSPIRE European Coordinator
Florence, Italy

In this report, I'll give some basic information about the work done in the Hessdalen Valley in Norway. First of all I'll take this opportunity to recall what we were looking for from VLF research in the field. The most important fact was to realize which kind of VLF electromagnetic natural noise situation should be defined as standard in order to understand if and when something may arise to influence in any way the local EM environment, in particular when Hessdalen Phenomena lights are appearing. This job was done using two VLF receivers: ELFO, with 2 square antennas, 2 meters long each arm[1], and the portable WR3 with its 60 cm whip antenna. Moreover an Inspire VLF receiver (http://image.gsfc.nasa.gov/poetry/inspire/) was set up in the Blue Box station, connected to a 50m dipole. Both the WR3 and the Inspire are broadband audio amplifiers, able to deal with about 12 kHz down to 300 Hz.

The first two nights, at Vista Point-Aspaskjolen[2], the WR3 receiver was used since ELFO was not ready to work. In the first recording session we experienced a very particular "whistler battle". Seldom was it possible record so many whistlers in just one night. This was probably due to the very rainy local night and, moreover, a similar weather condition was probably happening at the magnetic conjugate point in the Southern Hemisphere. These two special conditions at the same time, and at this high latitude, created a lot of whistlers and 2-hop whistlers[3].

The second night was a more usual one, since the weather turned clear with small electrical activity in the atmosphere. Both nights were free from Hessdalen lights, at least from our eyes, so was not possible to determine if the lights have any connection in VLF/ELF.

In the further nights recording sessions, we used the ELFO system in order to collect VLF /ELF data, from the BlueBox, the metallic box where are sited radio and optical instruments. Antennas used were the two square: the first directed toward 203° and the second toward 40°. During these sessions, most of them with Eng. Andrea Cremonini from CNR/IRA of Medicina Italy, two portable computers were used to store data digitally directly. These were a GEO PC Pentium 3/700 MHz (Andrea) using Spectrogram software (in addition to the ELFO software), while the other was an Apple Power Book 3400/180 MHz (myself) with SoundEdit software to create and analyze as a spectrogram the audio file recorded. Since SoundEdit is not able to show spectrograms in real time, when the system is recording, sometimse we have used MacTheScope software, which is able to create displays a real time in spectrogram mode (time vs. frequency) as well as spectrum analyzer (frequency vs. amplitude).

During these ELFO recording sessions, a very high number of unknown digital manmade signals were recorded. Most of them have nothing in common with the ones recorded during EMBLA2000 Mission. Very unfortunately these signals hide frequencies between 2.5 to 8 kHz most of the time and sometime even10 kHz. Therefore the very low amplitude emissions we were looking for, resulted almost invisible, if present. Since ELFO has a filter to cut away all below 1 kHz, the frequencies range we can analyze in a good shape are between 1 and 2.5 kHz (ELF) and, sometimes even up to 8 to 12 kHz (VLF). The lowest range appears to be the most interesting for our purpose. Anyway we are analyzing it at our best, in order to discover any signal that might be correlated with Hessdalen Phenomena.

Sometimes the very first impression about recording sessions was later changed and, after many weeks spent analyzing those files, I think we don't need to analyze in the closest detail any manmade or natural known emissions. We need to monitor the natural standard white noise, that has to be seen as a "carpet" where something will walk on. This is the situation that may arise in the Hessdalen Valley in the VLF/ELF radio range. We have to observe what is arriving to influence the local EM environment, though it may be extremely faint and not so easy to be recognized. In my opinion these influences may be very important to understand the Hessdalen Phenomena.

During our very useful group conversations at the school where we lived, Eng. Bjorne Gitle Hauge[4] told me about a Dr. Massimo Teodorani's interesting Hypothesis[5]: lights, as self-contained energy balls, may exist even when not visible. They should turn visible when "something" happens. Many hypothesis we can add to understand what are the particular phenomena that "break" those balls, though at this time it is not understood, for sure, why that break is happening.

Hypothesis

I'd like put our attention on Massimo Teodorani's hypothesis of self-contained energy balls that may be around us though not visible[5].

This intriguing idea has been with me since I first heard it. And that's the way I'm thinking. If such a ball (a Self-Contained-Energy-Bag or SCEB) is around me, it is probably moving randomly as it does when it is visible. Its speed is random as are its colors and altitude. But, as happen when the lights are visible, there may be more than one SCEB moving together as each SCEB may be composed of more than one internal light rolling together inside[5]. If it is and all conditions just mentioned exist, we may consider that such a SCEB may influence the very local EM standard condition though with an intensity that is even lower than when SCEB turn to visible lights. It is important to emphasize that the inside composition of the SCEB, beyond what appears to be the external light, is very important in order to detect them in VLF, or in any other range. Optical, infrared and physics research will give us decisive help. We like to propose an model as follows: we should think of a still sea-water surface representing the local EM field; when a fish passes close to our position we cannot see the fish (representing the SCEB/signal, but we will see the disturbance in the sea surface created by the fish passing. This is just the way we are expecting to find SCEB. They are invisible to our eyes but their passage can create some perturbations in the local electromagnetic field that we are trying to detect. If SCEB may be detected in VLF, we should observe, in the spectrogram (time vs. frequency), unusual emissions such as Doppler shifts (when SCEB approaches or is outbound from the antenna site), or a whirl when a rotating SCEB, is in the near vicinity of antenna. Sometimes the spectrogram appearing as a ball, all noise-like, as if noise appearing around particular spectrogram points, creating no sharp "ruffles", due to the very low amplitude of the signals from the random motions of the SCEB. It would be as if the EM environment is tracking a SCEB flight and its behavior, though such a SCEB is not creating a "real" VLF/ELF signal, just a perturbation in that low EM field. We should observe SCEB intermodulating with standard natural noise conditions in a that creates such very faint geometrical figures/perturbations described earlier.

If this hypothesis is right, we should observe the EM situation all day long, no matter if lights are visible or not, in order to realize if such "ruffle" emissions are really in the spectrogram. If this hypothesis is to be proven, we have to observe a dramatic change in such EM condition when SCEBs break themselves. Observing that sudden change in the radio wave spectrogram will help us to go one more step ahead. The VLF situation may change in this way: when SCEBs are going to break themselves, in the spectrogram may appear a blast-like signal, such as an EM bang all along the VLF frequency range. As soon as it happens we should observe everything just as before. It would be something like a seismogram during a quake event. Being, at that point, an optical emission, its likely that such a bang may lay in the UHF field, as well as in the VLF range, at least in very beginning. That's why we could set up a parallel UHF monitoring station as well as an infrared one, being a heat emission. Especially during the search for SCEB, it should be very important to measure the infrared emissions in a coordinated session with VLF/ELF radio range. In the VLF/ELF radio range, after such a blast-like emission, we should not observe any perturbation from that point on, being that the SCEB broke up, with no more energy inside to detect. At the same time we should still observe other SCEBs moving around. Are these SCEBs influenced in any way by such blast-like phenomena?

One more hypothesis arises, at this time: when lights turn off, disappearing optically, are they getting back in a way such as happens with SCEB? Can they be detected in VLF/ELF again?

To observe these "ruffle" emissions (but also the blast event), the VLF /ELF receiving stations have to be established as close to the phenomena as possible. We'll need extremely well performing antennas and software to carefully reproduce those very faint signs. In this way our knowledge might get a quantum leap. I propose that two dipole frames antennas, formed by 5 wires each be installed at the site statistically more likely to be involved in the SCEB/lights appearance, at a distance of 1 meter from each other, in order to be hit by the SCEB/Lights to understand if such matter can create different situations when it is hit or not, though at very close distance. Each dipole has to be connected to one instrument, so when lights/SCEB hit one, the others can tell us such things as the amplitude/shape difference and to show us which kind of data are arising from them. Moreover if SCEB/lights will hit one more wire, after 1 meter, we can realize if and how anything has changed, in its energy, from the first hit to the second, as measured by our tools.

Also, a deep research has to be done in the software field. In our opinion, to determine if the SCEB hypothesis is correct (or just to find out how lights are working), we need a software filter able to understand background electromagnetic noise and filter it from any other perturbation arising, even if much lower in amplitude. We need to go below the noise threshold as deep as we can, in order to better understand what it is in the very low amplitude EM field. Other manmade emissions are not important at this point and we have to coordinate our work looking at the "ruffles" in the noise carpet. Moreover it will be extremely important to understand the correct time-window in our spectrogram, in order to show the better way to evaluate those faint ruffles. If the time window is too small, ruffles will remain compressed in all the other noise and emission and will be invisible. On the other hand if the time window is too large, spectra will enlarge the ruffles too much making them again not visible at first sight.

Analysis

Our time spent over spectrograms for analysis purposes leads us to find out the right time-window to show such ruffles. We'll say again that such ruffles are extremely faint and we have to observe spectrograms very carefully to see them, at least with the instruments we are using at this moment. We have enclosed some VLF /ELF spectrogram recorded in the Hessdalen Valley where we can actually observe perturbations in that electromagnetic radio field.