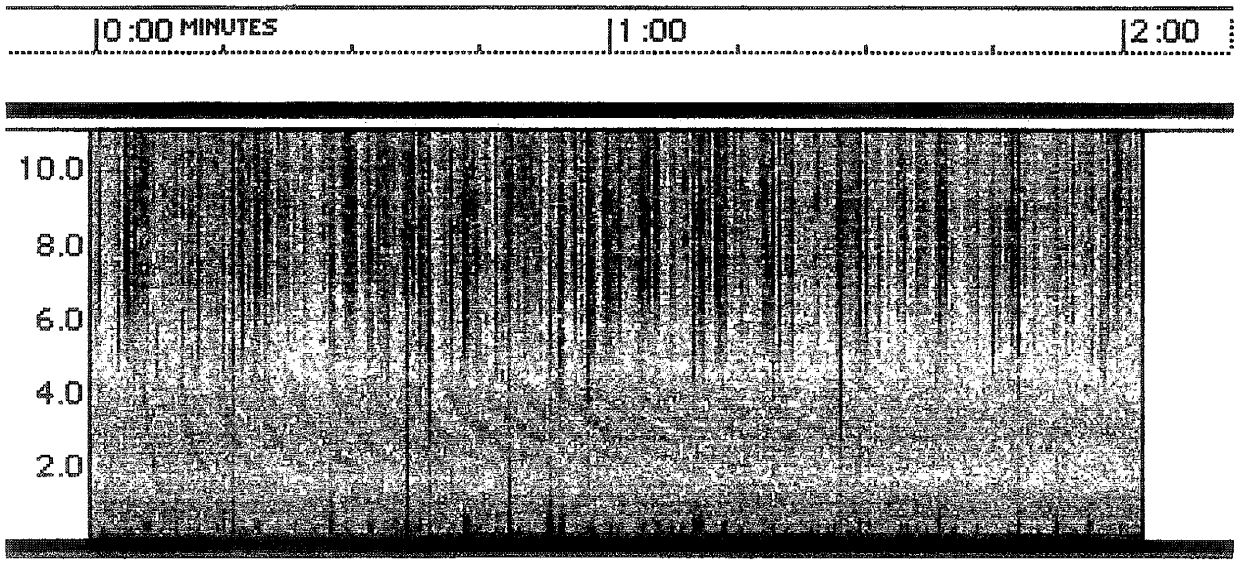
The INSPIRE Journal

Volume 8 Number 2

April 2000

A Whistler and Its Echo...Echo...Echo...Echo...



.Shawn Korgan of Gilcrest, Colorado, recorded this whistler and its many echoes during the Coordinated Observations on November 21, 1999. The whistler is at the left and the echoes continue for more than two minutes. There are 26 echoes on this view as they slowly fade away. See more details on Page 10 inside!

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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

Sounds from the *Journal* to be Available on the Website!

Check the INSPIRE website for audio files of some of VLF signals described in this issue. The URL is:

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

Select the "Journal" button on the home page and then select "Audio Samples". The amazing echo train will be one of the files available. We hope this new feature will help bring the *Journal* to life.

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. 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.

New email Addresses for the *Journal*

The editor of The INSPIRE Journal can now be reached at th following email addresses:

pine@mail630.gsfc.nasa.gov
billpine@earthlink.net

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 "00", then the next issue will be the last under this subscription. If your label shows "01", then your subscription is good through the November 2001 issue. If you have any questions or if you feel that the information shown is incorrect, please contact the editor.

INTMINS-April/2000 Operations Schedule

By Bill Taylor, Washington, DC
Stas Klimov, Moscow, Russia
Bill Pine, Ontario, CA

The April/2000 INTMINS Operations schedule will be finalized soon. Operations will occur on the last two weekends: April 22-23 and April 29-30. Data gathered will be analyzed and reported on in the November 2000 issue of *The INSPIRE Journal.*

Gathering Data:

IMPORTANT NOTE: Data gathering procedures will remain the same as those used since April 1996.

Perhaps the most important ingredient in a successful data gathering session is what happens **before** you go out in the field. The following is the recommended procedure for data gathering including preparation prior to the date of the operation.

Step 0: Completely check out all equipment. A good method is to set up everything in your living room. All you will hear is household 60 Hz, but you will know the equipment is working. This is also a good time to fill out the log cover sheet (see Page 52 of the *Journal*).

Step 1: Define "T-time" as the starting time for operation of ISTOCHNIK.
Convert the UT time to local time.
Arrive at your site with time to spare.

Step 2: Start data recording at T minus 12 minutes.
Prior to this time place a brief voice introduction on the tape identifying the observers and the operation number.

Step 3: Place time marks on the tape at: T-12, T-10, T-5, T, T+3, T+8, T+13, and near the end of the tape. Use UTC times only. Note that this schedule brackets the scheduled time of operation of ISTOCHNIK with time marks. Use 60 minute tapes and place one operation per side.

Step 4: Keep a written log (see Page 53 of the *Journal*) of time marks and descriptions of everything you hear.

Step 5: Review your tapes and revise your logs if necessary.

Step 6: Mail your tapes and logs to Bill Pine at the address shown on Page 2 of the *Journal.*
Your tapes will be returned to you.
Send in copies of your logs since they will not be returned.
You will receive a copy of the spectrograms made from your data.
Your data will be incorporated in the data analysis report article in the *Journal.*

Mode of Operation:

The two instruments on MIR are Ariel and ISTOCHNIK. Ariel is a plasma generator and operates for 5 minutes, alternating between axes. ISTOCHNIK is a modulated electron gun that accelerates a beam of electrons and emits them into space. The electron beam is turned on and off at frequencies of either 10 hertz or 1000 hertz (1 kHz), which should cause the radiation of electromagnetic waves in the VLF range at those two frequencies. ISTOCHNIK operates for a total of 2 minutes on the following schedule:

ISTOCHNIK mode:	10 seconds modulate at 10 Hz
	10 seconds modulate at 1000 Hz
	10 seconds modulate at 10 Hz
	10 seconds modulate at 1000 Hz
	repeat for 2 minutes of operation

On each pass, Ariel will either operate first or last, whichever gives the most coverage over INTMINS observers. Since the signal from ISTOCHNIK is more powerful, it is the one most likely to be detected. For that reason, the schedule emphasizes the operation of ISTOCHNIK.

Notes on Time Marks and Logging;

The purpose of putting time marks on the data tapes is twofold:

1. The obvious need to know what time is represented in each part of the tape,

2. also to provide a means of synchronizing the tape with actual time. Battery operated recorders tend to run slower as the batteries wear out. Some recorders run fast or slow because of the particular motor being used. By timing (with a stopwatch) the actual times between time marks, the speed of the analysis recorder can be adjusted to synchronize the data tape with actual time. This has the effect of adjusting the frequencies on the spectrogram to the proper values since incorrect tape speed on the data recorder will cause the frequencies to be out of position.

When time marks are put on the tape, they should include an announcement of the UT time and a mark (either by voice ("mark") or by WWV tone or some other means). Try to minimize the interruption to the data flow when putting on the time marks. This takes practice! Also, put the time marks on at least as often as is called for by the instructions. It is better to have more time marks than are called for than to have too few.

The purpose of the data log is to record the contents of the tape. The time of each time mark should be recorded. Anything else of interest should be noted on the log with the time indicated.

Tapes with incomplete or missing time marks and poor logs are nearly impossible to analyze. Your help in following good time mark and logging procedures is much appreciated.

INTMINS Schedule

The operation schedule had not been determined by press time. The schedule will be printed separately and mailed included with the *Journal*.

Coordinated Observation Schedule
April/2000

By Bill Pine Ontario, CA

In response to requests in the INSPIRE Survey for observation opportunities at more convenient times, the INSPIRE Coordinated Observation Program was established in April/98 in conjunction with the INTMINS observations. The purpose of the coordinated observations is to provide an opportunity for INSPIRE observers to make recordings of natural VLF radio and to compare the resulting data. Ideally, a coordinated session would result in everyone hearing whistlers. While coordinated observations in November revealed mostly quiet natural VLF conditions, some whistlers were heard along with tweeks and chorus. (See "Report on Coordinated Observations 11/99" on Page 34 in this issue of *The INSPIRE Journal* .)

The procedure to use for coordinated observations will be as follows:

1. Use the Data Cover Sheet and Data Log as with the INTMINS observations.
2. Record for 12 minutes at the start of each hour that you can monitor on the specified days. Keep a detailed 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.
3. 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.
4. Record at 8 AM and 9 AM **LOCAL** time.
5. 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).
6. 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.
7. 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

8. Your tapes will be returned with spectrograms of your data. An article reporting on the results will appear in the next *Journal.* .
9. 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/2000:

Saturday, April 29 and Sunday, April 30

The following article appeared in Volume 5 Number 1, November 1996

Recording Alone:

Learning From Experiences Recording INTMINS Sessions

Mike F. Aiello
Croton, NY 10520

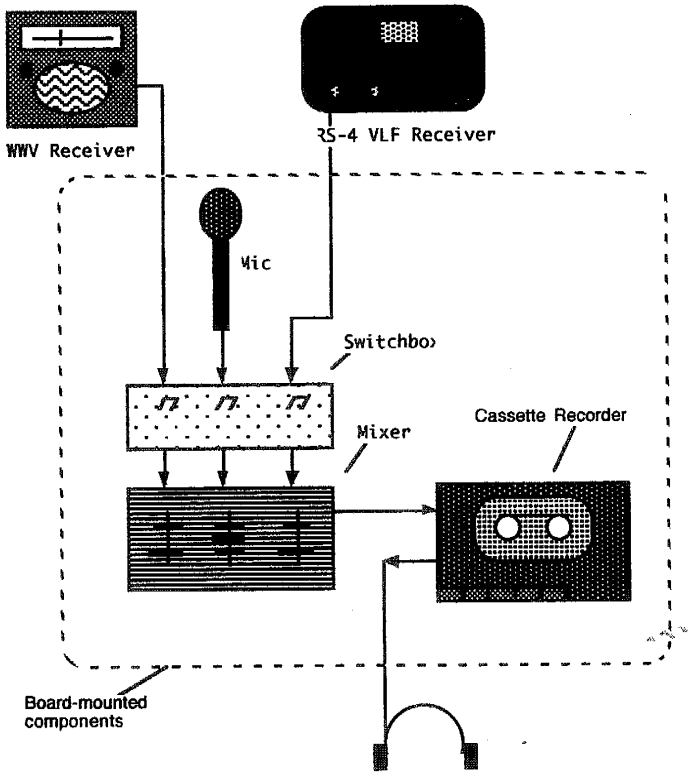
Since my first experience as one of many ground observers in the SEPAC experiments, I have found participating in an organized effort to collect scientific data both exciting and rewarding. There is a challenge to meeting a schedule, in the field, working with a fairly complex assortment of gear and a time-dependent protocol. This challenge is especially keen when you are working in pitch darkness, outdoors, in below freezing temperatures, alone, and at 2:03 AM local time on a weekday. (For some reason, these seem to be the only passes I can cover here on the East Coast...)

Not that VLF data collection is that difficult a process, but with at least four main components, (radio, VLF receiver, microphone, and cassette recorder), the need to set up antennas, make voice announcements on cue, etc., there is enough going on to make the whole process easy prey to Murphy, or just plain late night befuddlement. This is not to mention the 2n interconnections that must be made correctly, with good contact. And then there are batteries...

After many on-site mishaps and nearly missed schedules, I came up with two improvements for my recording sessions: one involving the hardware and one involving t he process. These are both simple ideas, but I thought they were worth sharing, because the improvement in field operation that resulted was dramatic. You may already be doing similar things; I would welcome any correspondence on ideas you've developed in the field. The key to the hardware improvement was to eliminate poor/incorrect interconnections by making most of them permanent. Now the equipment I use for VLF recording has other responsibilities in real life, so a hard-wired, permanent fixture wouldn't do. Instead, I found a medium sized composition drawing board at a local art supply store, and came up with secure, but removable, means of mounting my recording equipment on the board. Large pieces of equipment are attached using lengths of bungie cord passed through holes in the board and knotted behind. The smaller items are affixed with self-adhesive Velcro™ patches. The board itself had a convenient handle hole, making the whole affair easily portable. The board contains four items attached to it: the cassette recorder, a four-channel mixer, a homemade switch box for three audio channels, and a gooseneck that holds my microphone for voice announcements. There are only three off-board connections that must be made on-site: audio from the WWV receiver, audio from the VLF receiver, and my headphones. All other connections are made on the board beforehand, and are as short as possible. There is no possibility of tangles, dislodged or loose connections between the on-board components. You can see this layout in the accompanying block diagram.

The switch box is an extra convenience that I added to facilitate night work. Each switch is paired with an indicator LED that lights when that channel is enabled. Not only is this visual cue very handy, but the switches allow me to add in and drop out WWV and the microphone without changing the pre-set recording levels determined before the session. The whole audio mixing board is very secure and easy to transport and use. There's even a spot to clip a digital clock displaying UT.

VLF Field Recording Station
Block Diagram



The process of improvement took the form of a comprehensive set of checklists (on the next page) that record every setting and every connection necessary to complete the session. The settings include switch settings on the VLF receiver, and recording levels on the mixer and the cassette recorder. The WWV frequency, and radio volume and tone are also included. The interconnection checklist covers all the connection points in the system, including those on the board. You can see samples of the checklists at the end of the article. I use the checklists at two points in the recording session. Well before the start of the session, I set recording levels and select the WWV frequency I'll use. I record this information on the checklist at the appropriate places. After I have made all the necessary settings, I make all the connections between the board and the other components, and the VLF receiver and the antenna system. Just before the start of the session, I run over the checklist one last time, verifying each connection or setting. If I follow this procedure faithfully, I am set and ready when the recording start time arrives.

The audio board had its pilot run during the November 1995 INTMINS series. I only managed one session, and although the board components functioned well, I had battery trouble (figures...) and nearly missed the schedule. In the April session, I added the checklists and fresh batteries, and the session came off flawlessly. It was a warm, sunny late afternoon recording session, but I'm sure that had nothing at all to do with the successful run. In any event, by organizing the connections, and the set-up process, fortune has to be smiling just a little bit more on my recording efforts in the field.

VLF Recording Session Checklist 1 of 2

Board Hookups

- ☐ WWV: Radio(Tape Out)->Mixer(Channel 1 Mic)
- ☐ Mic: -->Mixer(Channel 2 Mic)
- ☐ VLF: RS-4(Rcvr Out)-->Mixer(Channel 3 Mic)
- ☐ Phones: -->CTR(Phones)
- ☐ Audio Mixer(Left Out)->CTR(Mic In)
- ☐ Clock Clip to board

RS-4 Hookups

- ☐ Ant: RS-4(Ant. In) -->Antenna Pigtail
- ☐ Gnd: RS-4(Gnd. In) -->Ground Strap (to car)

RS-4 Settings

- ☐ Level: 1 2 3 4 5 6
- ☐ Antenna: ___ Whip / ___ Long Wire
- ☐ Output ___ Rcvr / ___ Mic
- ☐ Filter: ___ In / ___ Out
- ☐ Power: ___ On / Off

VLF Recording Session Checklist 2 of 2

CTR Settings

- ☐ Level 1 2 3 4 5 6 7 8 9 10
- ☐ Tone 1 2 3 4 5 6 7 8 9 10
- ☐ Vox: ___ Out / ___ Lo / ___ Hi
- ☐ ALC ___ Out / ___ In
- ☐ Counter 000

Mixer Settings

- ☐ WWV: Channel 1 2 3 Level 1 2 3 4 5 6 7 8 9 10
- ☐ Mic: Channel 1 2 3 Level 1 2 3 4 5 6 7 8 9 10
- ☐ VLF: Channel 1 2 3 Level 1 2 3 4 5 6 7 8 9 10
- ☐ Output: ___ Mono / Stereo
- ☐ Power ___ On / Off

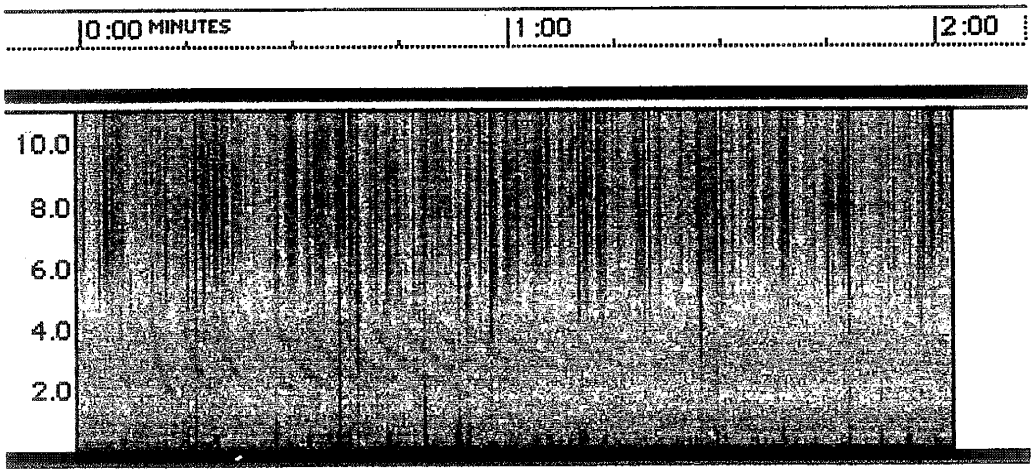
WWV Radio Settings

- ☐ Freq ___ 5000 / ___ 10000 / ___ 15000 / ___ 20000 kHz
- ☐ Base ___ 0 (Neutral)
- ☐ Treble ___ 0 (Neutral)
- ☐ Volume ___ 0 (Off)
- ☐ Mode ___ AM / FM / SSB
- ☐ Power ___ On / Off

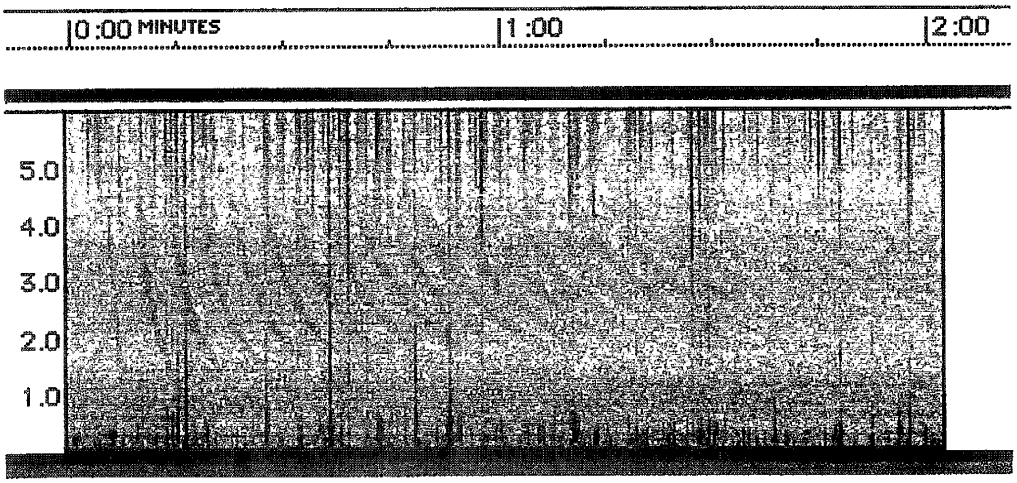
An Amazing Whistler Echo Train

Whistler Recorded by Shawn Korgan, Gilcrest, CO
Commentary by Bill Pine, Ontario, CA

During the Coordinated Observations of November/99, Shawn Korgan was observing from a dirt road on the open prairie four miles from power lines. This is a very quiet site and Shawn observes using a very hot homemade receiver he calls the SK-1. At 13:03:35 UT (6:03:35 MST) he logged "Long whistler begins". At 13:05:00 UT he logged "Can still hear the above whistler". In the margin of the log sheet he noted "Lasted almost two minutes in duration! There were a lot of these whistlers before 6 AM while I was setting up my equipment." Below is a spectrogram of the two minutes starting at 13:03:20 UT.

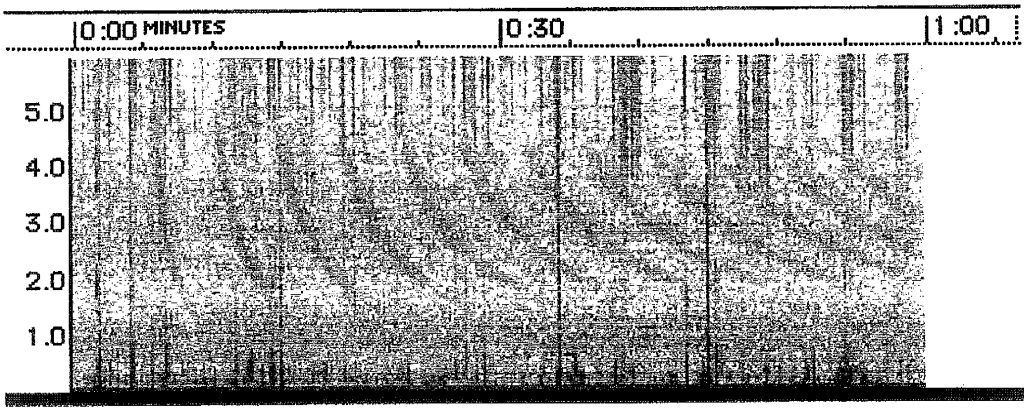


What Shawn captured is the longest whistler echo train I have ever heard of. Usually when you hear echoes, you hear one or two. Rarely do you hear more than a few and the echoes fade away rapidly. This whistler was not a particularly strong one and the echoes do not fade in intensity very fast. It kind of makes you wonder where the energy is coming from to provide so many echoes. Using a smaller frequency range (0-6 kHz) makes the echoes easier to see.

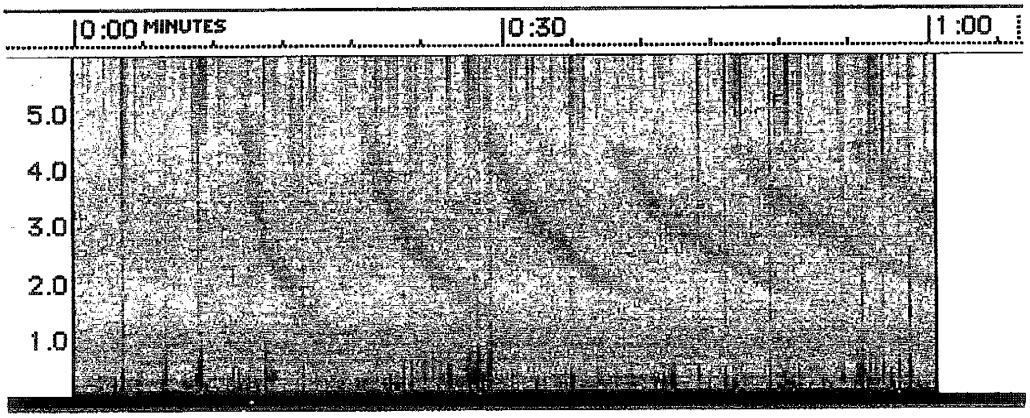


I remember seeing an article in a scientific journal years ago that showed the spectrogram of a whistler and its numerous echoes. One of the points made was that the number of echoes was surprisingly large. The number of echoes shown was eleven!

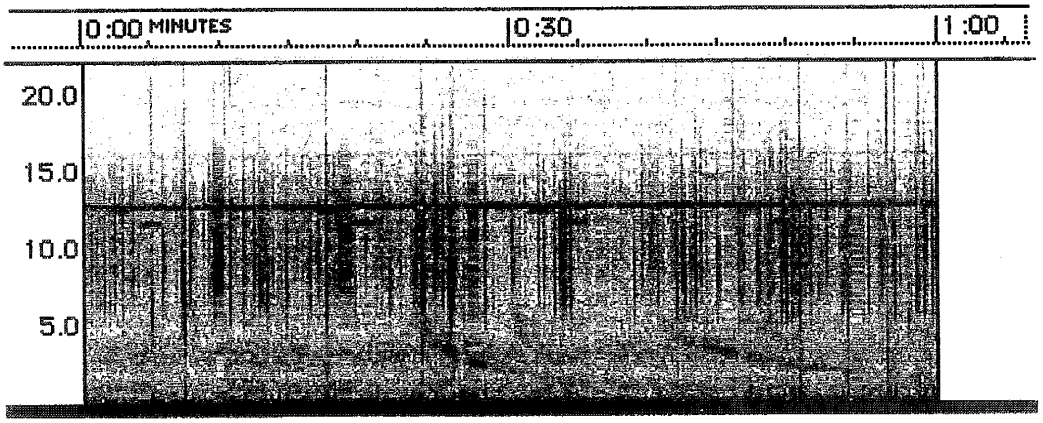
The next view is of the first minute of the segment.



Next is a view of the first 30 seconds.



Notice the continuos decrease in slope for successive echoes. Finally, here is a spectrogram of the first 25 seconds using a 0-22 kHz frequency range.

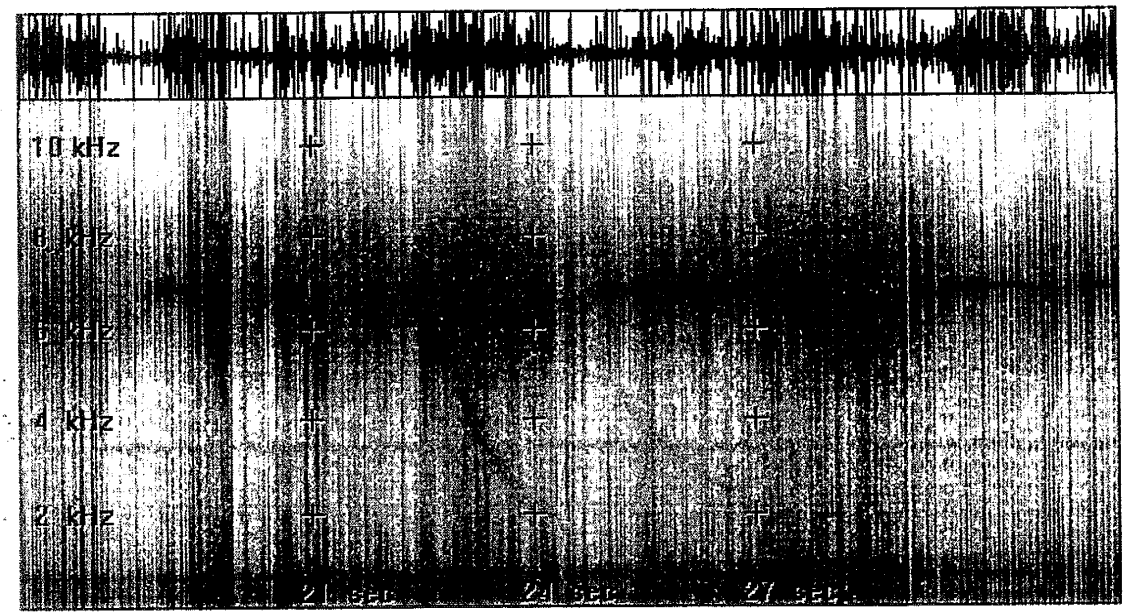


Notice the presence of Alpha dashes and a 13 kHz manmade line and the almost total absence of powerline hum. To properly display this amazing find, *The INSPIRE Journal* is introducing the first ever foldout – "An Amazing Echo Train"!

Using a Graphing Calculator to Analyze Whistler Echoes

By Mark Spencer, Coleville, CA

Whistlers that arrive in pairs are candidates for consideration as echoes. They might, however, be independent whistlers that happened to arrive close together. The following spectrogram shows two such whistlers that arrived about three seconds apart.

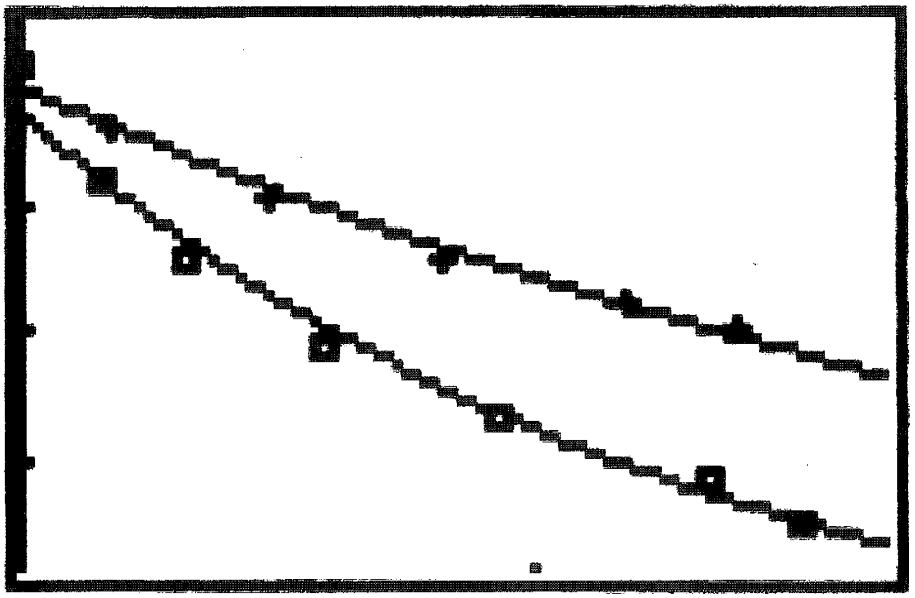


Spectrogram made using GRAM software for the PC.

One observation that can be made is that the whistlers do not have exactly the same shape or intensity. The second is a less steep curve and has a lower intensity. This relationship makes the second appear to be an echo of the first. To test this supposition I did the following:

1. I pulled off as many points (time and frequency values) from each curve as I could. The GRAM software has a feature that allows you to move the cursor to any point on the spectrogram and read the coordinates of that point.
2. I put the data into TI graphing calculator lists to plot the data and do some curve fitting.
3. Using the calculator functions, I determined the slopes of the individual curves for comparison.

The resulting graphs are shown on the next page. The result of the analysis is that the slope of the second curve is one half of the slope of the first, within the tolerance of the data taken from the spectrograms. I did a similar analysis on other whistlers on this mission and others and each time the whistlers from the same session had the same slopes.



Graph from a TI graphing calculator. The whistler is at the bottom, the echo is the top graph.

This analysis raises some questions:

1. Is there an algorithm that describes the speed versus frequency relationship through different media for VLF waves?

2. Can the above algorithm be used to determine the distance of travel of a signal based on the slope and length of a whistler in relation to the frequency?

What is LoScrittoio.it and Why Does it Exist?

By Flavio Gori, Florence ITALY
INSPIRE European Coordinator

LoScrittoio.it is an old project of mine as a web magazine that a small group of friends is helping to become a reality. We like to read and write about investigative science, each of us in a specific field of research. We decided to write some pages every month and put them on **LoScrittoio.it**. In few days it will appear on the web at: **http://www.loscrittoio.it**

Who we are?

- **Flavio Gori** is an Inspire Project member since 1992, as well as Inspire Journal contributor, he will hold the Publisher/Editor position, beyond writing about the Very Low Frequency subject;

- **Veronica Capasso** is a Journalist for an important daily newspaper here in Italy. She'll write about Archeology, her great interest;

- **Stefano Ceccatelli** is a teacher of Philosophy and will tell us about the Philosophy of Science;

- **Federica Donati** is an English language teacher. She, too, is interested to Astronomy and moreover, she'll be extremely useful translating information from English to Italian, as well as keeping good contact with researchers, journalists, students and teachers from all over the world, who share the same ideas working over the same subjects.

- **Laura Gori** is a Mathematics and Astronomy teacher and will write about the those subjects;

LoScrittoio.it is dedicated to good science, or what we feel is good science, the Galileian one. We'd like write about the basics of science: not too high level (only a few people can understand and they don't need us to know their subjects), or too low (many journals are dedicated to the low end, while people who read these can't really understand if what they are reading is true or not). Moreover we'll write about the history of some subjects (i.e. math), the way they have developed, if they have had any alternatives, why they were refused or why they were accepted (at all or in part).

All of us will write about professional and amateur research. Especially when they are working together, as the **Inspire Project** has demonstrated, can be done. This kind of research, made in a serious and correct way, may drive research to important results, also in some new

point of view, not the same as the classical system, though starting from very strong scientific base.

We also think that usual phenomenon, that happen every day, may appear as normal for people not involved in any way in the scientific research, though the same people may not be able to explain anything about it. So we decided to offer web space to these areas too: talk about normal phenomenon that "nobody" can say why and how they are. Just one simple example: why winter is colder than summer (in northern hemisphere, while on the contrary in the southern one)?

Philosophy of the science is with us because we believe that it can still bring a very important help to the scientific and technical subjects, as happened in the first 30 years of the last century. Physics has many thanks to say to Philosophy. In the same way we like to say a warm welcome to Archeology because we don't want to forget where we come from and what our grandfathers have made before to arrive at the present (how our technology have changed during millions of years). At the same time we'd like to understand if all of our tech-history is clear for sure, in the scientific way, or maybe something needs to be studied in a deeper way, in our past not only in the present and future.

An important thing to emphasize: journalists should not give solutions to their readers before explaining the problems. Too often in newspapers and general magazine, we read about great solutions to problems that nobody realizes we have. These solutions at no cost are useful to nobody. It should be right to inform nonscientist readers about what is going on, otherwise who needs the solution if no one knows there is a problem?

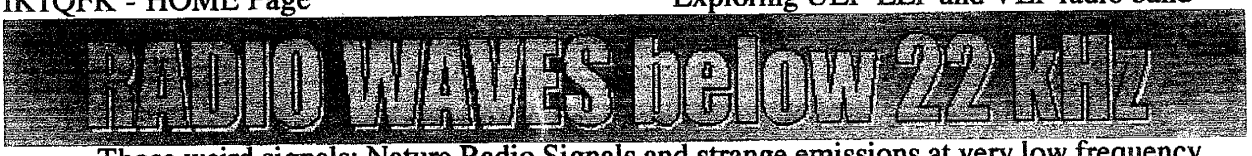
Beyond the contributors as said before, we hope there will be with us a larger group of researchers, worldwide, in our fields as well as in different ones, who would like to be part of our project, in an occasional way. We Inspire members will write for **LoScrittoio.it** many times per year, as I hope that some of our articles may appear in the Inspire Journal, both in paper and on the web. In the same way, the Inspire Journal might exchange links with LoScrittoio.it to give European visibility for its contributor and their ideas.

So we'd love to produce a serious magazine on the web. A "web paper" that informs and urges reflections in a calm way, designed for serious people. We hope to find people who are able to produce very strong intellectual battles, without losing human respect for themselves or for the other people, who may not have the same opinion. The human concept of respect has to be our base, especially in these days, when it seems to be an optional way for too many people living in the real world. We don't want disrespect to happen in the virtual world either.

Renato Romero's VLF Web Page

Renato Romero, Cumiana, ITALY
http://web.tiscalinet.it/vlfradio/

IK1QFK - HOME Page Exploring ULF-ELF and VLF radio band



Those weird signals: Nature Radio Signals and strange emissions at very low frequency.
The first WEB OPEN LAB, on the Long Wave topic.
Read OPEN LAB rules and give your free collaboration to this experience!

VLF RADIO SCIENCE OPEN LAB - Main INDEX

Send your comments to the author: reromero@tin.it
 Best view in Netscape and 800x600 monitor set.

INTMINS OBSERVERS

Roster Update

The following is a roster of INTMINS observers including first-time observers. Team number assignments are permanent and will be used to refer to teams in the future. (Unless noted otherwise, all longitudes are West and latitudes are North.)

Team #	Observer	Location	Longitude/Latitude
1	John Lamb, Jr.	Belton, TX	97° 27' 50" / 31° 7' 45"
	University of Mary Hardin-Baylor		
2	Stephen G. Davis	Fort Edwards, NY	73° 29' 30" / 43° 18' 00"
3	Don Shockey	Oklahoma City, OK	97° 40' 5" / 35° 43' 30"
4	Mike Aiello	Croton, NY	73° 46' 45" / 40°
5	Jean-Claude Touzin	St. VitalQuebec	79° 10' / 48° 55'
6	Bill Pine	Ontario, CA	117° 41' / 34° 14'
	Chaffey High School		
7	Dean Knight	Sonoma, CA	122° 33Õ / 38° 21Õ
	Sonoma Valley High School		
8	Mike Dormann	Seattle, WA	123.4° / 47.2°
9	Robert Moloch	Greentown, IN	85° 58Õ / 40° 28Õ
	Eastern Elementary School		
10	Bill Taylor	Washington, DC	77° 2Õ / 38° 54Õ
	INSPIRE		
11	Mark Mueller	Brown Deer, WI	87° 56' / 43° 10'
	Brown Deer High School		
12	Jon Wallace	Litchfield, CT	73° 15' / 41° 45'
13	Bill Combs	Crawfordsville, IN	86° 59' / 40° 4'
14	John Barry	West Lebanon, IN	87° 22' / 40° 18'
	Seeger High School		
15	Robert Bennett	Las Cruces, NM	106° 44' / 32° 36'
16	Leonard Marraccini	Finleyville, PA	80° 00' / 40° 16'
17	Kent Gardner	Fullerton, CA	117° 48' 30" / 34° 12' 13"
18	David Jones	Columbus, GA	77° 07' / 35° 00'
19	Larry Kramer / Clifton Lasky	Fresno, CA	119° 49' / 37° 01'
20	Barry S. Riehle	Cincinnati, OH	84° 15' / 39° 7'
	Turpin High School		
21	Phil Hartzell	Aurora, NE	98° 0' / 41° 0'
22	Rick Campbell	Brighton, MI	83°50'2.7" / 42°16'43.7"

23	Jim Ericson	Glacier, WA	121° 57.91' / 48° 53.57'
24	Paul DeVoe	Redlands, CA	116° 52' / 34° 10'
	Redlands High School		
25	Norm Anderson	Cedar Falls, IA	92° 15' / 42° 20'
26	Brian Page	Lawrenceville, GA	83° 45' / 34° 45'
27	Ron Janetzke	San Antonio, TX	98° 47' / 29° 35'
28	Thomas Earnest	San Angelo, TX	100° 25' / 31° 16'
29	Janet Lowry	Houston, TX	95° / 29°
30	Linden Lundback	Watrous, Sask,	105° 22' / 51° 41'
31	Lee Benson	Indianapolis, IN	86° 3' / 39° 23'
32	Shawn Korgan	Gilcrest, CO	104° 67' / 40° 22'

European observers:

Team #	Observer	Location	Longitude/Latitude
E1	Flavio Gori	Florence, IT	11° 50Õ 18Ó E/ 43° 50Õ 18Ó N
E2	Silvio Bernocco	Torino, IT	7° 12Õ E / 44° 54Õ N
E3	Fabio Courmoz	Aosta, IT	7.7° E / 45.7° N
E4	Joe Banks	London, UK	0° / 50° 52Õ N
E5	Renato Romero	Cumiana, IT	7° 24Õ E / 49° 57Õ N
E6	Marco Ibridi	Finale E., IT	11° 17' E / 44° 50' N
E7	Alessandro Arrighi	Firenze, IT	10° 57' 50" E / 43° 43' 21" N
E8	Zeljko Andreic	Zagreb, Croatia	
	Rudjer Boskovic Institute		
E9	Dr. Valery Korepanov	Lviv, UKRAINE	24° E / 50° N
	Lviv Center of Institute of Space Research of NASU		
E10	Sarah Dunkin	London, England	0° 02' E / 51° 40' N
	University College London		

INTMINS - November/99 Data Analysis Report

by Bill Pine
Chaffey High School
Ontario, CA

The November/99 INTMINS observations marked the tenth session in an ongoing series of operations conducted with the cooperation and assistance of the Russian Space Agency (IKI) and ENERGIA, the Russian space engineering organization. INTMINS is an attempt to detect manmade VLF radio waves emitted by instruments on the MIR Space Station.

INTMINS Status Report

Because the MIR space Station was unmanned last fall, operations could only be scheduled for parts of the orbit near Russia. This allowed operation of the electron gun only over Europe and the Western United States. A reduced schedule of operations was planned with this constraint in mind. The orbit was stable enough to allow the schedule to be conducted without alteration.

The bottom line of the analysis remains unchanged: the VLF signal from the pulsed electron beam was not detected on the ground. This is not an unsurprising result since theoretical calculations of the signal of the power of ISTOCHNIK when propagated to the ground place the signal strength at just about the same as the background of natural VLF. We will continue with INTMINS as long as the Russian Space Agency (IKI) and MIR are able to provide observing opportunities for us. It is beginning to look like (even to an optimist!) the beam strength of ISTOCHNIK is inadequate to propagate a VLF signal to the ground that can be detected by our receivers. In the future, perhaps on the International Space Station, maybe a more powerful electron gun will be available for us to use in this ongoing investigation.

Data Analysis Procedure

The data analysis procedure used consisted of the following:

1. A sound file was created of the 2-minute period of ISTOCHNIK operation.

2. A spectrogram image was made of this file using a frequency range of 0-22.05 kilohertz so that the 12-15 kilohertz range could be examined for the presence of Russian Alpha navigation signals. The 1 kilohertz region of the spectrogram was examined for the 10 seconds on, 10 seconds off signal from ISTOCHNIK.

3. A one-minute portion of the file was cropped, enlarged and an image made using a 0-11.025 kilohertz frequency range. Again the 1 kilohertz region of the spectrograph was examined.

4. Finally, a 30-second portion was cropped, enlarged and an image made. A final examination of the 1 kilohertz region was made.

5. Additional sound files and spectrogram images were made of items of interest noted in the logs.

INTMINS-November/98 Operations Summary

(NOTE: All times are UT on the date indicated.)

European Passes

Pass	ISTOCHNIK Start Time	Path during ISTOCHNIK Firing	Number of Observers Recording Data
E20-1	1532	Croatia	
E20-2	1709	Russia, south of Moscow	
E20-3	1838	England	
E20-4	2013	England	
E21-3	1548	Northern Italy	1
E21-4	1728	Croatia	
E21-5	1901	Russia, south of Moscow	
E27-1	1254	Central Italy	1
E27-2	1433	Russia, south of Moscow	
E28-1	1312	Northern Italy	1
E28-2	1451	Russia, south of Moscow	
E28-3	1624	Croatia	

North American Passes

Pass	ISTOCHNIK Start Time	Path during ISTOCHNIK Firing	Number of Observers Recording Data
20-5	2301	So. CA	
21-1	0522	WA	1
21-2	0659	No CA, So CA	2
21-6	2319	No CA, So CA	1
22-1	0056	WA	1
27-3	2025	So. CA,	
28-4	2043	No CA	2
28-5	2219	WA	1

Summary of European Passes Recorded

Team/Pass	E20-1	E20-2	E20-3	E20-4	E21-3	E21-4	E21-5	E27-1	E27-2	E28-1	E28-2	E28-3
E5					x			x		x		

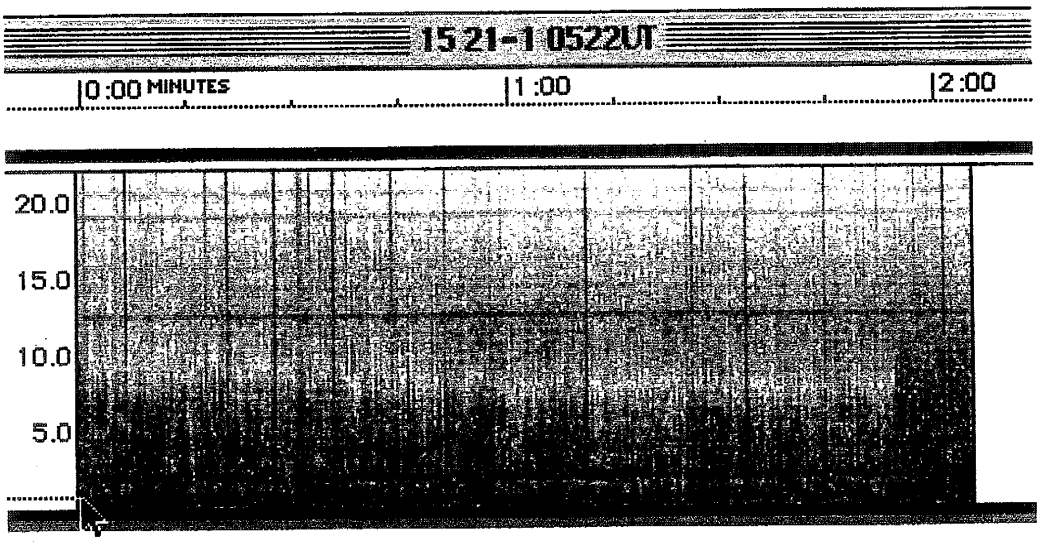
Summary of North American Passes Recorded

Pass	11/20	11/21			11/22	11/27	11/28	
	5	1	2	6	1	3	4	5
Team								
7			x	x			x	
15		x	x				x	x
30					x			

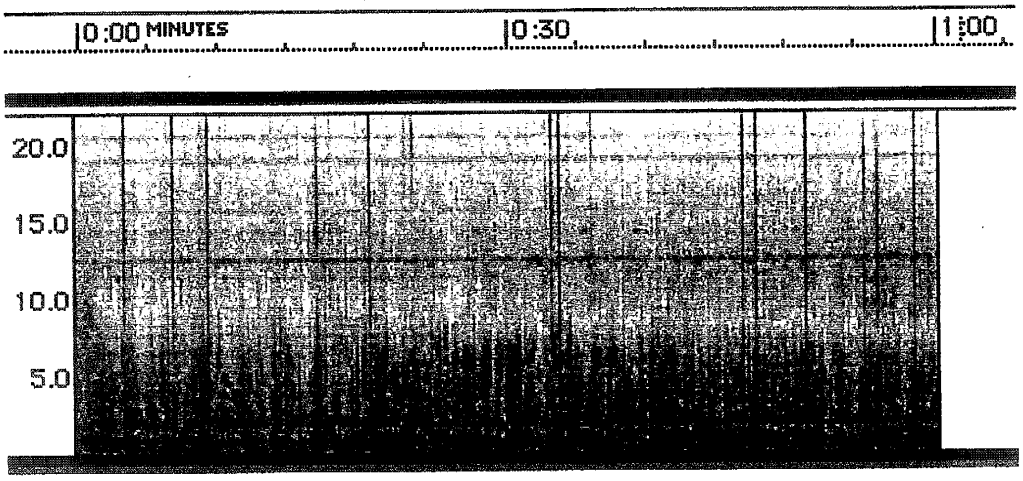
INTMINS Data

The following spectrograms are taken from data tapes submitted by INSPIRE observers. The first view shown will be that of the entire two-minute interval analyzed. At the top of the image is the sound filename, which consists of the Team Number, operation number, and the start time of the operation. Subsequent views will be of portions of the first. Use the time scale at the top to determine the length of the view. Unless otherwise noted, the start time of the cropped view is the same as the start time of the operation.

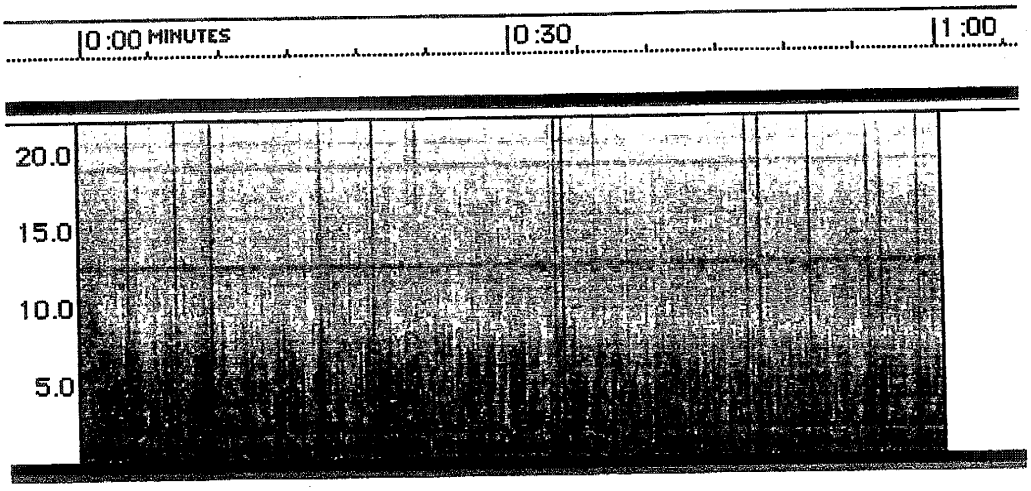
21-1



Team 15 Robert Bennett, Las Cruces, NM. This is a sensitive recording showing dense sferics and tweeks. These are typical late night conditions. The horizontal line at about 13.5 kHz is a manmade signal. The horizontal dashes above and below that line are from the Russian Alpha navigation system (similar to the now-defunct OMEGA system). LORAN is also audible, but the spectrogram signature does not show up on this scale.

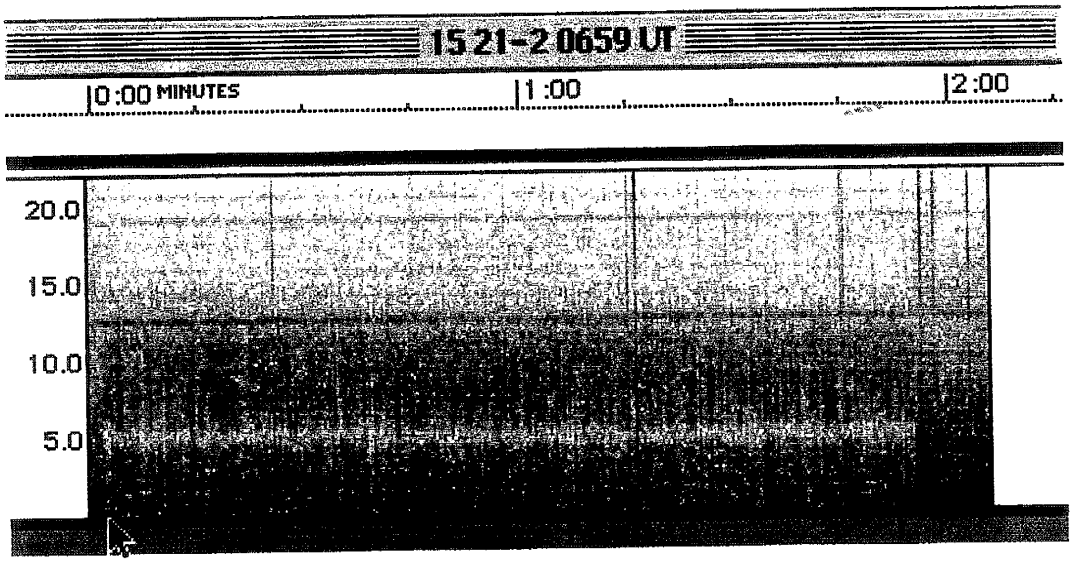


The first minute from above. Alpha dashes are easier to see.

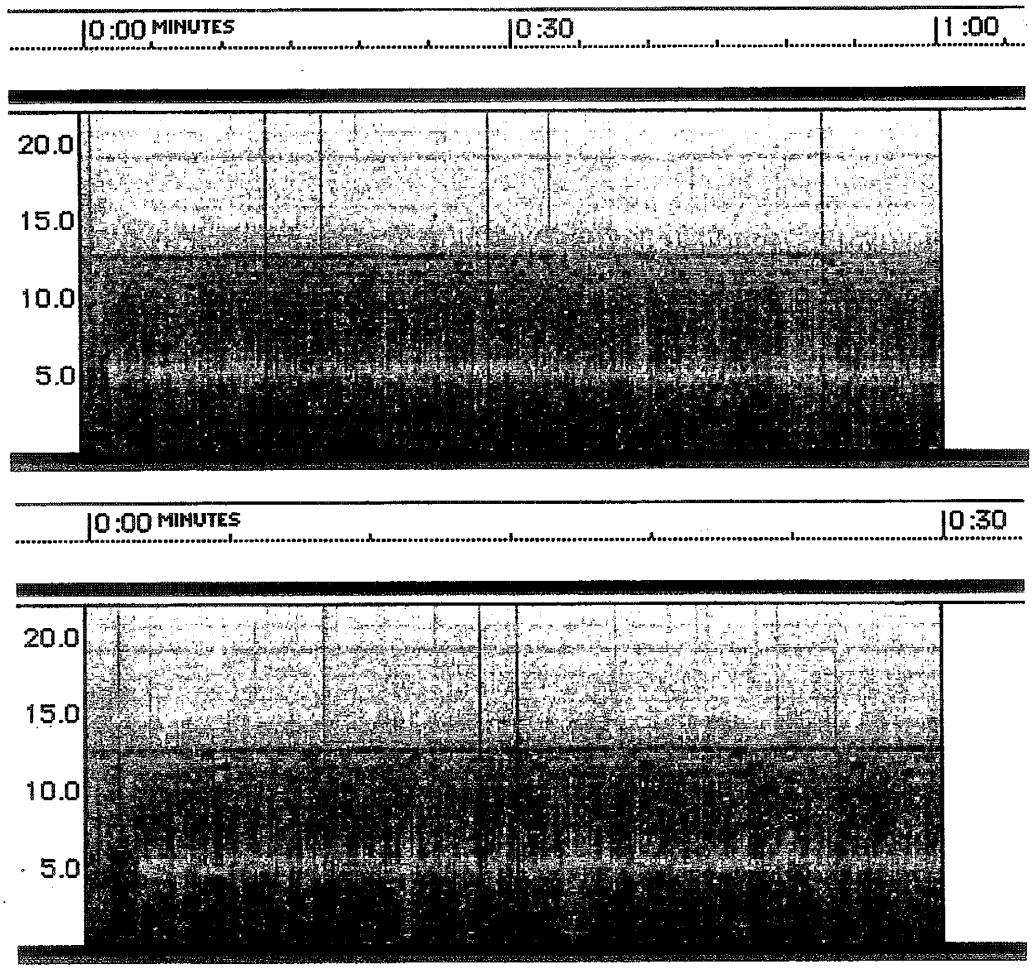


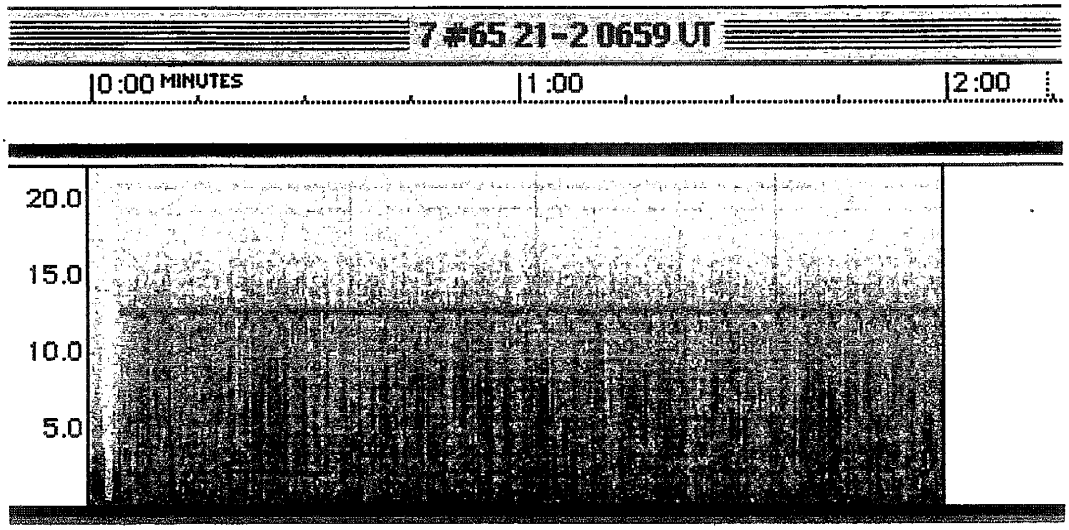
The first 30 seconds. The smudge-like band at about 2 kHz consists of the bottom "hooks" of the tweeks.

21-2

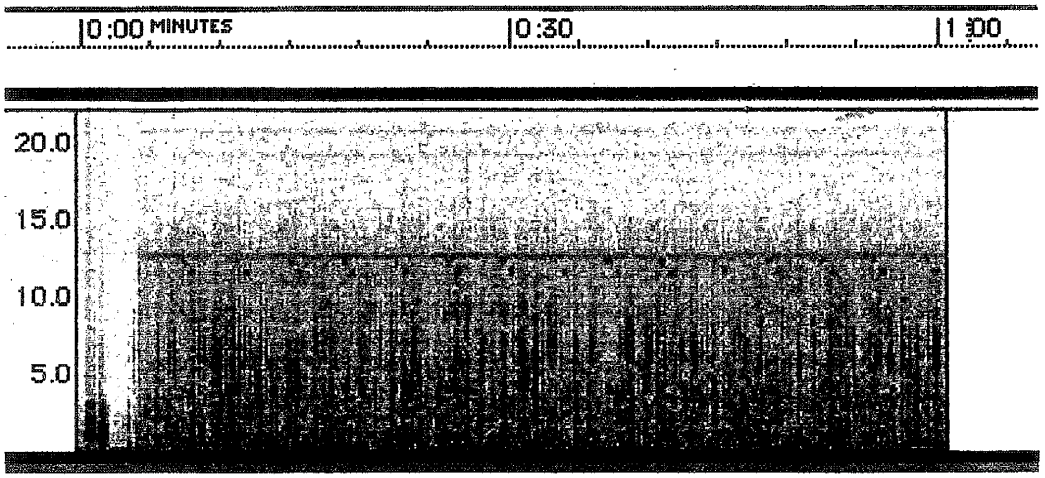


Team 15 Robert Bennett, Las Cruces, NM. Similar conditions remain about 1.5 hours after Operation 21-1. The arrow points to the 0659 UT WWV tone.

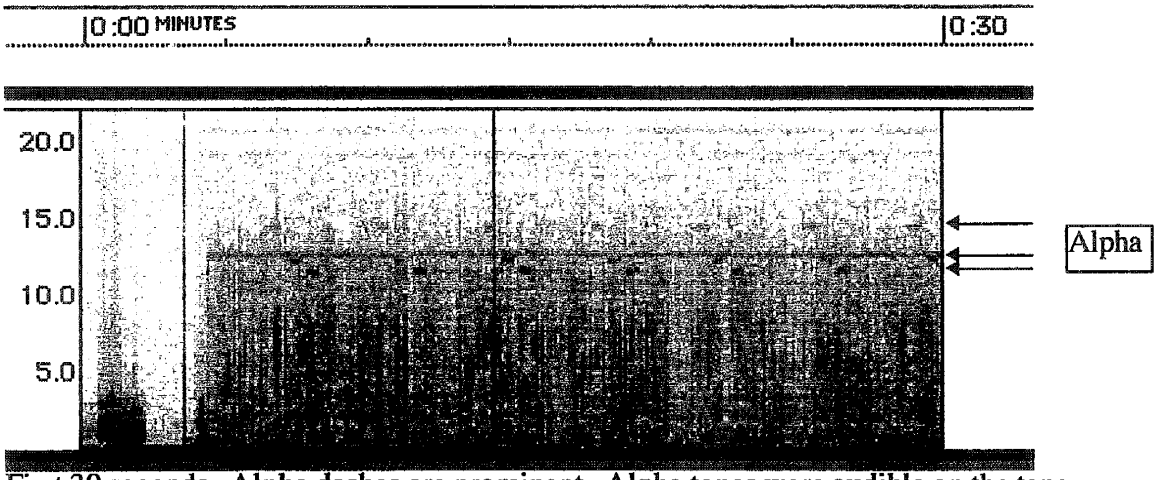

0:00 MINUTES
0:30
1:00
20.0
15.0
10.0
5.0
0:00 MINUTES
0:30
20.0
15.0
10.0
5.0



Team 7. Dean Knight, Sonoma Valley High School, Sonoma, CA. Dean and his students set up 3 RS4 receivers with different antennas and recorders. This is receiver #65 which uses a 91 foot longwire antenna oriented east-west. Note the similarities to Bob Bennett's results from New Mexico.

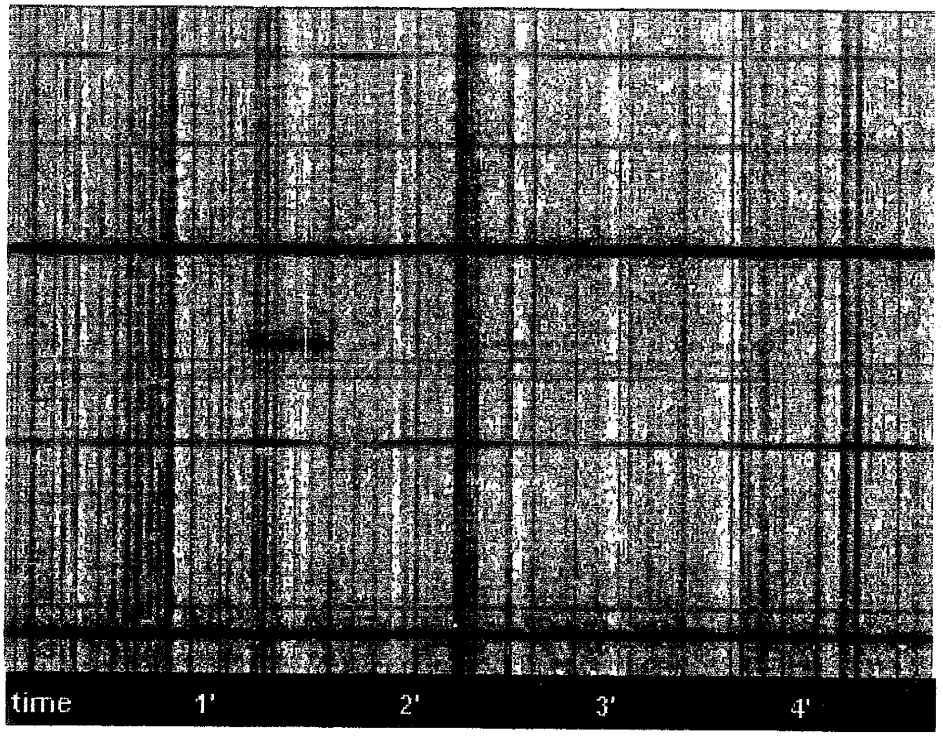


First minute.



First 30 seconds. Alpha dashes are prominent. Alpha tones were audible on the tape.

E21-3



Team E5. Renato Romero, Cumiana, ITALY. Renato analyzes his own data. This is a view that includes the E21-3 operation time and shows a frequency range of 940- to 1122 Hz. ISTOCHNIK signals, if present, would show up as intermittent dashes 10 seconds on, 10 seconds off at 1000 Hz. The horizontal lines are harmonics of the 50 Hz powerline signals. Renato's analysis: "Static noise high; signals at 1025 Hz from power line in vertical field. Periodical noise in horizontal field. Nothing around 1000 Hz. "