



# The INSPIRE Journal

Volume 9

Number 2

April 2001

## The End of MIR Means the End of INTMINS But Not the End of INSPIRE!

When the MIR Space Station was deorbited, the instruments used for the INTMINS observations, Istochnik and Ariel, came with it. That event marked a definitive end to the 5-year INTMINS Program. While this marks the end of an important and historic phase in the life of INSPIRE, it does not mark the end of INSPIRE.

In this issue of *The INSPIRE Journal*, we give a retrospective view of the INTMINS Project. INTMINS was historic because it represented perhaps the first formal agreement between IKI, the Russian Space Agency, and a private, nonprofit educational/scientific organization, INSPIRE. On Page 11 the original agreement is reprinted. A final roster of all who contributed data to INTMINS is found on Page 16. Finally, on Page 18, is a reprint of the article "Looking Back on INTMINS..."

The Coordinated Observation schedule for April/2001 has been expanded to two weekends – the last two weekends of April. The schedule is found on Page 5.

To further support the Coordinated Observation program, new log forms have been devised. The forms are introduced in an article that appears on Page 22.

The third in a series of articles by Mark Spencer on using a graphing calculator to analyze whistler data can be found on Page 6. On Page 20, Phil Hartzell of Aurora, Nebraska tells us about his brother-in-law, "The First Astronaut from Nebraska".

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## The INSPIRE Journal

Volume 9 Number 2

April 2001

*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:

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## **INSPIRE Workshop Held in San Antonio, TX**

On Monday, February 12, 2001, an INSPIRE workshop was held at O'Connor High School in Helotes, TX, near San Antonio. Teachers from the Northside Independent School District gathered to learn about natural radio and the VLF2 receiver. A second session was held on March 2 when students joined their teachers to learn about The INSPIRE Project and complete assembly of their receivers. Dr. Jill Marshall of Utah State University and Marilyn Koch from Marshall High School organized the workshop. Presenting at the workshop were Bill Pine from Chaffey High School in Ontario, CA, and Bill Lewis from Southwest Research Institute in San Antonio.

Teachers attending included:

Robert Luna	Health Careers High School
Tony Pearson	Holmes High School
Elizabeth Quick	Marshall High School
Kathryn Robinson	O'Connor High School
Cip Munoz	Taft High School
Ray Gonzales	Clark High School

Also attending from the local area were Jim Crawford, Ralph Hill and Jim Hoback.

## **email List of INSPIRE Participants Being Collected**

If you would like to receive notification of the any observing opportunities when they become available, send a message to:

[pine@mail630.gsfc.nasa.gov](mailto:pine@mail630.gsfc.nasa.gov)

## **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.

## 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 "01", then the November issue will be the last under this subscription. If your label shows "02", then your subscription is good through the November 2002 issue. If you have any questions or if you feel that the information shown is incorrect, please contact the editor.

## Experiments With the IMAGE Satellite on Hold

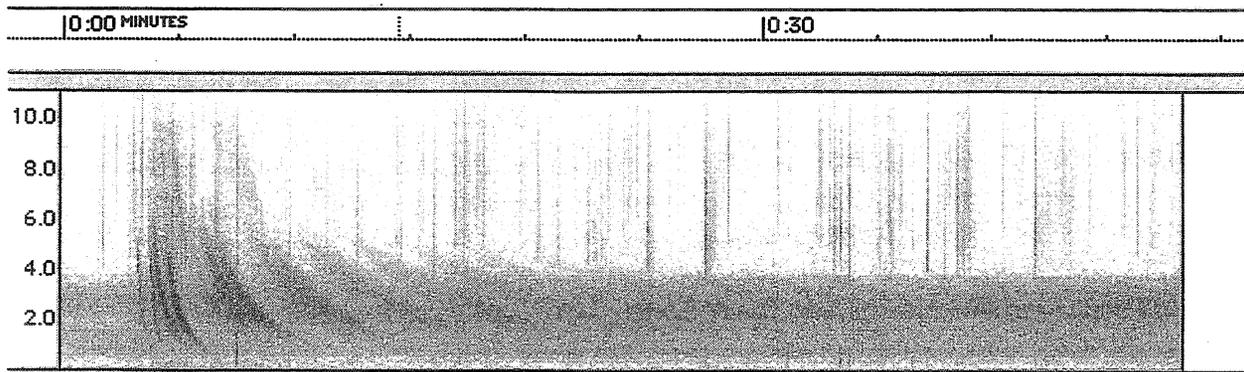
Due to a problem with the transmitting antenna on the IMAGE satellite, proposed attempts to detect the radio signal on Earth during perigee passes have been delayed indefinitely. If you would like to be informed of any observing opportunities, please send your email address to:

[pine@mail630.gsfc.nasa.gov](mailto:pine@mail630.gsfc.nasa.gov)

## The Latest from Shawn Korgan

Just a brief email. I was out Monday night (March 19) and heard some TERRIFIC sounds as I watched the aurora all night into early morning. I figured I would head out again Tuesday night and boy am I glad that I did! Here is just one of the MANY LOUD whistlers I recorded. These whistlers were occurring for at least six hours and were still going strong when I left at 9:30 am this morning. You will be glad you spent the time downloading this whistler! Trust me!

Shawn Korgan  
INSPIRE Team 32



This file starts out with a triple whistler (three whistlers almost on top of one another) followed by multiple overlapping echoes. Notice the cutoff frequency is well below 2 kHz meaning Shawn must have been at ground zero for the entry of the whistlers.

# Coordinated Observation Schedule April 2001

By Bill Pine Ontario, CA

Since INTMINS operations are at an end, Coordinated Observations are now INSPIRE's primary observations. The Coordinated Observation schedule will be expanded to include four dates – the last two weekends of April. All data is welcome and should be submitted even if the conditions are quiet. It is not required that you observe on all four days. Any data you can contribute is valuable. The procedure to use for Coordinated Observations will remain unchanged and will be as follows:

1. Use the Data Cover Sheet and Data Log or data forms of your own design.
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/2001:

Saturday, April 21, Sunday, April 22

Saturday, April 28 and Sunday, April 29

# What Does Dispersion Tell Us?

By: Mark Spencer  
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## ABSTRACT

“Okaaay;.....So What!?” That is a tough question to answer, particularly when it comes from a student. This article is the next installment in my quest to answer that question. In the first installment in the April 2000 INSPIRE Journal, I presented a technique that used a graphing calculator to analyze whistlers. My purpose was to provide a tool that students can use to translate the signal received in the field and displayed on the computer screen in the classroom into a mathematical model that can be studied and analyzed. The second installment in the November 2000 Journal used the graphing calculator analysis tool to test and verify low-frequency and high-density models of whistlers with actual collected data.

In this installment I will first present a shorthand way of determining the dispersion of a whistler using a graphing calculator. Then I will illustrate how a collection of dispersion data can be used to explore and speculate what is happening out there beyond the ionosphere. Read on and let the quest continue.

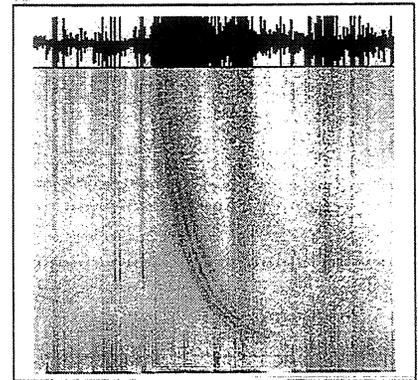
## DISPERSION

The concept that different frequencies of a wave travel at different velocities is defined as the dispersion of the wave. Mathematically, dispersion is defined by:

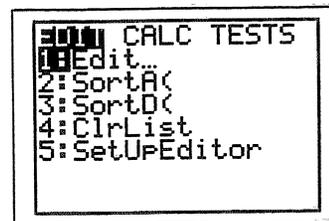
$$D \approx \frac{t}{\sqrt{f}}$$

You can use the following technique on the TI-83Plus graphing calculator to calculate the dispersion of a whistler.

For this illustration I will use the whistler displayed here. From the display program, carefully place the mouse cursor at various locations along the length of the whistler and record the time and the frequency of the cursor location. You should record as many different points as you can but as a minimum, you will need three; I prefer five. Once you have the time and frequency data points, enter them into the graphing calculator **LISTS 1** and **2**.



Press **STAT** to enter the list editor. Select **1** and enter the time data in **L1** and frequency data in **L2**. The time data should be normalized to begin around one second so enter the lowest 3 or 4 digits of the time data (i.e. 17345 absolute time would be entered as either 345 (milliseconds) or 1345 (1.345 seconds) normalized time). Normalizing the time will keep the calculations within the limitations of the calculator and also keep the calculated dispersion consistent between whistlers for future comparison.



You now need to prepare the data for the curve fitting operations. First, convert the milliseconds in **L1** into seconds by dividing the list by 1000. Use the following keystrokes:

L1	L2	L3	3
.863	5502		
.938	4555		
1.063	3456		
1.213	2509		
1.388	1841		
1.638	1281		
1.813	1066		

L3(1)=

**2nd** **1** **÷** **1** **0** **0** **0** **STO** **▶** **2nd** **1** **ENTER**

Next, take the reciprocal square root of the frequency in **L2** and store the result in **L3**. Use the following keystrokes:

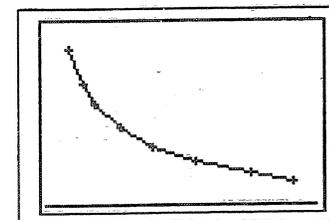
L1	L2	L3	3
.863	5502	.01482	
.938	4555	.01701	
1.063	3456	.01996	
1.213	2509	.02331	
1.388	1841	.02794	
1.638	1281	.03063	
1.813	1066		

L3(1)= .0134815462...

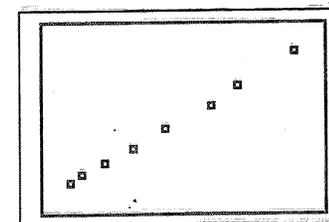
**1** **÷** **2nd** **x<sup>2</sup>** **2nd** **2** **STO** **▶** **2nd** **3** **ENTER**

The resulting table listing should look like this.

You can confirm that your extracted data is close to reality by displaying a plot of frequency (**L2**) on the Y-axis and time (**L1**) on the X-axis. This plot should be similar to the display of the actual whistler. Using the data from the example whistler you will see this display.



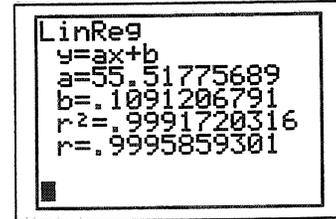
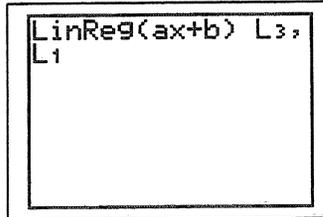
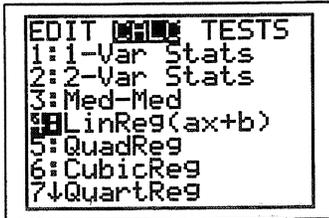
Next, confirm that the data follows the mathematical model for dispersion by displaying a plot of the square root of the frequency (**L3**) on the X-axis and time (**L1**) on the Y-axis. The resulting plot should be linear; the slope is the dispersion. Using the data from the example whistler you will see this display.



## DISPERSION CALCULATION

You can use the curve fitting capabilities of the graphing calculator to determine the slope of the data. Use the following keystrokes to find the function that fits the data of L3 and L1.

**STAT** **▶** **4** **2nd** **3** **,** **2nd** **1** **ENTER**

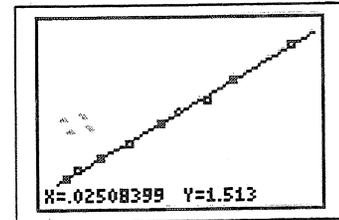


The resulting equation that fits the data is displayed. In this case, the dispersion (slope) is  $a = 55.5$ .

You can confirm the validity of the fitted curve by displaying the curve on the plotted data. Use the following keystrokes:

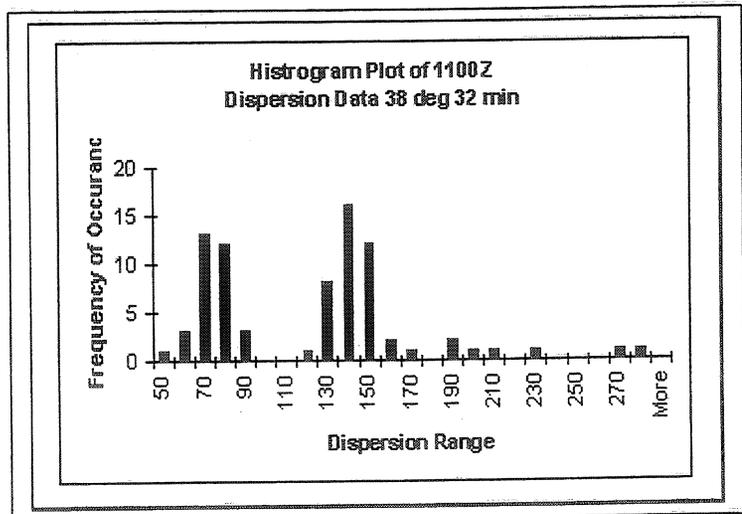
**Y=** **CLEAR** **VARS** **5** **▶** **▶** **ENTER** **ZOOM** **9**

The resulting display will look like this.



## EXPLORING WHISTLERS BY OBSERVING THEIR DISPERSIONS

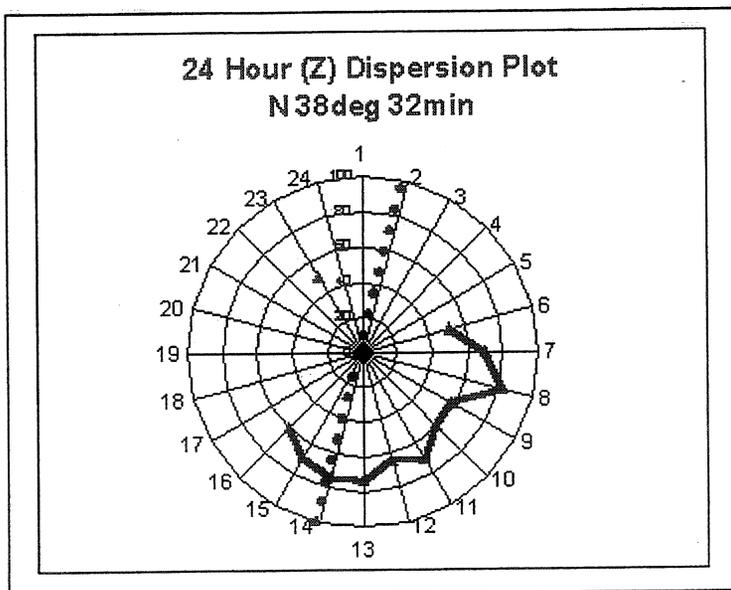
Over time I have collected a few hundred whistlers and calculated their dispersions. I keep a log of the data in an Excel Spread Sheet so that I can manipulate the data. In one analysis I look at the distribution of dispersion magnitudes within one Zulu hour time blocks. This is a histogram of the 1100z time block. You will note there are distinct clusters of whistler dispersions that indicate one, two, etc. hop whistlers. You can validate that these clusters represent multiple hop whistlers



because the dispersion values (proportional to the distances traveled by the signals) are harmonic. The first cluster centers on 70, the second cluster (harmonic) centers on 140, the

third cluster centers on 210, the fourth cluster centers on 280 (all multiples of 70). It stands to reason that one and two hop whistlers would be the strongest signals received, and therefore more prevalent, due to the shorter distances traveled (and less signal loss).

Another interesting way of looking at the accumulated data is to compare average dispersions within Zulu hour time periods over the 24 hour day. In this polar graph, the average one-hop whistler dispersion is plotted radially around a 24-hour period. The dotted, heavy line from 2 Zulu to 14 Zulu indicates the day/night terminator line at this longitude. There is a noticeable lack of whistler data when the ionosphere is energized (a few hours after sunrise until well after sunset). This is due to the absorption/reflection of potential whistler generating signals.



There appears to be an hourly variation in dispersion. I tentatively speculate that the variation in dispersion is due in part to solar wind distortion of the earth's magnetosphere. Logically this distortion would elongate the areas of the magnetosphere that are tangential to the solar wind vector and down-wind at higher latitudes, compress the areas of the magnetosphere that are up-wind and frontal to the solar wind vector, and have lessened effect on areas of the magnetosphere that are down-wind and shielded from the solar wind by the earth's disk (at my low latitude). My speculation is very tenuous because there are many uncontrolled variables that contribute to variation in the dispersion that have not been accounted for by this elementary analysis.

### WHAT'S IN THE NEXT INSTALLMENT?

I plan to collect data over a number of 24-hour periods when the opportunity arises. This collection strategy should minimize the effects on dispersion by changes in electron density and variations in solar wind velocity, leaving only the effect of solar wind and the earth's orientation to the solar wind vector. A similar polar display of dispersion variation as done above should prove interesting.

Happy Listening.

# INTMINS is Over: Looking Back

By Bill Pine  
Ontario, CA

When Mir was launched, the planned life span of the space station was five years. Fifteen years later, Mir has reached the end of its mission. During this time, tremendous strides were made in space research. One area, of course, is the effect on humans of extended exposure to weightlessness. Another important area is space physics research.

Instruments on Mir were used to investigate the behavior of electromagnetic waves in the space plasma near Earth. A pulsed electron gun, Istochnik, was operated on Mir and the resulting electromagnetic waves were detected and analyzed by another satellite called Interball located at the opposite end of the magnetic field line passing through Mir. Another instrument, a plasma generator called Ariel, was also used in similar experiments. The lead scientist of this effort is Stanislas (Stas) Klimov, Head of the Laboratory for Electromagnetic Emissions Investigation of IKI (Russian Space Research Institute).

William (Bill) Taylor, co-founder of The INSPIRE Project, Inc., is a long time friend and colleague of Stas. About 6 years ago the two of them began discussing the possibility of conducting space to ground experiments in addition to and in conjunction with the experiments of Interball. The end result of these discussions is the program known as INTMINS (Interball-Mir-Inspire).

A formal agreement was drawn up and signed in 1995. A signatory on this agreement was Academician Albert A. Galeev, the Director of IKI. Other members of the Russian space science community have also been instrumental in the success of INTMINS. Yuri Lissakov, a senior researcher at IKI, coordinated the parts of the INTMINS program. Victoria Prokhorenko, a senior scientist at IKI, assisted in the planning and the communication of the schedule with Mir. She was especially helpful on those occasions when the schedule had to be modified on short notice to bring the ground track into agreement with the plan. Oleg Prokhotelov of the United Institute of Physics of the Earth was also helpful.

INSPIRE owes a debt of gratitude to all of our Russian colleagues who were so helpful. We look forward to continuing our association with them and all space scientists everywhere.

On the following pages you will find:

- Page 11      A reprint of the INTMINS agreement from the May 1995 *Journal*.
- Page 16      The final roster of INTMINS observers.
- Page 18      A reprint of the article "Looking Back on INTMINS..." from the April 1999 *Journal*.

## INTERBALL-MIR-INSPIRE AGREEMENT

### OBJECTIVES OF PROJECT

INTERBALL is a Russian space physics program to investigate the physics of magnetosphere processes. It has two satellites, Tail Probe and Auroral Probe. Each probe has a subsatellite. MIR is the Russian space station, currently in orbit. INSPIRE is a project to interest students in science and technology by making it possible for them to observe very low frequency (VLF, 3 to 30 kHz) radio waves. INTERBALL-MIR-INSPIRE (INTERMI) is a planned joint IKI/INSPIRE space physics research project, based on the Mir-INTERBALL program which is planned to start after the Tail Probe launch in June 1995. INTERMI will perform coordinated activities of MIR, INTERBALL, and INSPIRE.

The scientific objectives of MIR-INTERBALL are to:

- Study the interactions between the ionospheric plasma and the injected plasma and electrons.
- Understand the dynamics of the injected, artificial plasma in the ionosphere
- Investigate the initial phase of plasma instabilities, the resulting electromagnetic emissions and their propagation in the ionosphere, magnetosphere, and atmosphere
- Investigate effects of wave particle interactions

INSPIRE is a scientific/educational project to bring the excitement of observing natural and manmade VLF radio waves to students. Underlying this objective is the conviction that science and technology are the underpinnings of our modern society and that only with an understanding of science and technology can people make correct decisions in their lives, public, professional, and private. Stimulating students to learn and understand science and technology is key to them fulfilling their potential in the best interests of our society. INSPIRE also is an innovative, unique opportunity for students to actively gather data for basic research projects, such as INTERMI.

### DESCRIPTION OF INTERMI EXPERIMENTS

Ariel and Istochnik instrumentation on the MIR station will inject plasma clouds and beams of electrons into the ionospheric plasma. Experiments will be performed to determine the effects of the injection angle with respect to the earth's magnetic field lines. Using plasma and wave instruments of the INTERBALL project and the observations of the VLF radio waves on the ground from the INSPIRE project, the scientific objectives listed above will be met.

## INSTRUMENTATION DESCRIPTION

An electron gun (Istochnik) and plasma pulse generators (Ariel) have been installed on the KVANT module of MIR. Istochnik and Ariel are now being used in conjunction with the Freja satellite. In mid-June the Space Shuttle is to dock with MIR, and it is proposed that Istochnik and Ariel be operated after the docking. The INTERMI project will plan injector operations in June over the US, so that INSPIRE participants can attempt to receive the VLF waves that may propagate to the ground.

Details of the MIR instrumentation are given in Annex 1, INTERBALL instrumentation in Annex 2, and INSPIRE instrumentation in Annex 3.

## SCHEDULE

<u>Item</u>	<u>Planned Date</u>
Launch of STS-71	May 24, 1995
Shuttle docking with MIR	Late May, 1995
Launch of the Tail Probe and its subsatellite	June 8, 1995
First period of MIR-INSPIRE operations	June 15-30, 1995
Possible meeting to discuss MIR-INSPIRE results	August/September 1995
Second period of MIR-INSPIRE operations	October 1995
Third period of MIR-INSPIRE operations	To be determined
Launch of the Auroral Probe and its subsatellite	March/April 1996

## AGREEMENT

IKI and INSPIRE will make their best efforts to fulfill their obligations under this agreement, recognizing that resources to meet them may not be available.

The following factors will be taken into account for selecting time periods of the experiment operations:

- The MIR station must be above the US or on a magnetic field line in the southern hemisphere that passes through the US.
- Experiments will be preferably performed during the day.
- Experiments should be performed during undisturbed conditions in the ionosphere.
- The time schedule of the other global geophysical projects, e.g. the International Geophysical Calendar's Regular World Day (RWD), Regular Geophysical Day (RGD) and Incoherent Scatter Coordinated Observation Day, will be considered.

IKI will:

- Schedule experiment operations as early as possible.
- Inform INSPIRE of the experiment operations, as soon as they are scheduled, by electronic mail, including the Universal Time, geographic latitude, and geographic longitude of the start and stop times. If possible, plots of the orbit during operations will be sent by facsimile.
- Report the start and stop times of actual experiment operations to INSPIRE.

INSPIRE will:

- Publicize INTERMI in the INSPIRE Journal and elsewhere, and recruit INSPIRE observers.
- Notify INSPIRE observers of upcoming experiment operations.
- Provide selected recordings of INSPIRE observations during experiment operations to IKI.

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A. A. Galeev  
Director, IKI

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W. W. L. Taylor  
President, INSPIRE

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S. I. Klimov  
Project Scientist

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W. E. Pine  
Secretary/Treasurer, INSPIRE

## Annex 1. MIR Instrumentation

The main technical parameters of Ariel and Istochnik are given below.

### Ariel (Plasma pulse generator)

Power consumption	130 watts
Maximum current	10 amperes
Pulse duration	10 E-4 seconds
Pulse repetition frequency	10 seconds
Source material	BaCl
Discharge channels:	
Electromagnetic channel (-Y axis)	
Ejection velocity	15 kilometers per second
Number of Ba ions in pulse	10 E 18
Total number of Ba ions	>10 E 19
Electron temperature	2-3 eV
Specific ionization	10%
Plasma density in jet	10 E 18 per cubic cm
Jet divergence	30 degrees
Thermal channel (+Z axis)	
Ejection velocity	3 kilometers per second
Number of Ba ions in pulse	5 x 10 E 18
Electron temperature	1-2 eV
Specific ionization	10%
Plasma density in jet	5 x 10 E 18 per cubic cm
Jet divergence	70 degrees

### Istochnik (Electron gun)

Electron energy	10 keV
Pulse duration	4 microseconds
Pulse current	0.7 amperes
Pulse frequency	10,140 and 1000 Hz

The experiment will be performed when the electron beam plasma blobs can be injected approximately along or perpendicular to the earth's magnetic field. There are three modes of operation of the instruments. The first two have different sequences of alternating plasma injections between the electromagnetic channel (-Y axis, approximately perpendicular to the magnetic field) and the thermal channel (+Z axis, approximately parallel to the magnetic field). The third mode, using the electron gun, will probably be the most likely to be observed on the ground. The pulsing frequency of 1000 Hz will generate plasma waves at 1000 Hz and its harmonics (2000 Hz, 3000 Hz, etc. . .). The harmonics are in the pass band of the INSPIRE VLF receiver.

## Annex 2. INTERBALL Instrumentation

### TAIL PROBE AND SUBSATELLITE SPACE PHYSICS INSTRUMENTS

Electromagnetic fields and waves	0 to 1.5 MHz
Particles	
Electrons	.01 to 400 keV
Protons	0 to 1000 keV
Ions	0 to 100 keV/Q
Xrays	2 to 200 keV

### AURORAL PROBE AND SUBSATELLITE SPACE PHYSICS INSTRUMENTS

Electromagnetic fields and waves	0 to 240 kHz
Ion beam source	1 to 10 microamperes
Particles	
Electrons	0 to 400 keV
Protons	0 to 350 MeV
Ions	0 to 500 keV/Q
Optical	
Auroral emissions	130 to 160 nm
Xrays	2 to 200 KeV

## Annex 3. INSPIRE Instrumentation

The VLF or INSPIRE receivers are high input impedance, band limited audio amplifiers with electric field (whip or long wire) antennas. They are sensitive to frequencies from about 3 kHz to 15 kHz. The lower frequency cutoff is to reduce the effects of noise from power lines, both the fundamental frequency (60 Hz in the US) and its harmonics (120 Hz, 180 Hz, . . .). The upper frequency cutoff is to reduce noise from man made radio transmitters. Other receiver/antenna combinations are also in use, such as the magnetic field antenna/receiver designed for the ACTIVE project. Data from the VLF receivers is recorded with a portable tape recorder. Time announcements or recordings of WWV (the US time standard short-wave radio station) provide coarse (within a few seconds) timing. More accurate timing can be achieved using the signals of the OMEGA (the 10 to 15 kHz radionavigation beacons which are recorded with the data on the tape) stations. Some information can be achieved by listening to the tape, but the best way to analyze the data is by making spectrograms from the data. Spectrograms are frequency time plots of the data, with intensities, at a frequency and time coded as colors in the z axis of the plot.

# INTMINS OBSERVERS

## Final Roster – April/2001

This is the final roster including all who have contributed INTMINS observations during the five and one half year lifetime of INTMINS. New team numbers will be established starting with the April/2001 Coordinated Observations.

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

Team #	Observer	Location	Longitude/Latitude
1	John Lamb, Jr. University of Mary Hardin-Baylor	Belton, TX	97° 27' 50" / 31° 7' 45"
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. Vital, Quebec	79° 10' / 48° 55'
6	Bill Pine Chaffey High School	Ontario, CA	117° 41' / 34° 14'
7	Dean Knight Sonoma Valley High School	Sonoma, CA	122° 33' / 38° 21'
8	Mike Dormann	Seattle, WA	123.4° / 47.2°
9	Robert Moloch Eastern Elementary School	Greentown, IN	85° 58' / 40° 28'
10	Bill Taylor INSPIRE	Washington, DC	77° 2' / 38° 54'
11	Mark Mueller Brown Deer High School	Brown Deer, WI	87° 56' / 43° 10'
12	Jon Wallace	Litchfield, CT	73° 15' / 41° 45'
13	Bill Combs	Crawfordsville, IN	86° 59' / 40° 4'
14	John Barry Seeger High School	West Lebanon, IN	87° 22' / 40° 18'
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 Turpin High School	Cincinnati, OH	84° 15' / 39° 7'

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° 50' 18" E / 43° 50' 18" N
E2	Silvio Bernocco	Torino, IT	7° 12' E / 44° 54' N
E3	Fabio Courmoz	Aosta, IT	7.7° E / 45.7° N
E4	Joe Banks	London, UK	0° / 50° 52' N
E5	Renato Romero	Cumiana, IT	7° 24' E / 49° 57' N
E6	Marcò 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			

## Looking Back on INTMINS ...

by: Dean Knight, Sonoma, CA  
Jack Lamb, Belton, TX  
Bill Pine, Ontario, CA

With the approach of the end of the MIR Space Station, we also approach the end of the INTMINS operations. Several participants have contributed thoughts on the value of the INTMINS operations and the future of this type of scientific investigation. Similar contributions are solicited from any other *INSPIRE* participants. Another article "Looking Back on INTMINS..." will be published in the next *INSPIRE Journal*.

**Dean Knight, Sonoma Valley High School, Sonoma, CA**

If I were to list the primary contributions of INTMINS, it would be a statement that included two parts: one for my students and one for international cooperation.

First and foremost is that for my students. The chance for the students to do real science in a relaxed, fun, exciting situation that involves a bit of hiking (both daytime and night), a bit of involvement with technical apparatus (other than a TV or computer), a bit of camaraderie (quite a bit), a bit of careful observation, a bit of new ideas (both up on the mountain-our radio site- and back in the classroom), a bit of continuity (we have been involved with this for a while, and this year we had a group of senior students who had been involved as freshmen as well as present freshmen students who had participated with their older brothers or sisters several years back), and a bit of a chance for students to claim on resumes that they have been involved in an international physics study. (There have also been a few perks for the school to be involved in such a project--actually at this point it may surprise some that this is our last year with the project as it is now configured--hard to believe!) Needless to say, I hope that every effort will be taken to continue the study in a meaningful international way.

The second part (the international cooperation one) has advantages that speak for itself. YES, I think an experiment like INTMINS should be included in the International Space Station, but I hope we don't wait until the Station is available- we need to occupy the intervening years with another project. Coordinated observations are, of course, a possibility, but I personally would like to see a project that would continue to more directly involve the Russians. I really think this is important. Maybe there is something significant that can be done. Thanks for keeping the project going.

**Jack Lamb, Belton, TX**

So far, I think INTMINS' contribution to science has been minimal since I am not aware of any discoveries that resulted from our work. The fact that we have worked with MIR in this study is a fine example of international cooperation in science. Perhaps it will lead to more such cooperation in the future.

My wife and I have enjoyed getting out to our quiet site to record the various operations. We wish we knew more about what we were doing, but we are happy to know we are contributing something to a project that we feel is very worthwhile. My grandson is not as excited about standing around listening to static. A few minutes is enough for him. He always brings a book to read while I stand around and listen to static. It is nice to have him there anyway in case something goes wrong.

The value of INTMINS is not entirely clear to me. It has certainly been a valuable experience for me and, hopefully, for all other participants to be part of a team that spans the globe. It is interesting to see the graphs of our data we send in. I am beginning to understand what the dark marks mean. I hope we discover something dramatic (maybe even useful) before MIR burns up in the atmosphere next year. INTMINS should certainly be included in the International Space Station so we can continue our research. Hopefully, the novelty of the new space station will attract more members for our team.

I mentioned a global team above, but have noticed, in particular, that there are no Russian observers as far as I know. I hope that will change soon. I wonder if we would benefit from observers in the southern hemisphere? Now that we are on line, perhaps we can make ourselves known to more people in the world so that they can consider joining us.

I hope there reflections on the past and wishes for the future are helpful for your retrospective article in the April, 1999 issue of *The INSPIRE Journal*. I am looking forward to reading it.

**Bill Pine, Chaffey High School, Ontario, CA**

I have been involved with natural VLF radio observations for the past 10 years. I have taught physics for the past 25 years, so I am in a position to compare the physics curriculum with and without VLF radio observations. Even though the radio observations occur outside the normal school day and outside the formal physics curriculum, participation in INSPIRE activities has had a positive impact on both my students and me. INTMINS, as the latest example of INSPIRE activities, is a prime example of that positive influence. There are many good things about being involved in something like INTMINS:

1. Spending time off campus with students allows everyone to get better acquainted - both with the teacher and with each other. Lasting friendships have been forged between students who might not otherwise have even met. The times riding up the mountain and back down are very pleasant and the feeling of accomplishment after successfully meeting an operation schedule is something to be proud of.

2. Meeting a schedule like that of INTMINS is an important activity for students (and teacher). In the school system, the emphasis seems to be less on encouraging students to be responsible and more on constantly giving them second chances. With INTMINS, if the team is late, MIR does not wait! Your "second chance" may not come for another six months. Students do a pretty good job of meeting their time obligations, but when they do not, they find that the "bus" has left and they miss out. This is a good experience for them especially since the only consequence is that they miss out.

3. Finally, INTMINS has a positive impact on physics enrollment and attitude. Each year several students who might not have taken physics otherwise enroll in physics. The enthusiasm and positive attitude of the students involved in INSPIRE is a good example for other students to follow - and some of them do!

I don't know what the physics program at Chaffey High would be like without INSPIRE and INTMINS, but I strongly believe that it would not be as good.

# First Astronaut From Nebraska

By Phillip D. Hartzell  
Aurora, NE

Hello Fellow Listeners:

The last year or so have brought some changes in my day-to-day activities. This has limited my VLF experimentation, and as a result I have missed several of the scheduled recording sessions. I expanded my business on Dec 19 1999. I sold my existing shop and on that date made the move to a larger location. My business is custom auto upholstery. Previous to that event, I married Lorie Anderson on May 29 1999. Being married to Lorie is a great deal, but at that time I also became brother-in-law to Clayton Anderson, the first astronaut from the state of Nebraska.

Clay was born in Ashland, NE and spent all of his life growing up in this small community of about 2000 in population. He was a typical kid, lots of athletics and play. Clay was never really that interested in space, until his mom woke him, his brother Kirby and sister Lorie at 3 am to see one of the Apollo missions photograph the backside of the moon. Clay stated "That was kind of cool, Mom" and went back to sleep. That experience ate at him some, and he thought someday he might like to become an astronaut, but he would rather play basketball instead.

Clay graduated from Ashland High School and headed to Hastings College (in Nebraska) to study something and play ball. His heart for space was rekindled and he decided to study physics and engineering. He graduated from Hastings College in 1981 and quickly received a chance for an internship over the summer at NASA in Houston. As an intern he worked on data analysis systems with various flight and space simulators. His next step was to receive his masters degree in 1983 in aerospace engineering from Iowa State. (Yes, he is still a Nebraska Cornhusker!). He applied for the astronaut training at that point but they gave him other duties to attend to while at Houston. He vividly remembers his lowest point was the Challenger accident in 1986. He gets teary eyed when he recalls how stunned and shocked the people were on that tragic day.

Clay was finally accepted for training in June of 1998. He graduated with the 17th astronaut class, one of 31 men and women. The 17th class has chosen the penguins as their mascot, the reason being is that "penguins will never fly". Quite a sense of humor! At the present time Clay has been working on engineering and data involved with the new Space Station. He has spent several weeks in Nebraska speaking at various schools and organizations. Clay hopes to receive a mission on the shuttle very soon. If all goes as planned he will likely get some serious time on the Space Station in the next 5 to 8 years. His wife Sue has reservations about Clay being gone several months at a time, but she understands as she is a NASA employee herself, working as a liaison with the Russian Space Agency. Clay and Sue have one son Cole, who is five. They are expecting their second child in March. It has been a lot of fun to be married into the Anderson family. We all hope to see Clay in orbit very soon.

Happy Listening.

Phil

(Reprinted from the Lincoln Journal-Star, Lincoln, NE)

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THURSDAY, JULY 13, 2000  
LINCOLN, NEBRASKA



# Space odyssey starts in Ashland



---

## Clayton Anderson, astronaut candidate

**Age:** 41

**Hometown:** Ashland

**College:** Physics degree, Hastings College; master's, aerospace engineering, Iowa State

**Training, NASA roles:** Began work at NASA in 1983 in mission planning, analysis division; has worked with Galileo, Magellan and Gamma Ray Observatory missions; now works with solar and other power systems for shuttle; selected to be astronaut candidate in 1998.

**Goal:** Mission Specialist 2 on space shuttle mission, possibly to space station or Mars.

**Itinerary:** Could fly in space shuttle in five to six years.

---

# Logging INSPIRE Data

By Bill Pine  
Chaffey High School  
Ontario, CA

A feature of all scientific investigations is careful record keeping. A laboratory scientist may keep records in the form of a journal in which all equipment used is described, all procedures outlined, all data is recorded and computations and graphs are shown. For field study it may not be convenient to carry a large, bound volume, so data may be recorded on separate pages. This is the method used by INSPIRE. The Data Log Cover Sheet and INSPIRE Data forms have been modified over the years to accommodate the various data gathering activities and opportunities that INSPIRE has conducted. With the demise of MIR and INTMINS, these forms have been revised once again. The new forms appear as pages 47 and 48 of this *Journal*. The following is a brief explanation of how to use these forms.

The purpose of the Data Log Cover Sheet is to provide information about the INSPIRE team that does not change from session to session. Only one of these pages needs to be submitted with each set of data. In other words, if you record data for several sessions of the April Coordinated Observations, you only need one Cover Sheet for all of the data.

Data Log Cover Sheet	(copy as needed)
INSPIRE Observer Team _____	Team Number: _____
Equipment:	
Receiver	_____
Recorder	_____
Antenna	_____
WWV radio	_____

The Observer Team name is up to you. We use "Chaffey", you could use your school name or your own name or a name of your choice. Team Numbers will be assigned as data arrives and will be permanent for use on Coordinated Observations. Equipment descriptions include brand names and model numbers, when applicable.

Site description: \_\_\_\_\_

Longitude:     \_\_\_° \_\_\_' W                      Latitude:     \_\_\_° \_\_\_' N

Personnel:     \_\_\_\_\_     \_\_\_\_\_     \_\_\_\_\_

                  \_\_\_\_\_     \_\_\_\_\_     \_\_\_\_\_

Site Description is in words; Longitude and Latitude are included, if known. Personnel can be listed if the same people always participate. If personnel changes, a separate note can be included.

INSPIRE Data (copy as needed)

INSPIRE Observer Team \_\_\_\_\_ Team Number: \_\_\_\_\_

Coordinated Observation Date: \_\_\_\_\_ Receiver \_\_\_\_\_

Tape Start Time (UT) \_\_\_\_\_ Tape Start Time (Local) \_\_\_\_\_

.....

This part should be read into the recorder at the start of each session. The "Receiver" entry is for those teams using more than one receiver.

Local weather: \_\_\_\_\_

Code: M - Mark (WWV or Voice) S - sferics T - tweak W - whistler A - Alpha C - chorus  
 Sferic Density: D: \_\_\_ Scale of 1-5 (1 - Very Low, 3 - Medium, 5 - Very High)

Time (UT)	Entry	Observer
_____	M-WWV M-V S T C W _____	D: _____

At each time mark (every 2 minutes) or more often, record the time and circle all of the relevant codes. If the time mark is from a WWV radio, circle "M-WWV", if the mark is by voice, circle "M-V". Circle all natural signals present: S T C W. Place a number in the "D: \_\_\_" location indicating your estimate of the sferic density. Use the space available to make other observations (use more than one line if needed). Indicate the observer's name, especially if the observers are changing. At the end of each session, say "End of Data" into the recorder, log this and you are done.

On the following pages are some examples of logging done by INTMINS observers using the previous versions of the forms. Notice the variety of methods and the variety of forms. All are examples of good data recording.

Team 15      Robert Bennett      Las Cruces, NM

Robert has modified the cover sheet so that the only blanks are the items that might change from operation to operation. This streamlines the log preparation process.

**DATA LOG COVER SHEET**  
**OBSERVER: Robert Bennett**  
**DATE: 28 Nov 99**

\*\*\*\*\*

**OPERATIONS DETAILS**

Type Operation: ISTOCKNIK MISSION 28-4

Tape Start Time: 2031 UTC

Local Time 1331 MT.

Operation Start Time: 2043 UTC

Local Time: 1343

Operation Stop Time: 2045 UTC

Local Time 1345

Tape Stop Time: 2056 UTC

Local Time 1356

\*\*\*\*\*

**EQUIPMENT**

Receiver: RS-6

NOTE: The "RS6" is a souped up RS4 modified by Bob

WWV Receiver: Yupiteru MVT 7100

Recorder: Marantz CP 430.

WWV Antenna: 3' whip

Antenna: 120 Ft Longwire  
orientation 270° (West)

WWV Frequency: 15MHz MHZ.

NOTE: A long wire antenna increases the sensitivity of the receiver.

Misc: RS-6 Settings: Ant on Longwire, HPF-in, Gain on MAX,  
Recorder limiter <sup>OUT</sup>, WWV on left channel. Note, in Whip" setting on  
RS-6, too much horizon pick-up.

All settings are logged. Changes in settings are noted in the Data Log.

\*\*\*\*\*

**SITE INFORMATION**

Location: 32 deg, 34 min N LAT: 106 deg, 41 min W LON: Elevation: 4290 Feet

Site Description: Desert valley between two mountain ranges.

Temp: 68 F. R.H. 45 %.

Local Weather: Warm dry winter day. No wind Very nice  
out in desert.

Bob also modified the Data Log sheet. An important change is to include the counter reading from the recorder. This makes it easy to find a specific location in the data.

mission 28-4  
28 Nov 99

DATA COLLECTION FORM

TAPE RECORDER COUNTER	TIME UT	EVENT	SFERIC LEVEL	COMMENTS
0-11	-	Voice Announcement	-	1. 600 Hz present
13	2032	WWV	4-5	2. No Loran, or very low Tweaks and Sferics
28	-	Noise burst	-	Average recorder level -6 to -8db
34	2033	WWV	-	Note recorder limiter = off
37	-	Noise burst	-	
65-68	-	feed back, I moved	toward	antenna with headset on
73	2035	WWV	-	
99	-	strong static clash	Not	duse of source.
125	2038	WWV	-	
141	2039	WWV	-	
172	2041	WWV	-	
194	-	weak insect noise	-	
202	2043	T-Time	-	T-Time ←
223	-	more insect noise	-	
230	2045	WWV - Mission End	-	End time ←
257	2047	WWV	-	
282	2049	WWV	-	
307	2051	WWV	-	
317	-	strong insect noise	-	
331	2053	WWV	-	
332-337	-	Put RS Ant switch on "whip" and LPF-out	-	
338	-	put LPF back in	-	
354	2055	WWV	-	Loran now very strong Recorder limiter in
-	-	both Ant on whip and LPF out from here to End	-	
376	2057	WWV	6-7	This test shows very clearly that Loran is strong enough in my area to saturate RX when Long wire Ant is used.
398	2059	WWV	-	
419	2101	WWV	-	
430	-	End of Recording Side A	-	

Team 21

Phil Hartzell

Aurora, NE

Phil uses the INSPIRE Cover Sheet.

Note the use of a loop antenna with the VLF2 receiver.

Data Log Cover Sheet

(copy as needed)

IT  
II  
C  
I

INSPIRE Observer Team 21- HARTZELL Receiver VLF-2  
 Operation 24-8  
 Date 4-24-99 Tape Start Time (UT) 18:35

\*\*\*\*\*

Operation details: Tape start time: 18:35 UT 1:35 PM local  
 Operation start time: 18:35 UT 1:35 PM local  
 Operation type: INTERNAL ISTOCHNIK  
 Operation stop time: 1900 UT 2:00 PM local  
 Tape stop time: 1900 UT 2:00 PM local

Equipment: Receiver VLF-2 WW V reception: \_\_\_\_\_  
 Recorder CTR69 \_\_\_\_\_  
 Antenna LOOP-4FT DIAMETER \_\_\_\_\_  
 WWV radio SYNC WITH WWV \_\_\_\_\_

Site description: HILL OVERLOOKING SMALL POND -

Longitude: 98° 0' W Latitude: 41° 0' N

Local weather: CLOUDY - NO DRIZZLE - WIND EAST 10 MPH 49°F

Personnel: PHIL HARTZELL

Team Leader address: Name PHIL HARTZELL  
211 - 0 -

Notice the informative details on the "Entry" line. Also notice the references to "car noises". The VLF2 picks up radio signals from the ignition system of passing cars. The loop antenna is especially sensitive to ignition noise.

INSPIRE Data

(copy as needed)

INSPIRE Observer Team

21- HARTZEL

Receiver VLF-2

Operation

27-8

Date

4-24-99

Tape Start Time (UT)

18:35

\*\*\*\*\*

Code: S - sferics 0 1 2 3 4 5 M - Mark T - tweek W - whistler O - OMEGA C - chorus  
L M H

Time	Entry		Observer
M 1835	<del>S</del> - CAR NOISE AT 56 SEC	S: 0 1 2 3 4 5	PAUL
1836	T- SFERICS W41 W48	S: 0 1 2 3 4 5	
M 1837	SFERICS -	S: 0 1 2 3 4 5	
1838	BURST OF S AT 12 SEC	S: 0 1 2 3 4 5	
1839	STRONG SAT 27 SEC	S: 0 1 2 3 4 5	
1840	SFERIC AT 48 SEC - 35 + 50	S: 0 1 2 3 4 5	
1841	(CONSTANT STATIC MASKING	S: 0 1 2 3 4 5	
	WHISTLERS??)	S: 0 1 2 3 4 5	
M 1842	SAME	S: 0 1 2 3 4 5	
18:43	CAR HUM FROM WEDDING	S: 0 1 2 3 4 5	
18:44	ENGINE NOISE FADING	S: 0 1 2 3 4 5	
	FIRST 10 SEC -	S: 0 1 2 3 4 5	
18:45	NEARLY SOLID SFERICS	S: 0 1 2 3 4 5	
1846	SAME	S: 0 1 2 3 4 5	
(T) M 18:47	CAR NOISE AT 45 SEC	S: 0 1 2 3 4 5	
18:48	STILL CAR NOISE	S: 0 1 2 3 4 5	
18:49	CAR AT 20 SEC	S: 0 1 2 3 4 5	

Team 18

David Jones

Columbus, GA

David uses the INSPIRE Cover Sheet.

Data Log Cover Sheet

INSPIRE Observer Team

18 JONES

Receiver RS4

Operation

18 - 9

Date

4 18 99

2104

\*\*\*\*\*

Operation details:

Tape start time 2104 UT 1704  
 Operation start time 2116 UT 1716 local  
 Operation type: 1STOCHNIK  
 Operation stop time 2118 UT 1718 local  
 Tape stop time 2131 UT 1731 local

Equipment:

Receiver RS4  
 Recorder RS CTR69  
 Antenna VERTICAL  
 WWV radio LOW FREQ WWVB VOICE HACKS

Site description:

OPEN FIELD

Longitude:

84.55 W

Latitude:

32 16

Local weather:

CLEAR DRY

Personnel:

Team Leader address:

Name

DAVID M JONES

1000 HUNTER AV

INSPIRE Data

INSPIRE Observer Team

Operation

Date

18 JONES

18-9

18 APR

(copy as needed)

Receiver RS4

2104

Code: S - sferics

012345

Time

21:04:00 CLANKING MAST AND WIRE

21:08:58 W

21:10:00 CLANK STOPS

21:10:29 W

21:12:04 INSECT

21:12:33 CLANK STARTS

a 21:12:52 W

b 21:12:55 W

21:14:15 W

21:15:05 RISING IGNITION OR ALTERNATOR

21:15:30 W

21:17:15 INSECT

21:17:54 INSECT

21:18:38 W

21:19:59 INSECT

21:20:30 W, also clanking

21:24:28 DOUBLE WHISTLE

21:27:12 W

21:27:50 W

21:30:36 W

21:35:28 END OF TAPE

Windy conditions led to the clanking noises.

The VLF2 picks up a signal from insects. Sounds just like a mosquito buzzing in your ear!

Whistlers logged to the nearest second.

Team 7

Dean Knight Sonoma Valley High School

Sonoma, CA

Dean fills out the Cover Sheets and his students do the logging. The Sonoma Valley High School Team sets up 3 RS-4 receivers using different antenna arrangements. Long wire antennas of various lengths are set up in specific orientations. Often there is a notable difference in signals received from a North-South antenna and an East-West antenna.

#65

Data Log Cover Sheet

(reproduce as necessary)

INSPIRE Observer Team

Sonoma Valley High

Receiver RS-4

Operation

21-2

Date

Sat 11/20/99 PST Tape Start Time (UT) 0647

Operation details:

Tape start time: 11/21/99 0647 UT 10:47pm local PST

Operation start time: 0659 UT 10:59pm local PST

Operation type: Ionospheric

Operation stop time: 0701 UT 11:01pm local PST

Tape stop time: 0712 UT 11:12pm local PST

Equipment:

Receiver

RS-4

WWV reception:

The receivers are all RS-4s, but the recorders are different.

Recorder

#65 Bell & Howell Model 3185-A Radio Shack DX-375

Antenna

longwire ~ 91ft E-W

Receiver

WWV radio

Radio Shack DX-375

Site description:

orchard - Sonoma Developmental Center near south boundary of Jack London State Park

Longitude:

122° 32.96' W

Latitude

38° 20.89' N

Local weather:

rain, drizzle

Personnel:

(see attached)

Lists of students operating each receiver are

Team Leader address:

Name

Dean Knight

name AKA WAVE  
 Date: Nov 24, 1999

INSPIRE Data  
 INSPIRE Observer Team Sonoma Valley High Receiver # 64  
 Operation 21-6  
 Date Sun 11/21/99 (PST) Tape Start Time (UT) 2307 (11/21/99)

\*\*\*\*\*

Code: S - sferics 012345 M - Mark T - tweak W - whistler O - ~~OMEGA~~ C - chorus  
 L M H 60 cycle hum-throughout Observer Loren

	Time	UT	Entry	S: 012345
PST 11/21/99 3:07pm T-12	2307		Problem w/tape	S: 012345
	2308			S: 012345
3:09pm T-10	2309			S: 012345
	2310			S: 012345
	2311			S: 012345
	2312		C	S: 012345
	2313		C	S: 012345
3:14pm T-5	2314		C	S: 012345
	2315		C	S: 012345
	2316		C	S: 012345
	2317		C	S: 012345
	2318		airplane C	S: 012345
3:19pm T	2319		airplane C	S: 012345
	2320		C	S: 012345
	2321		C	S: 012345
3:22pm T+3	2322		airplane w/mb	S: 012345
	2323		C	S: 012345

Time marks are logged.

Problems with equipment are logged to explain missing data.

An entry is made each minute noting conditions and especially any changes.

Team 32

Shawn Korgan

Gilcrest, CO

Shawn uses a home built receiver. He often observes in the Rocky Mountains at an altitude of over 10,000 feet.

*Tape Seven*

Data Log Cover Sheet

(copy as needed)

INSPIRE Observer Team Not currently assigned Receiver Lmc6001

Operation Whistlers/C.L.S. 15:00-15:12

Date 4-25-99 Tape Start Time (UT) 14:45

\*\*\*\*\*

Operation details:

Tape start time: 14:45 UT 8:45AM local (MDT)

Operation start time: 15:00 UT 9:00AM local (MDT)

Operation type: Whistlers/Coordinated listening session

Operation stop time: 15:12 UT 9:12AM local (MDT)

Tape stop time: 15:15 UT 9:15AM local (MDT)

Equipment:

Receiver Lmc6001 Homemade e-field WWV reception:

Recorder Sharp RT-22 Good in

Antenna 8-9 Ft mounted on car Colorado!

WWV radio PRO-68

Site description: Open country, near paved road and gas well, one mile from power lines

Longitude: 104° 67' W Latitude: 40° 22' N

Local weather: Light to medium snow, very cold,

Personnel: Shawn Korgan

Team Leader address: Name SHAWN KORGAN



Team 30 Linden Lundback and Brian Cowan

Watrous, Saskatchewan, CANADA

Linden and Brian have a very quiet site. Note the long (13 feet) vertical whip antenna, which gives them excellent sensitivity.

Data Log Cover Sheet Tape #12

(copy as needed)

INSPIRE Observer Team #30 Lundback/Cowan

Receiver RS-4

Operation Ariel/Istochnik 25-6 T-time 1427 UTC  
0827 CST

Date \_\_\_\_\_ Tape Start Time (UT) 1417

\*\*\*\*\*

Operation details: Tape start time: 1417 UT 0817 local CST

Operation start time: 1415 UT 0815 local

Operation type: Ariel/Istochnik 25-6

Operation stop time: 1440 UT 0840 local

Tape stop time: 1440 UT 0840 local

Equipment: Receiver RS-4 receiver level 5.5 WWV reception: \_\_\_\_\_

Recorder CTR-69 recording level 7 \_\_\_\_\_

Antenna 13 ft. vertical whip \_\_\_\_\_

WWV radio Sony ICF-SW40 10.0 mhz

Site description: Road approach 8 miles SW of below co-ordinates

Longitude: 105° 22' W Latitude: 51° 41' N

Local weather: 10 knot SE wind, Temp +6°C, clear sky

Personnel: Linden Lundback Brian Cowan

Team Leader address: Name Linden Lundback

Linden and Brian use a sheet of lined paper for a data log and record detailed observations in columns using the shorthand codes for the natural signals.

Team #30 Linden Lundback / Brian Cowan RS-4 receiver April 25, 1999  
 Ariel/Istochnik 25-6 T-time 14 27 UTC Tape #12.  
 T-start 1417 UTC

S-spherics T-tweek W-whistler WW-weak whistler M-mark H-high tone  
 n-riser tone K-whooper tones KE-whooper & echo t-pronounced emission

General reception: A hum, background hiss, whooper chorus (1435), rising tone chorus, spheric chorus.

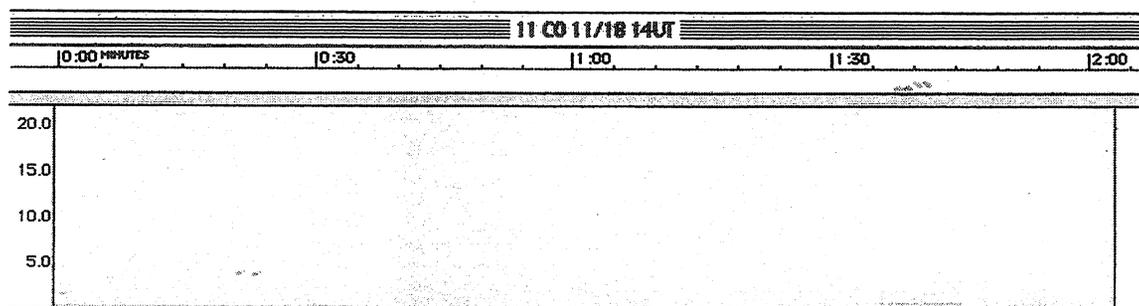
14:15:00 } not on	14:27:35-S	14:33:33-H
14:17:00 } tape	40-S	39-H
14:17:00-M	28:39-S	42-H
10-S	29:36-H	52-WH
19-S	30:00-M	34-42-R
39-K	03-R	35-00-M
52-S	04-H chorus starts	22-K chorus starts
18	09-R	28-H
19	39-R	57-H
20:13-S	55-R & H	36:39-H
24-S	31:01-H	48-R
45-H	23-H	37:03-S
48-S	25-H	10-H
50-H	38-H	45-S
21:33-H	43-H	58-H
38-H	57-R	38:22-H
46-H	32:05-RH	39-H
22:00-M	10-RH	50-S
28-S	24-RH	39:21-H
23:35-S	36-RH	40-S
56-WW	39-RH	50-S
24:18-S	44-H	40:00-M
39-S	52-H	
25:02-S	57-H	
54-S	33:01-H	
26:03-S	06-H	
27:00-M	15-H	
08-S	22-H	

Observers:	Team 11	Mark Mueller, Brown Deer High School Brown Deer, WI	(CDT)
	Team 15	Robert Bennett, Las Cruces, NM	(MDT)
	Team 21	Phil Hartzell, Aurora, NE	(CDT)
	Team 32	Shawn Korgan, Gilcrest, CO	(MDT)
	Team 6	Bill Pine, Chaffey High School, Ontario, CA	(PDT)

For analysis purposes, a spectrogram was made of the first two minutes of each 12-minute hourly session. Additional spectrograms were made of any items of interest and of any segments requested by the observer. Time marks were placed on the tape every two minutes and a complete log was made of each session.

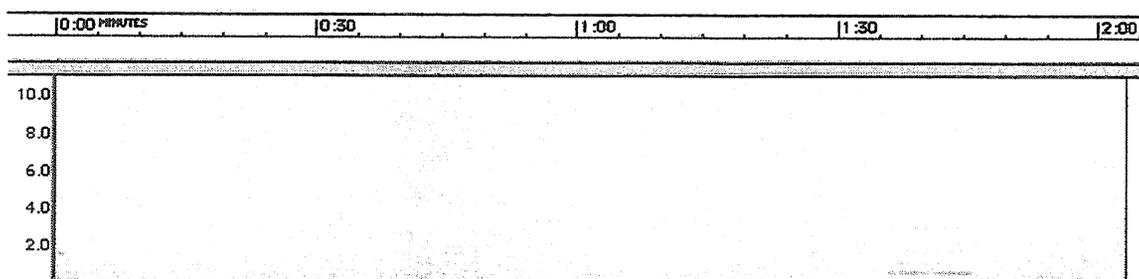
### 11/18/00 1400 UT

The only observer to submit data for the Saturday sessions was Mark Mueller of Brown Deer High School, Brown Deer, WI (Team 11). Mark found the conditions very quiet. Almost nothing shows up on the spectrograms, although the sferics are faintly heard on the tape.

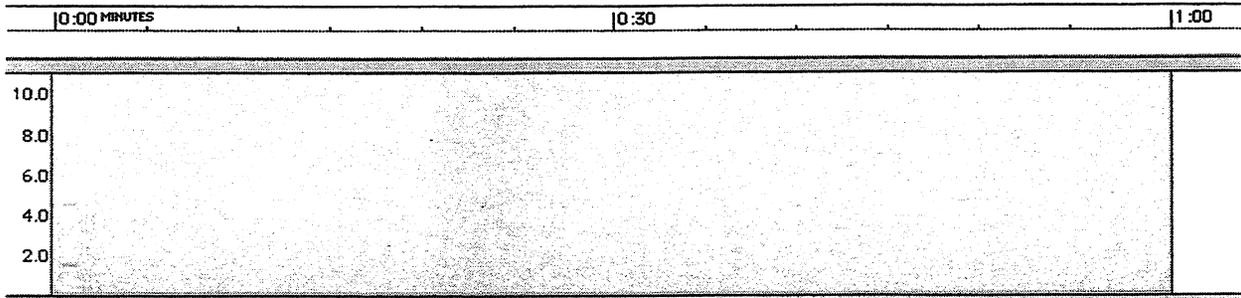


Team 11. Mark Mueller, Brown Deer, WI.  
The first 2 minutes are shown starting at 1400 UT.  
Quiet conditions, but sferics are present.

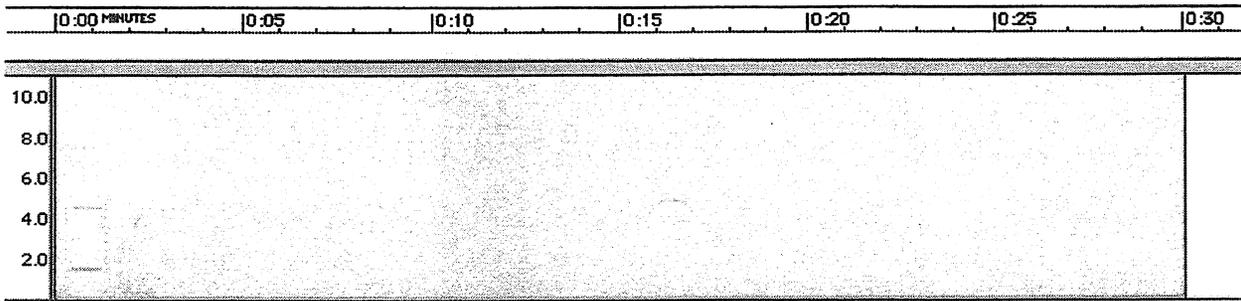
This spectrogram shows the full frequency range allowed by the software 0-22 kHz).



The same time period as the first spectrogram with the frequency range reduced to 0-11 kHz.  
This frequency range coincides closely with the design parameters of the VLF2 receiver (0-10 kHz.)



The first minute. A WWV tone appears at the start of the spectrogram.

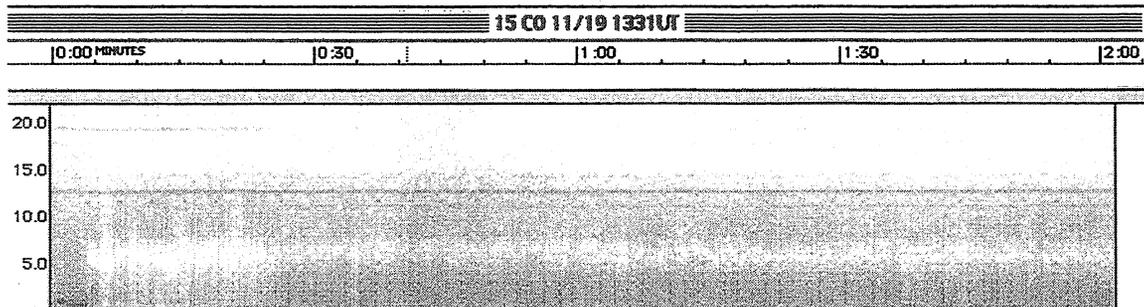


The first 30 seconds.

### 11/19/00 1300 UT

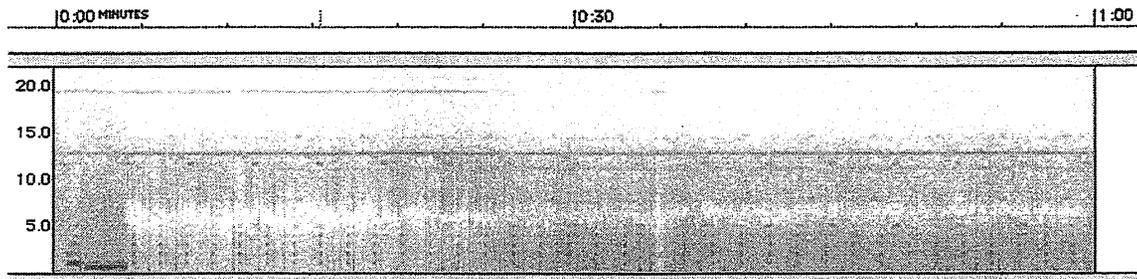
This data actually starts at 1331 UT. Robert Bennett intended to record at 6 AM MST, but as he reports:

We received heavy rains on Monday and Tuesday and I thought that the roads would be dry by Sunday, but not the case. This time wet roads slowed me down a lot. I have to drive along a minimally maintained gravel range road for 15 miles and then along a dirt trail for another four miles to get to my preferred monitoring site. The gravel road was still wet and slippery so I had to drive a lot slower than I usually do. The dirt road was a disaster. I had difficulty getting over the trail even though I was driving a four-wheel drive vehicle.

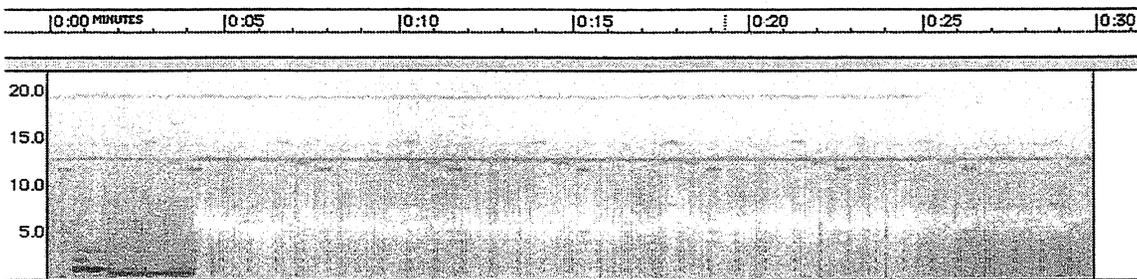


Team 15. Robert Bennett, Las Cruces, NM.

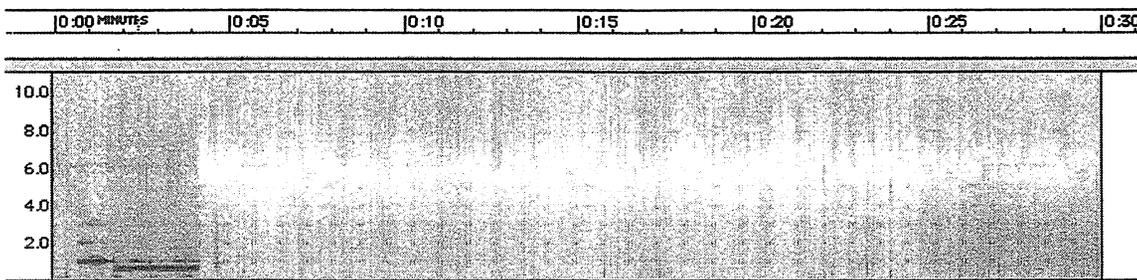
Robert's receiver is very sensitive. Visible on the 0-22 kHz spectrogram are several manmade signals above the 11 kHz frequency level.



First minute.

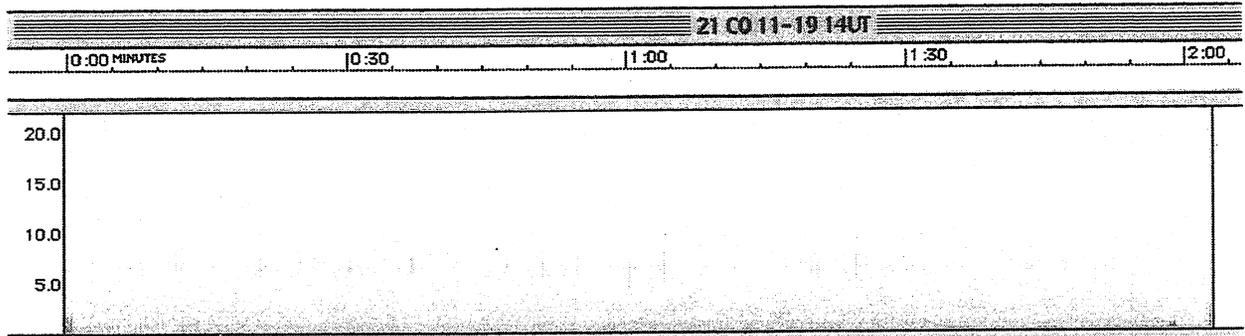


First 30 seconds. WWV signals and voice appears at and below 1 kHz for the first few seconds. The horizontal traces at about 13 kHz and just below 20 kHz are carrier signals for some VLF communication stations. The dashes that appear between 12 and 15 kHz are from the Russian Alpha navigation system, which is similar in operation to the now defunct OMEGA system.

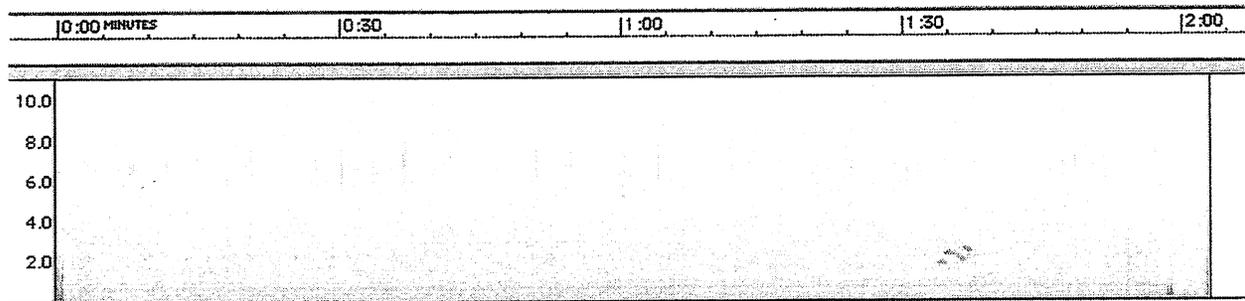


First 30 seconds using a 0-11 kHz frequency range. The sets of vertical dots are from a LORAN navigation station. This signal sounds like a "clacking" noise on the tape.

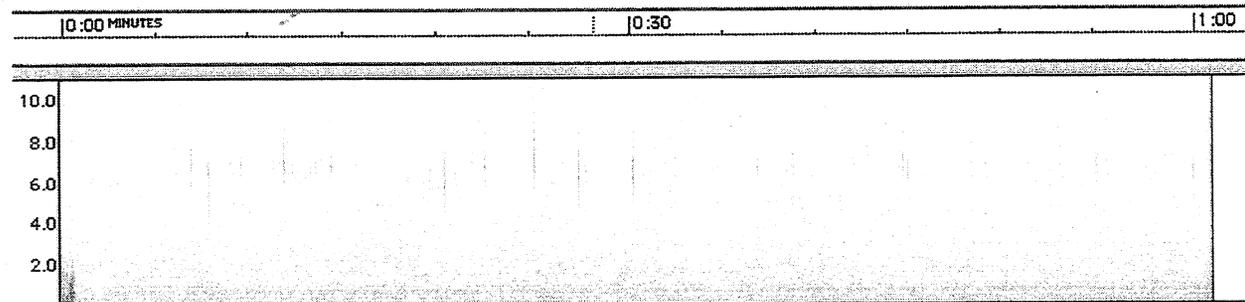
11/19/00 1400 UT



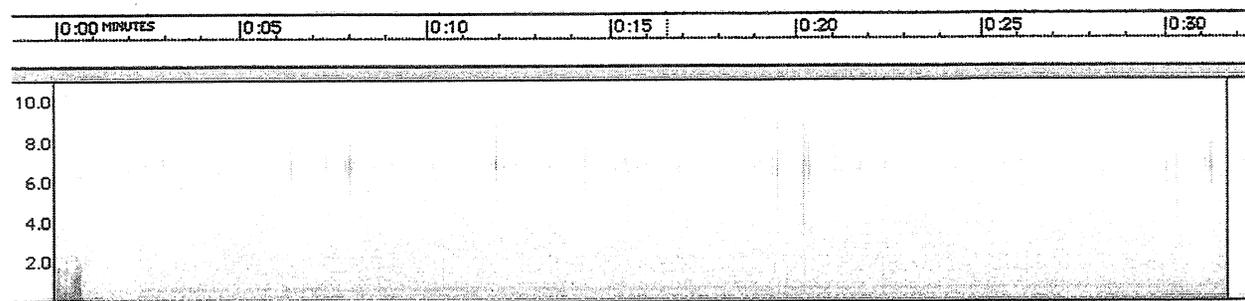
Team 21 Phil Hartzell, Aurora, NE. Quiet conditions, but the sferics are clearly heard and seen. The arrow points to the voice "Mark" at 1400 UT.



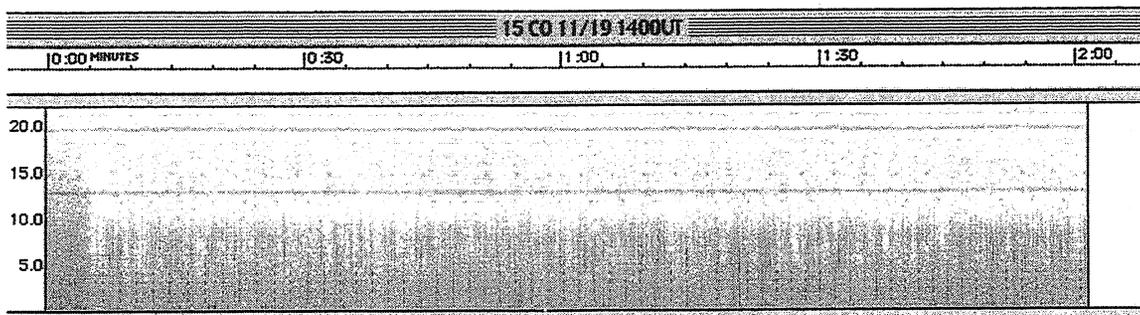
Team 21 data, 0-11 kHz frequency range.



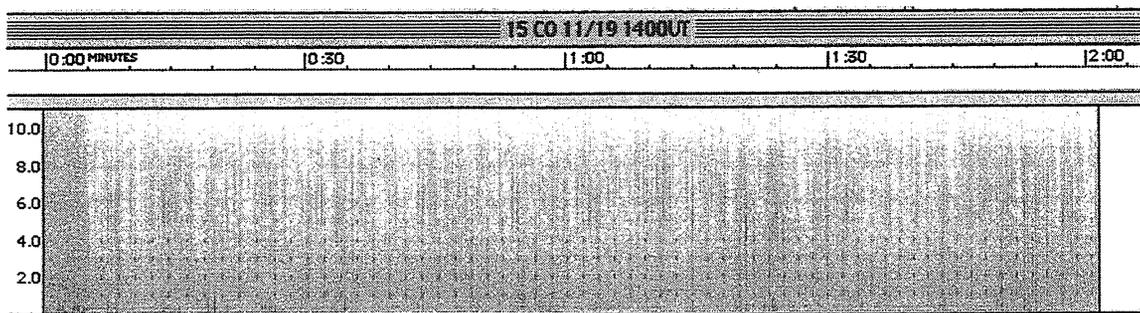
First minute.



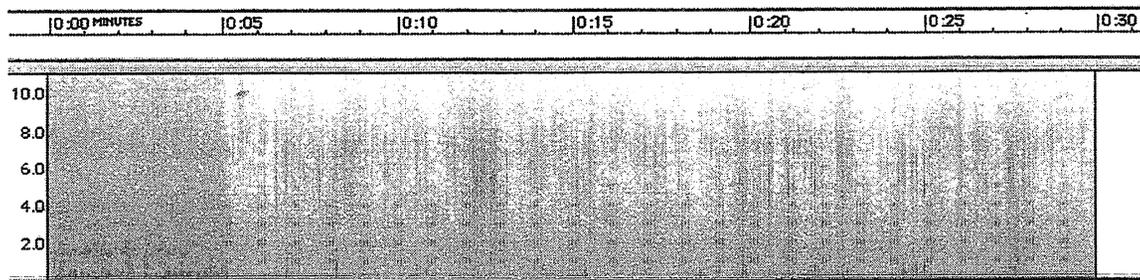
First 30 seconds. The spectrogram starts with a voiceprint of "Mark" at 1400 UT



Team 15. Robert Bennett, Las Cruces, NM.

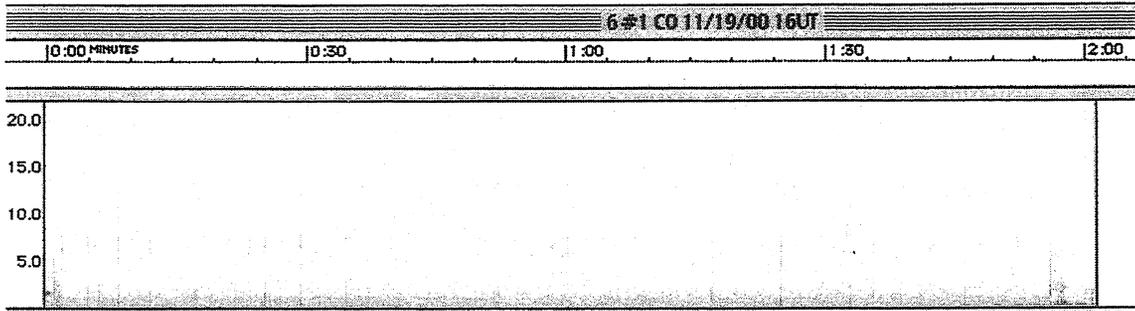


0-11 kHz.

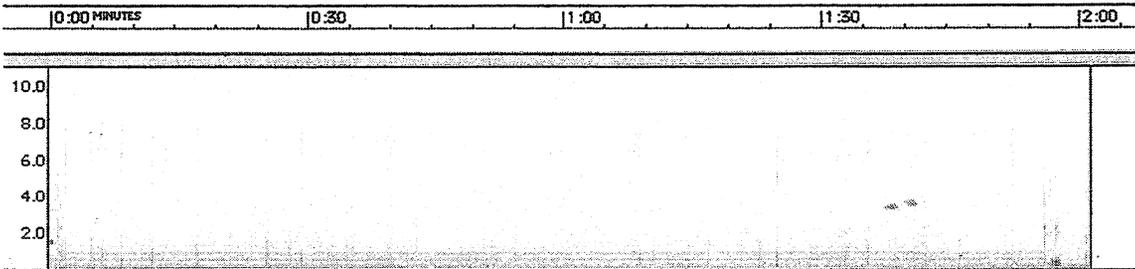


First 30 seconds. LORAN present.

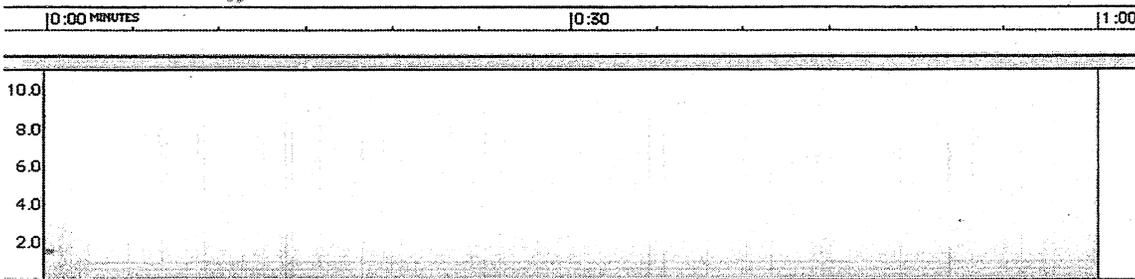
11/19/00 1500 UT



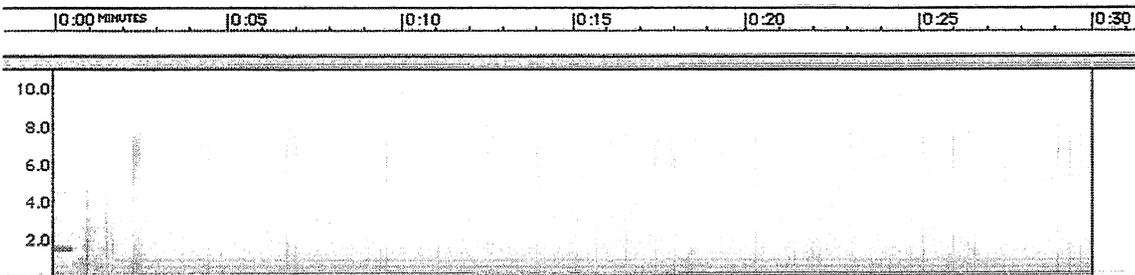
Team 6 Bill Pine, Chaffey High School, Ontario, CA  
This is Receiver #1, a 10-year old ACTIVE B-field receiver using a 1-meter square loop with 90 turns. Conditions were quiet, but the spheric density was estimated at 2.



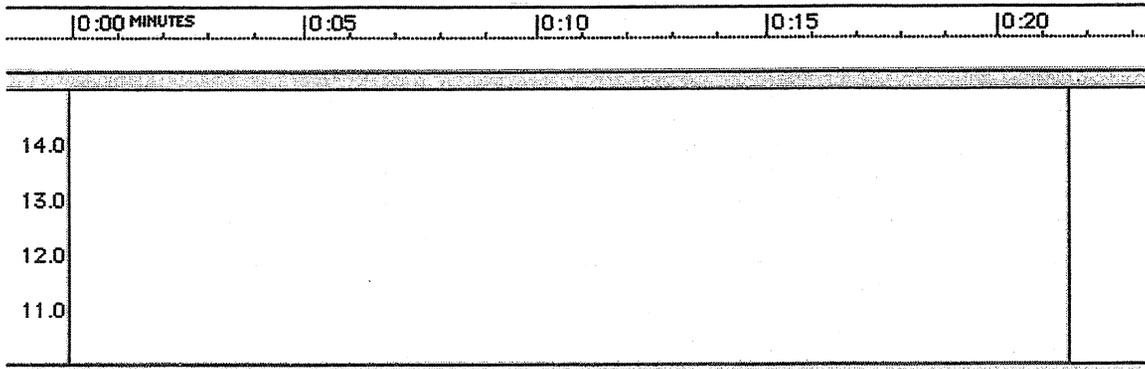
Full spectrogram using 0-11 kHz range.



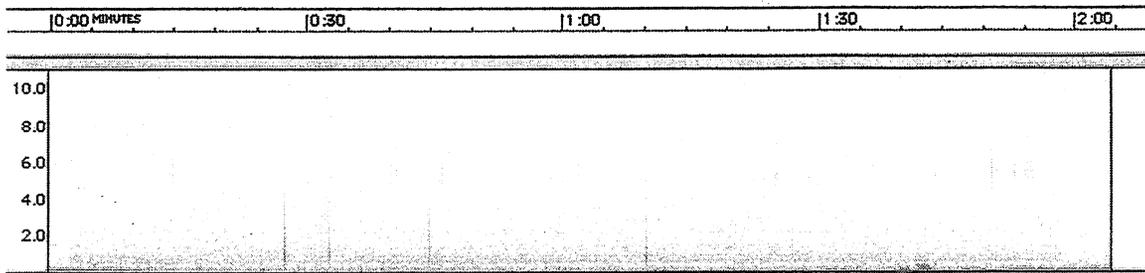
First minute, 0-11 kHz



First 30 seconds

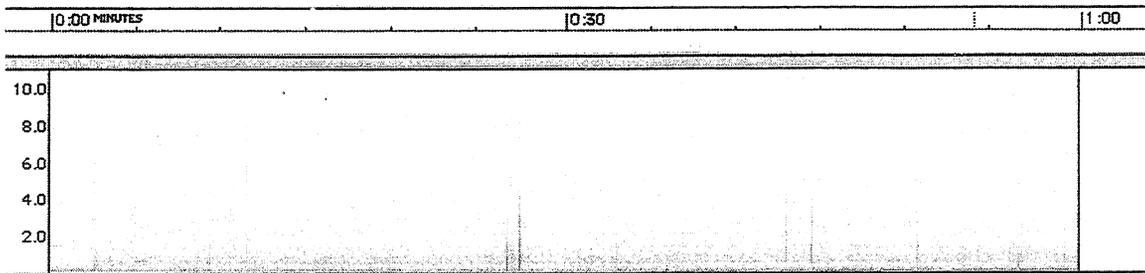


First 30 seconds; 10-15 kHz range showing faint Alpha traces.

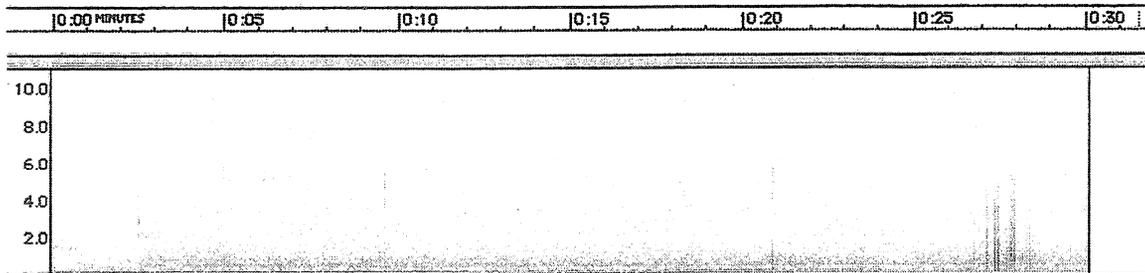


Team 6 Bill Pine, Chaffey High School, Ontario, CA Receiver #2  
 Data recorded by Sarah Pine, University of California, Riverside, CA

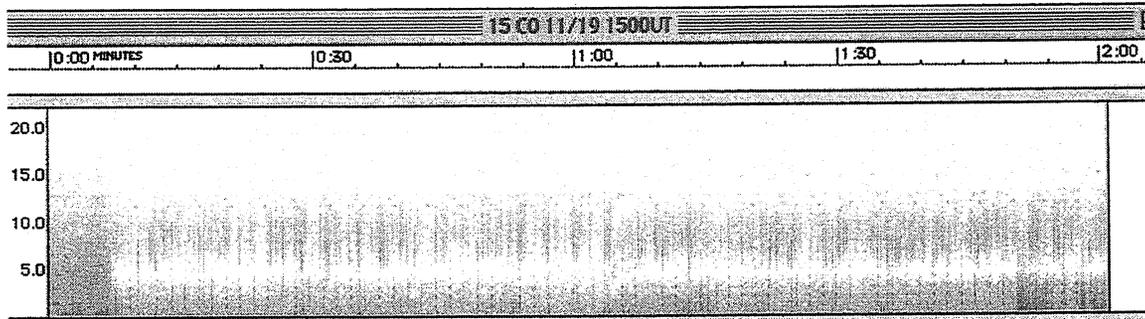
Receiver #2 is an INSPIRE RS4 receiver, the forerunner of the VLF2.



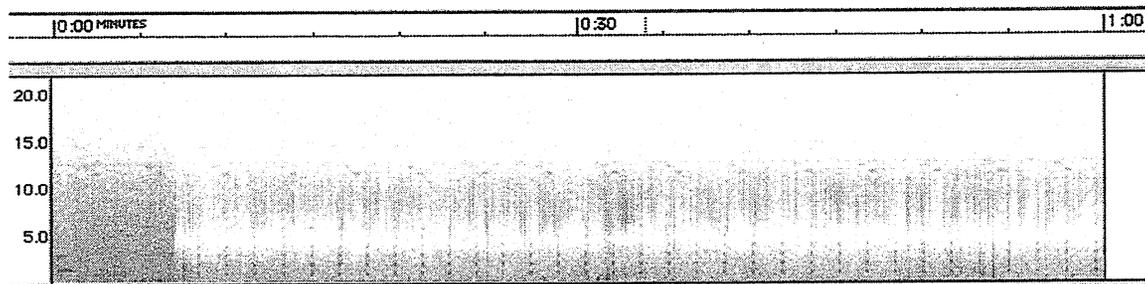
First minute.



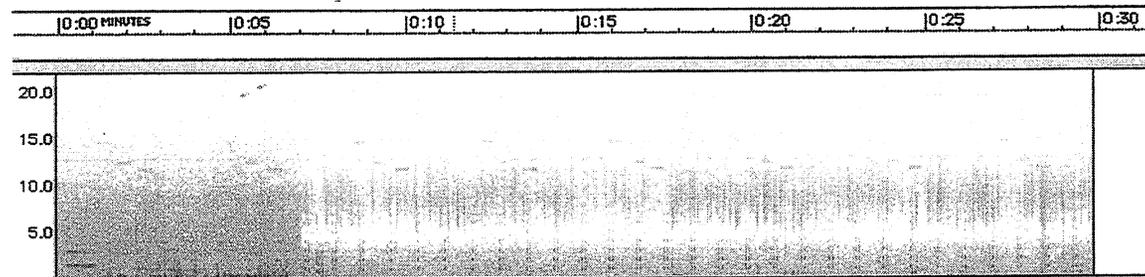
First 30 seconds.



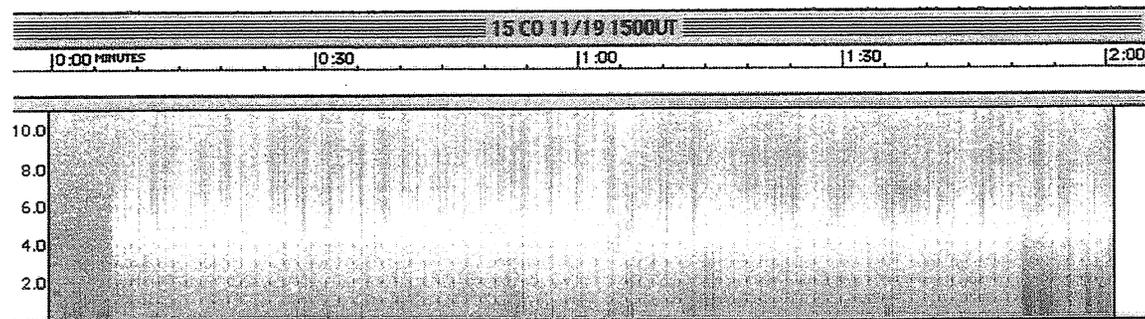
Team 15 Robert Bennett, Las Cruces, NM  
 Note that the manmade signals above 12 kHz are less strong.



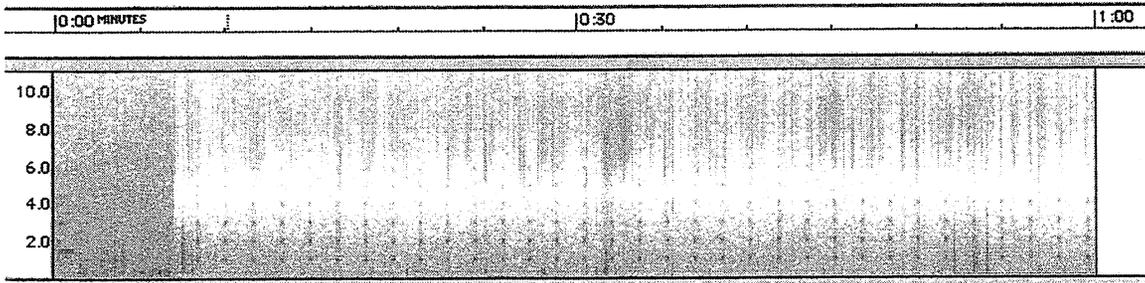
First minute.



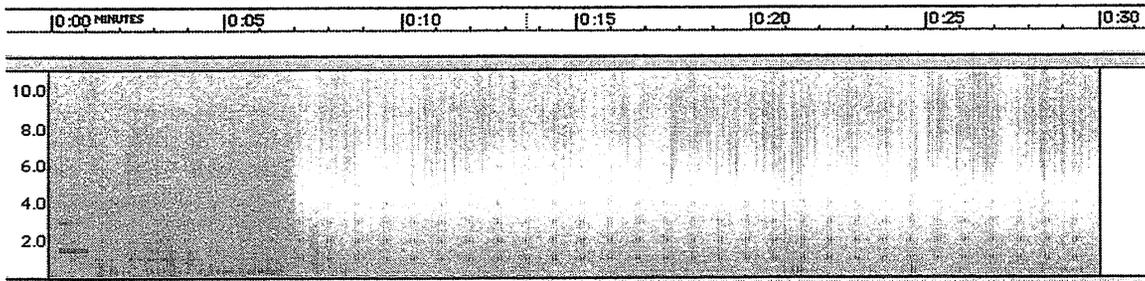
First 30 seconds. Alpha signals are visible, other carrier signals are not.



0-11 kHz.

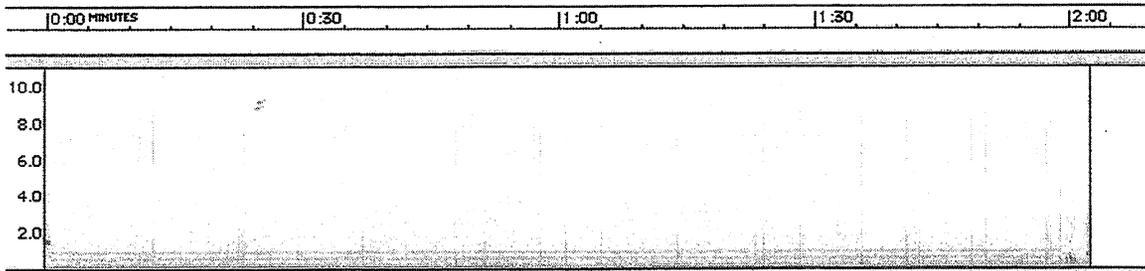


First minute. LORAN signal appears.

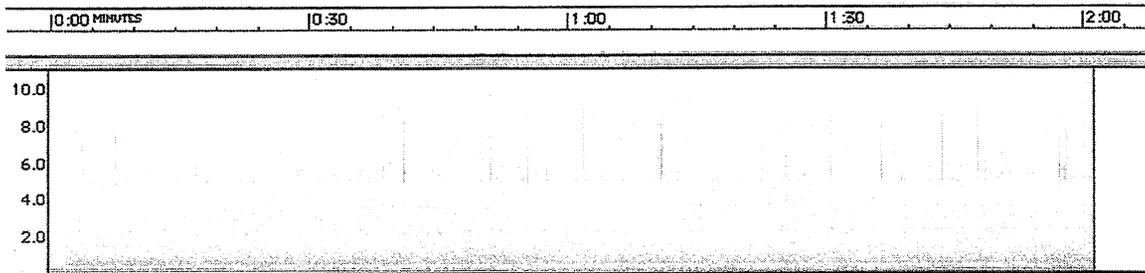


First 30 seconds. WWV tones and voiceprint are visible for the first 7 seconds.

11/19/2001 1600 UT

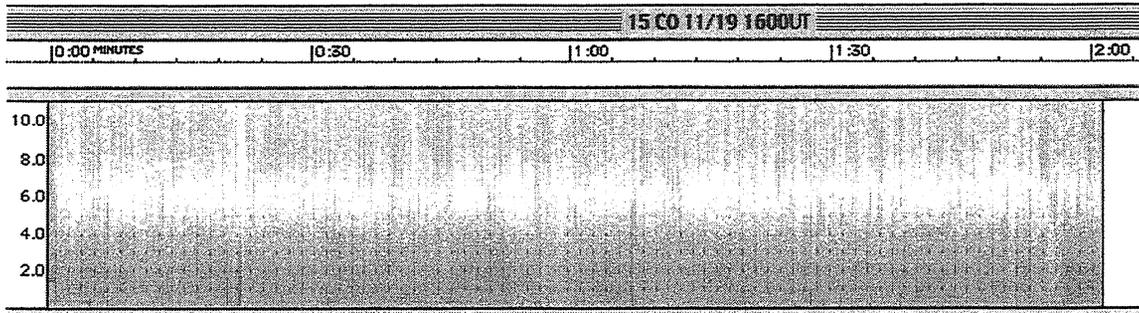


Receiver #1

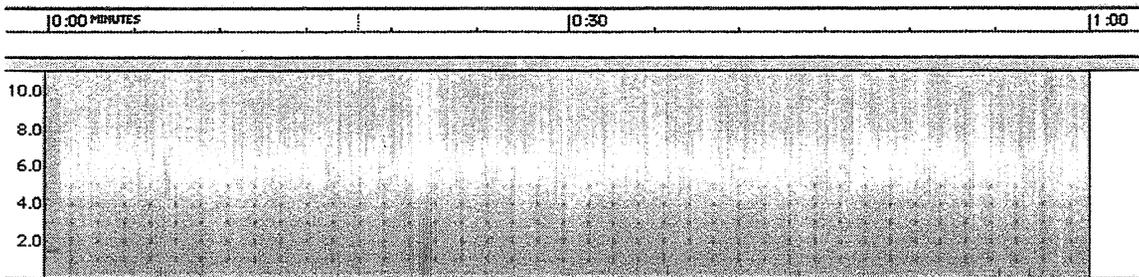


Receiver #2

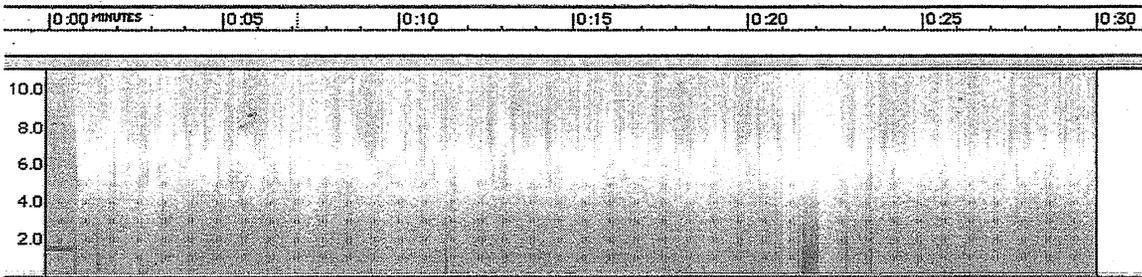
Team 6 Bill Pine, Chaffey High School, Ontario, CA  
 Sarah Pine, University of California, Riverside, CA



Team 15 Robert Bennett, Las Cruces, NM



First minute. LORAN signals appear.



First 30 seconds.

INSPIRE Observer Team \_\_\_\_\_

Team Number: \_\_\_\_\_

Equipment: Receiver \_\_\_\_\_

Recorder \_\_\_\_\_

Antenna \_\_\_\_\_

WWV radio \_\_\_\_\_

Site description: \_\_\_\_\_

Longitude: \_\_\_\_\_ ° \_\_\_\_\_ ' W

Latitude: \_\_\_\_\_ ° \_\_\_\_\_ ' N

Personnel: \_\_\_\_\_

\_\_\_\_\_

Team Leader address: Name \_\_\_\_\_

Street \_\_\_\_\_

City, State, Zip, Country \_\_\_\_\_

email: \_\_\_\_\_

**Local Time to UT Conversion Table**

EST + 5 = UT

EDT + 4 = UT

CST + 6 = UT

CDT + 5 = UT

MST + 7 = UT

MDT + 6 = UT

PST + 8 = UT

PDT + 7 = UT

