The INSPIRE Journal

Volume 5 Number 2

April 1997

Newly Designed Radio Receiver Kits Available!

The new INSPIRE Very Low Frequency radio receiver kits are now in stock and ready to ship. Christened the "VLF2", the new kit offers several improvements in features and design. See the article on Page 7 for details and ordering information.

Also in this issue:

Table of Contents

The INSPIRE Journal
Volume 5 Number 2
April 1997

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

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INSPIRE Is Now on World Wide Web:

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email Address and Fax for INSPIRE

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pine@chs.chaffey.k12.ca.us

Fax: 909 931 0392

Chaffey Science has a Web Site!

Chaffey High School Science Department has a World Wide Web Site. While still under construction, but we would like to get some INSPIRE information on the site this spring. We will try to get the INTMINS maps and schedules posted and will try to include updates on schedule changes if they occur. Even if the operation schedule for ISTOCHNIK changes, observers are still to follow the schedule included as an insert with this issue of the *Journal.* Visit the site and give us some feedback. All of the html programming has been done by Brad Olsan, a senior here at Chaffey High. The URL is:

www.chs.chaffey.k12.ca.us

Help Design and Evaluate Curriculum Materials

The editor (Bill Pine) is involved in a NASA project called IMAGE - Imager for Magnetopause to Aurora Global Exploration. I am working with Bill Taylor of Hughes STX Corporation and Jim Green of NASA Goddard Space Flight Center. My job is to create curriculum materials to support the educational objectives of the IMAGE mission. The IMAGE satellite is scheduled for launch in January 2000, so the materials are in the early stage of development. The material I am working on is designed for high school physics students, but there is also material being developed for the junior high/middle school level. If you would like to review the materials as they are developed, use them in your classes, evaluate them and help create materials for the project, please let me know.

Is the OMEGA System Doomed?

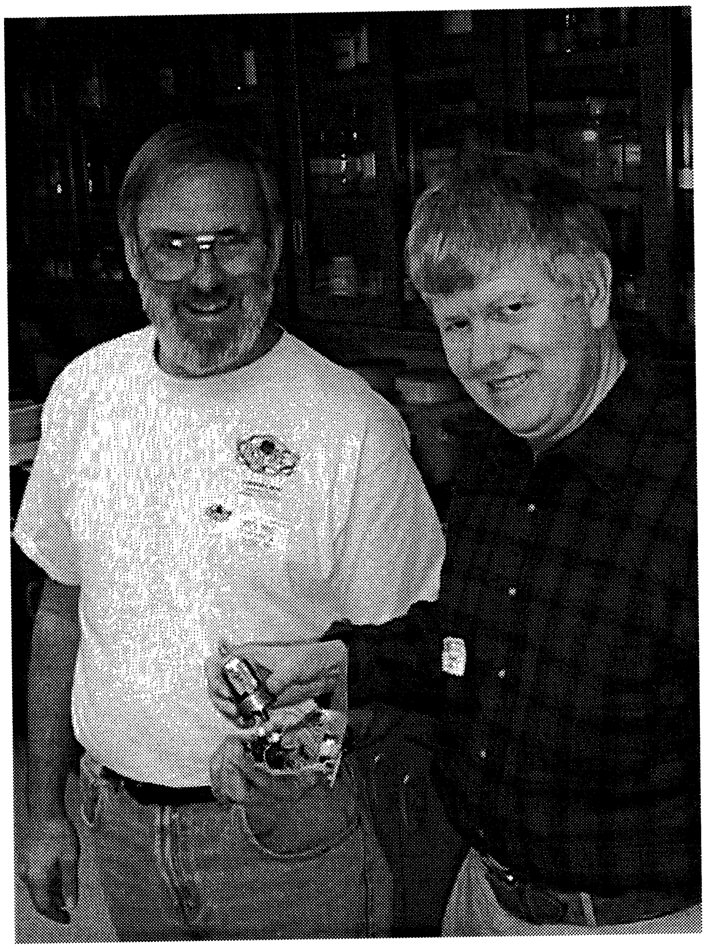
United States participation in the OMEGA navigational system is scheduled to end in September 1997. This will probably mean the end of the entire system since all seven stations are required to get the word wide coverage necessary. The reason given for the termination of support is that the Global Positioning System (GPS) has taken over the function served by OMEGA. If the United States ceases support for the system, the other participating nations will also probably close up shop.

This is not good news for INSPIRE. The presence of the OMEGA signal is a good indicator that the VLF receiver is working well. We use the OMEGA signals as an accurate time mark for correlating data from several observers. Others will be more inconvenienced by loss of OMEGA than INSPIRE. For example:

1. Navy submarines cannot use GPS under the polar ice caps.
2. Navy planes still use OMEGA extensively and the changeover will be expensive.
3. Weather stations around the world use disposable OMEGA-tracked weather balloons. A change to GPS would be expensive and the GPS tracking systems would be too expensive to be disposable. Recovery of these balloons is very difficult.
4. Whale tracking and other wildlife tracking uses OMEGA.
5. Many small airlines may be put out of business by the cost of transition.
6. Hurricane tracking uses disposable OMEGA-based dropwindsondes.

Maybe with all of these problems and expenses, someone will see the light and OMEGA will be saved. Others have a lot more to lose than INSPIRE does.

Vacuum Tube Receiver NOT Planned!



Bill Pine (left) holds the inner workings of a VLF2 receiver while Jack Reed shows a single vacuum tube which is almost as large as the entire radio circuit!

INTMINS-April/97 Operations Schedule

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

The April 1997 INTMINS Operations schedule has been determined. Operations will occur on the last two weekends: April 19-20 and April 26-27. Data gathered will be analyzed and reported on in the November 1997 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 the page 61 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 62 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.
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 spectrographs 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.

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INTMINS Schedule

In order to obtain the most reliable schedule for INTMINS operations, determination of the scheduled is delayed as long as possible. Having the smallest possible time between requesting the schedule from the Russian Space Agency (represented by Stas Klimov) and the actual operations minimizes the adjustments that may have to be made later due to changes in the orbit of MIR. For this reason, the schedule is not determined until after the *Journal* goes to the printer. The INTMINS schedule has been included as a separate supplement to this issue.

The VLF2 Radio Receiver Kit

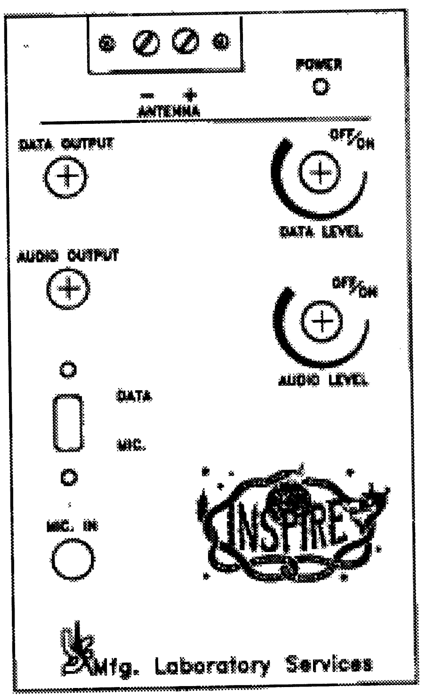
New from INSPIRE: The Next Generation of Natural Radio Receivers

The newly designed very low frequency radio receiver kits are now available. Named the "INSPIRE VLF2 Radio Receiver", this model represents some real improvements over the reliable RS4 receiver. Created especially for INSPIRE by John Kohus of Laboratory Services in South Barre, MA, the new kit is designed for ease of construction and ease of use. The frequency response is similar to that of the RS4, with peak response at about 2 kHz, good low frequency filtering and high frequency rolloff at about 9 kHz. Both prototype and production models have been field tested with good results. The assembly instructions have been field tested also at the workshop in Washington, DC, in February.

The price of the VLF2 is $65 including shipping in North America. Shipping cost to other locations is $10. Assembled VLF2 receivers are priced at $80 (plus $10 shipping outside North America). At the present time, separate printed circuit boards and parts lists are not available, but they should be available by fall 1997. Look for details in the November 1997 *Journal.*

Features

The Front Control Panel is shown below:



An important new feature of the VLF2 is the addition of a separate audio amplifier on the circuit board. The output from this amplifier can be heard by inserting a headphone plug into the "Audio Output" jack. There is no need for a cassette recorder if all you want to do is hear the natural radio signals. This feature will make it easier to test for quiet sites quickly.

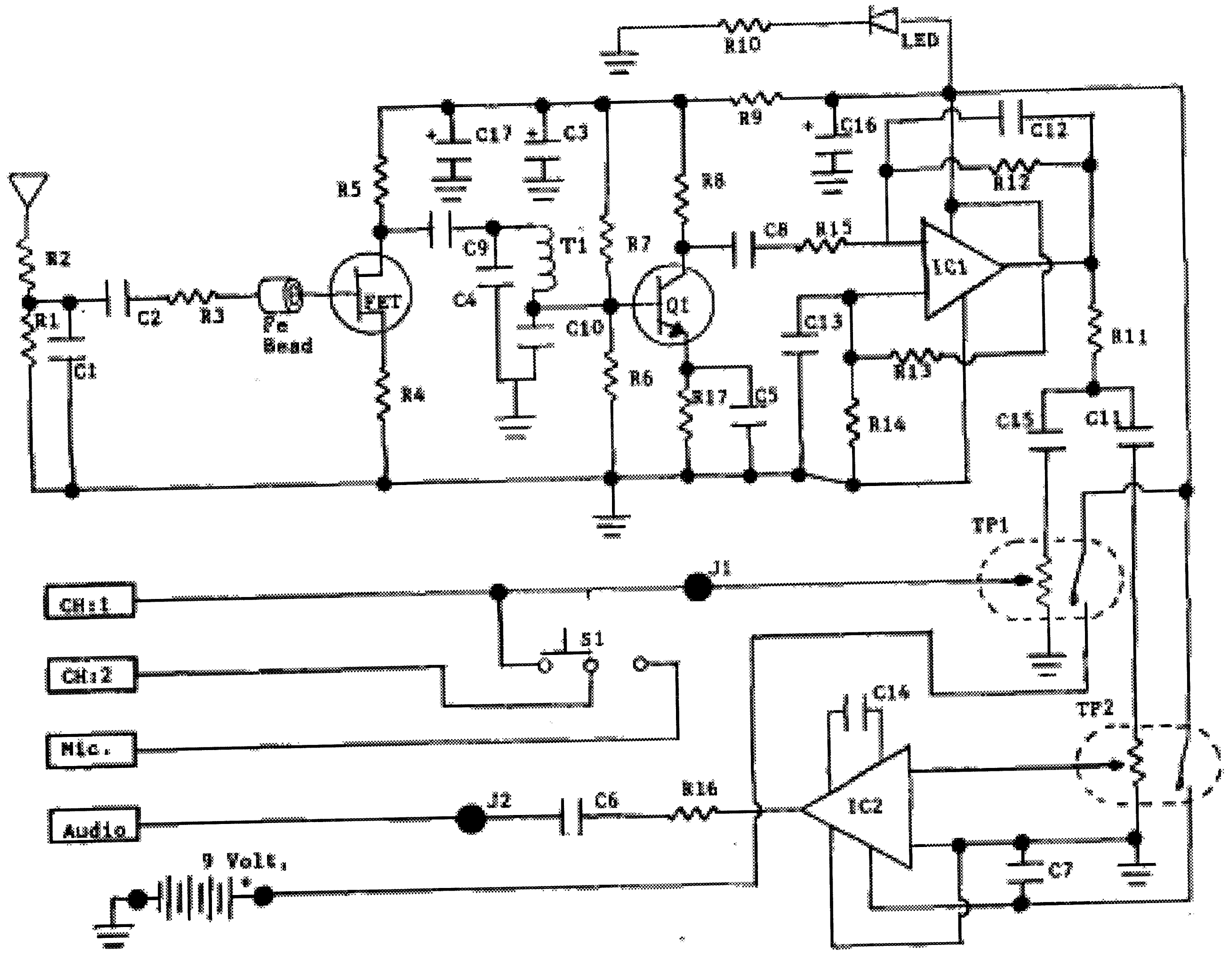
The OFF/ON VOLUME controls are mounted directly onto the printed circuit board, eliminating the need for several of the interconnecting wired used previously.

The MIC switch still allows voice announcements to be put on one stereo channel while continuously recording the VLF signal on the other channel.

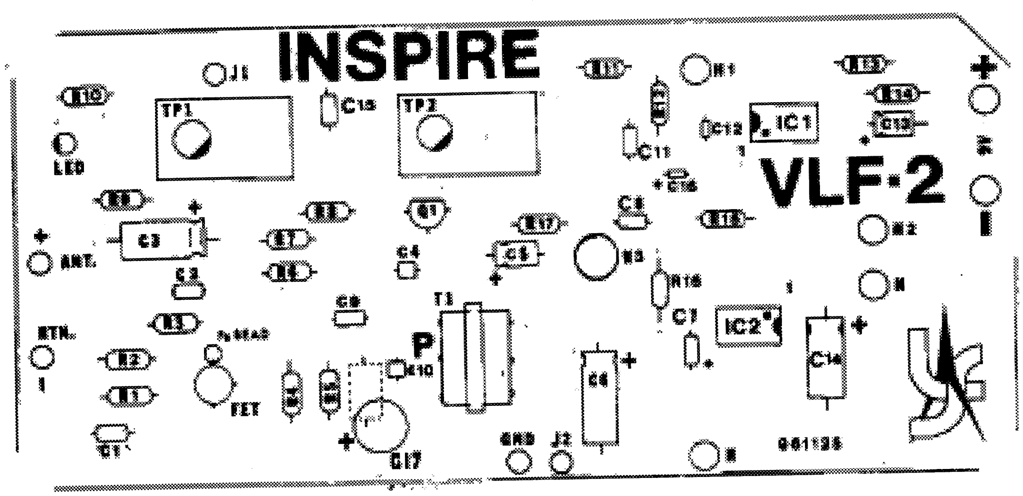
The addition of an LED power light makes it easy to see when power is on.

The VLF2 uses the same plastic enclosure used for the RS4. An antenna (not supplied) is required, but a 2 meter telescoping whip works well . (Radio Shack Part No. 270-1408A) A ground stake is also required, but a short length of pipe driven into the ground will work as will connecting the ground to a large conductor (such as the body of a car) to act as a counterpoise. In a pinch, you can hold a ground wire in your hand and use your body as a ground.

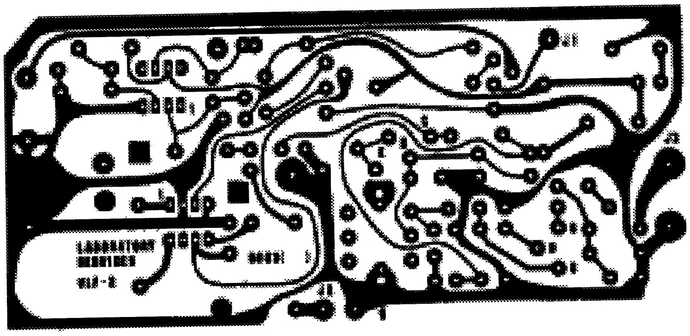
The schematic diagram of the VLF2:



Printed circuit board layout, front side, is shown here.



The circuit side of the printed circuit board is shown here.

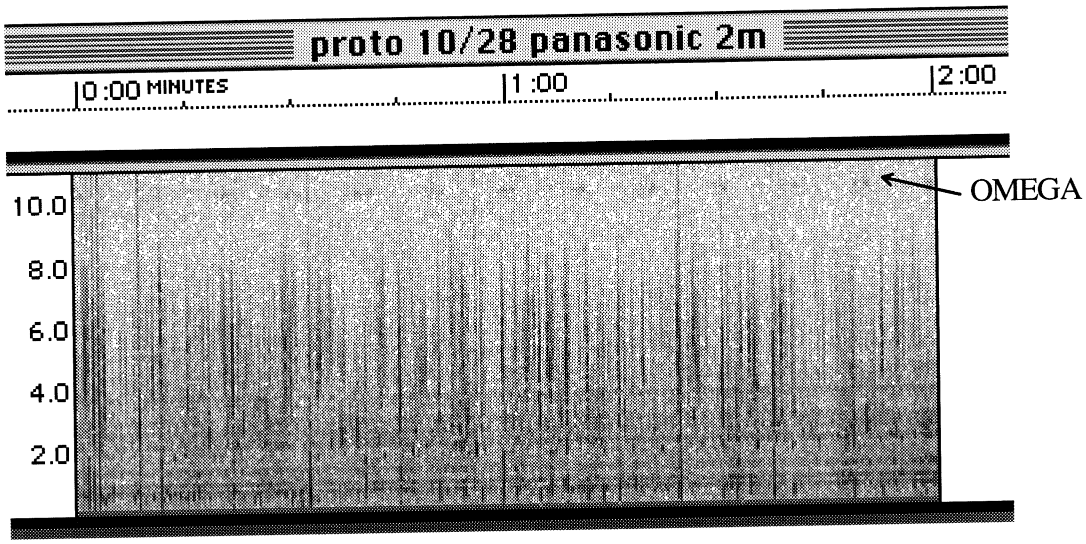


MATERIAL:

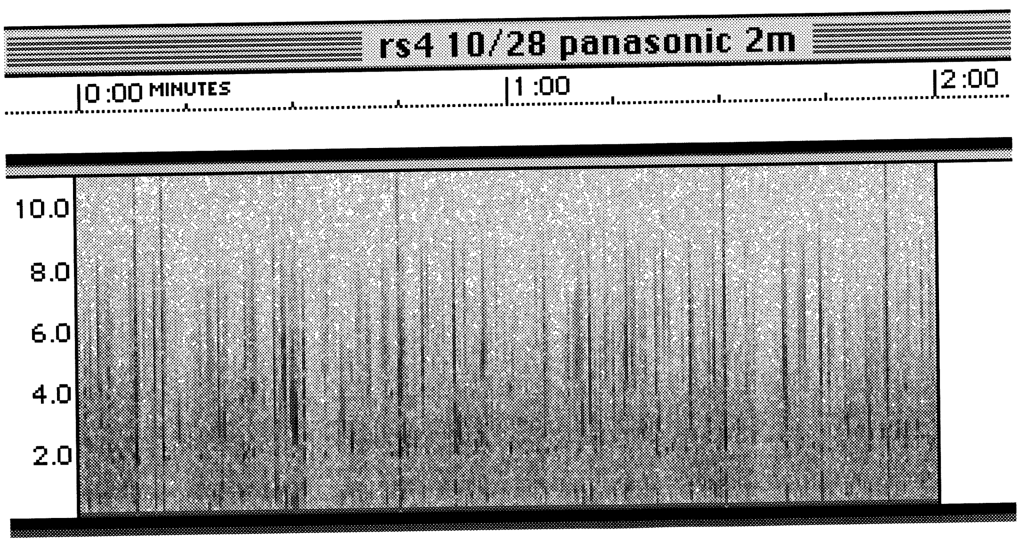
FR4-Fiberglass with
1 oz. Cu. Single
sided.

Topside silkscreened
with part location.

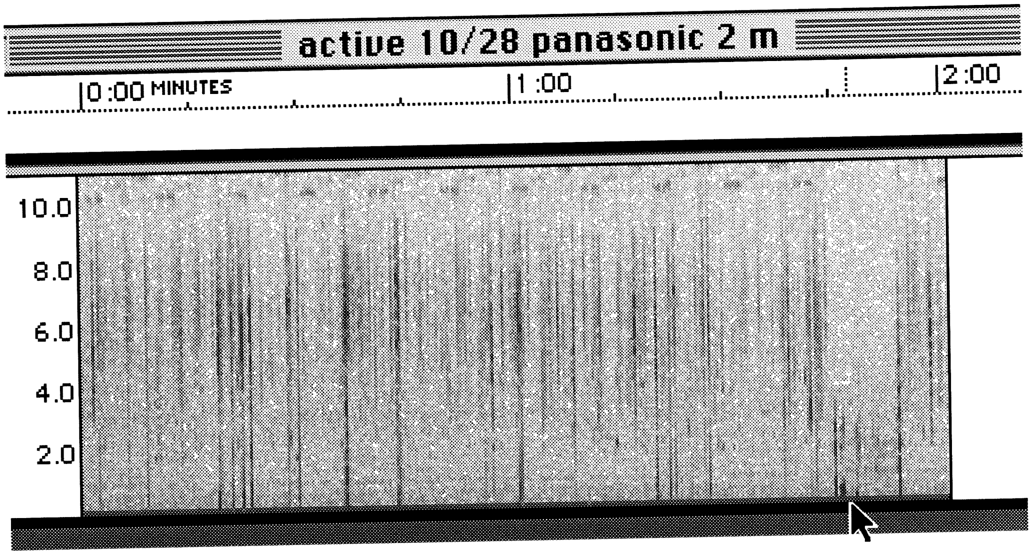
Field Test Results



A 2-minute file using the prototype VLF2 and a Panasonic cassette recorder.



Output from the same session using an RS4 and the Panasonic recorder.



Output from the same session using an ACTIVE B-field receiver and the Panasonic recorder.

The differences noted for the prototype VLF2 receiver are:

1. Reception of OMEGA is better than on the RS4. Because of the circuit design, the ACTIVE receiver is inherently more sensitive to the frequency range of 10 - 15 kHz.

2. The response in the 1 - 8 kHz range seems to be more even on the VLF2 than on either of the others. That is, the sferic lines seem to be stronger and more complete.

The end result of this field test was the determination that the design of the VLF2 was satisfactory. After some minor modifications of front panel layout a production run of 100 kits was ordered. This order has since been delivered and the kits are ready to be shipped.

10 MHz WWV Receiver Kit

by Scott Green
Springbrook High School
Silver Spring, MD

Background

My name is Scott Green. I live in Maryland. I am 14 years old and I have put together several INSPIRE Receiver Kits. Mr. Pine, from INSPIRE, asked me to put together a WWV Receiver Kit and report my impressions in this volume of the INSPIRE Newsletter.

Introduction

One of the most important procedures for taking data in the field with an INSPIRE receiver is the addition of an accurate time stamp on the audio data tape. The most important source for accurate time in the United States is the NOAA WWV broadcast station in Pueblo, Colorado. This station broadcasts time 24 hours per day every day, of the year, at 15, 10 and 5 MHz. There are several types of WWV receivers on the market, and I will be reviewing the 10 MHz WWV Receiver Kit produced by "Almost All Digital Electronics" (AADE) in Auburn, Washington. The AADE WWV Receiver Kit sells for $40 including shipping.

Assembly

After receiving the AADE Kit I did a parts inventory and found that I was missing a 150 Ω resistor. This was easy to purchase but it just delayed getting the system operational and working. The kit also does not come with an antenna, which is something else you are going to have to purchase or make. Another parts error is the fact that the diagrams show a two prong on/off switch but you are given a three prong switch. Of course, in this case you just use two prongs on either side (it doesn't really matter which side you choose). In addition, the switch is much larger than the mounting hole available for it. So, you are indeed going to have to cut a bigger hole to mount the switch.

Not only were there problems with the parts there were problems with the instructions. The instructions did not provide an organized way about putting the receiver kit together. Even though it ultimately didn't matter the order of assembly beyond soldering the components on first then completing the wiring to the switches I found that my past experience putting together several INSPIRE Kits was essential to clearly understand how the AADE Kit should go together.

Among the many things you will notice about this kit is that it's much harder to assemble than an INSPIRE kit because of its extremely crowded PC board. This board has very narrow circuit pathways that are close together and very easily bridged (with solder). When assembling this kit be sure to have a solder sucker on hand, because you may need one to clean up all the bridging mistakes. Also, make sure you use a sharp tipped soldering iron and take your time.

Another thing you must look out for is the placement of the three Integrated Circuit (IC) chips. I installed two of the three ICs backwards due to mistakes I made at looking at the diagrams that were given (all the labels on the ICs were shown as being in the same orientation but they actually depended on the pin position). Since IC sockets do not come with the kit and therefore are not used, the whole IC had to be unsoldered, reoriented, and then of course soldered back into place. Make sure you have extra wire on hand too because, I found that the battery snap wires are not long enough to reach the other side where the switch is located, and still be able to comfortably change the battery. In fact the kit comes with absolutely no additional wire that you can use to connect everything up.

There is no resistor color code diagram that comes with this kit making it difficult for beginners. You can use the resistor color code in the assembly instructions that comes with your INSPIRE kit.

Operations

In the area of operations there were a few glitches such as there is an extremely awkward volume control that is set permanently inside the box. So basically if the volume is too soft then you have to open up the box and adjust it with a small screw driver. Reception is a large problem because the AADE unit is a 10 MHz receiver and on the east coast 15 MHz works the best. So this may be considered more of a regional WWV kit. You probably will not get as good a reception on the east coast as you would on the west coast or midwest.

Conclusion

I would like to say that there were more things that I didn't like about this kit than things that I did like. I liked the fact that it was very compact and it had a nice big speaker. Yet I really disliked the fact that there were inadequate instructions, a small PC board, I didn't get all of the parts, and there was no external volume control. So over all I would say that during the process of making this kit I became very frustrated at times because of the incompleteness of the kit as a whole. The kit is not for beginners and is probably more useful on the west coast than the east coast due to better reception at 10 Mhz.

Ordering Information

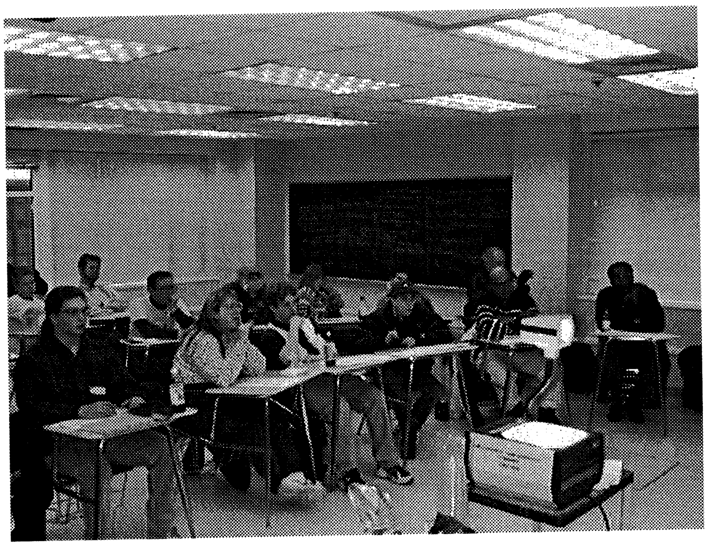
Almost all digital Electronics
1412 Elm St. S.E.
Auburn, WA 98092

Complete kit: $35.95 + $4.00 (shipping)

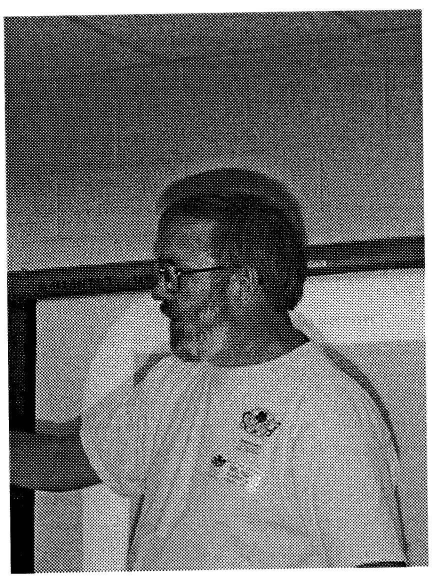
Second Annual DC Area INSPIRE Workshop

The Story in Pictures

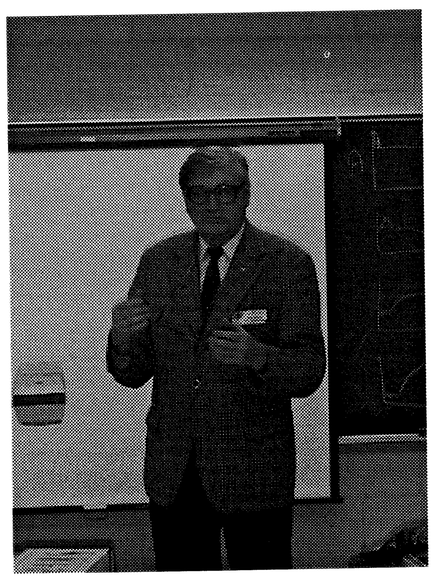
The Second Annual DC Area INSPIRE Workshop was held at Gallaudet University on Saturday February 8, 1997. A total of 7 teachers and 6 students attended. Some who planned to attend were unable to because of the first significant snow storm of the season. Those who did attend joined an INSPIRE staff of 7 in a very interesting and rewarding day. The following pictures were taken with a digital camera provided (and operated) by David Snyder, science professor at Gallaudet and our host for the day. The workshop was cosponsored by INSPIRE, the DC Space Grant Consortium (DCSGC) and Gallaudet University.



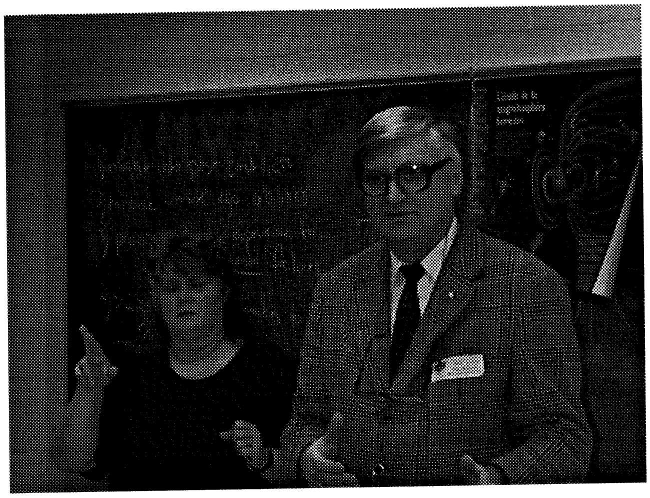
The group gathers for the morning session.



Bill Pine gives a talk on natural radio.

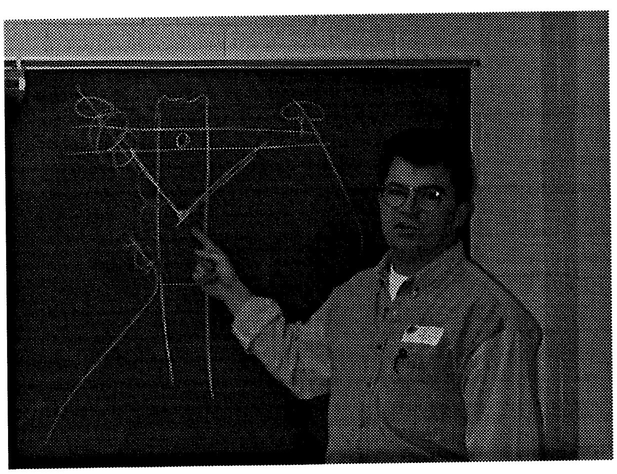


Stas Klimov of the Russian Space Agency described he instruments carried on MIR.



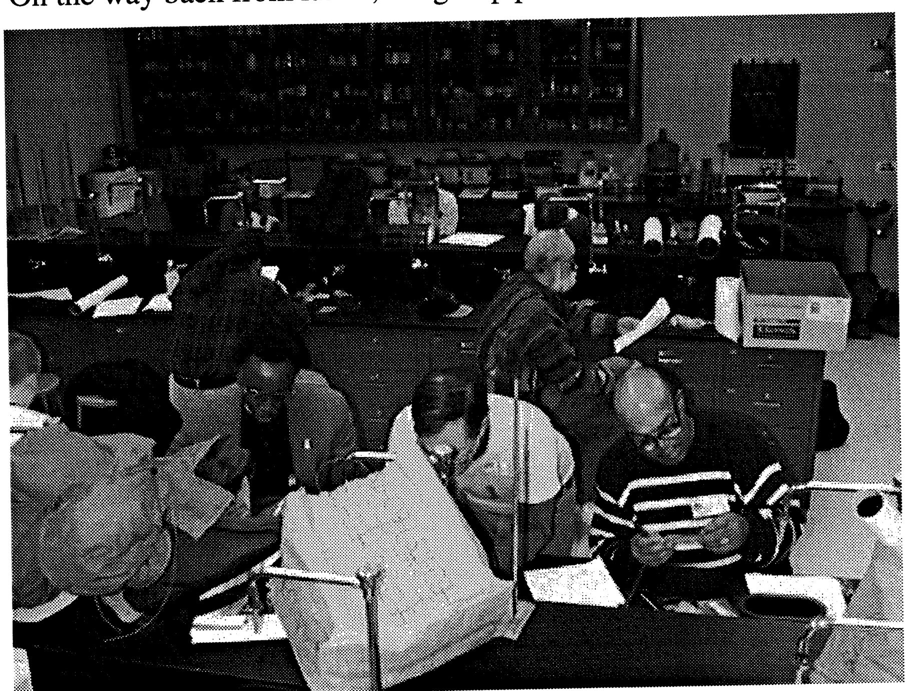
An interpreter signs as Stas talks. Two students from Maryland School for the Deaf attended. Interpreter services were provided by Gallaudet University. Stas was a guest of INSPIRE.

Olga Lapshinova is an engineer with ENERGIA Corporation in Moscow. She is our direct contact with the MIR Space Station. She was a guest of INSPIRE at the workshop.

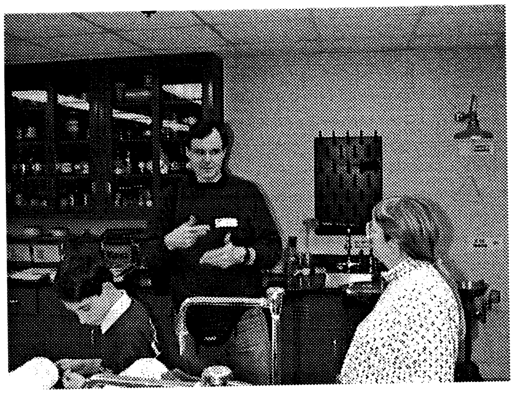


Mike Martin, of Potomac Electric Power Company (PEPCO), gave an interesting talk on radio sources from power lines and malfunctioning appliances. Mike's job with PEPCO is to work with customers to find sources of radio interference in their homes. Mike also spoke last year at the First Workshop.

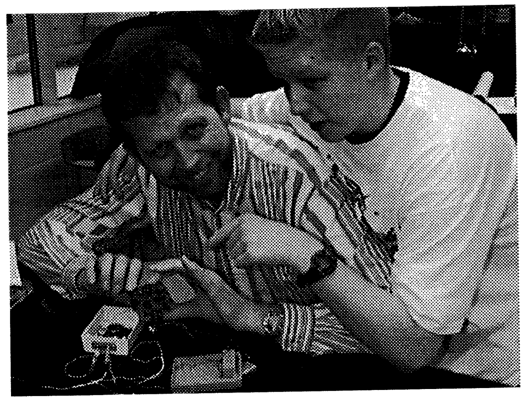
On the way back from lunch, the group posed in the snow for a photo.



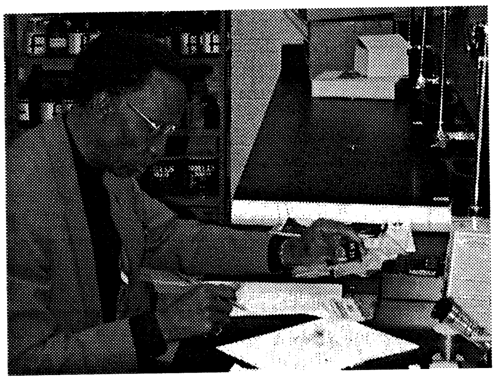
The early afternoon session was devoted to learning about assembling the new VLF2 kit.



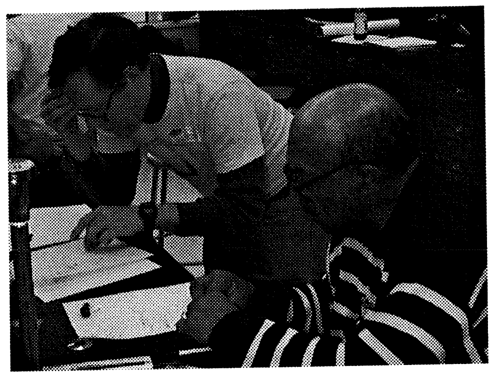
David Snyder of Gallaudet University talks to Becky DeLameter of the Maryland School for the Deaf.



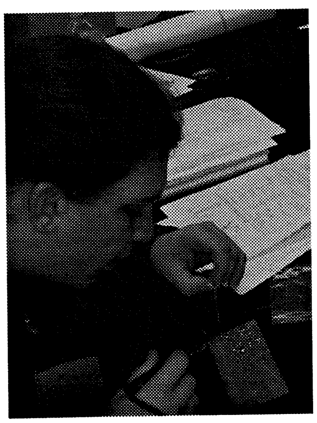
Scott Green instructs his dad, Jim Green of NASA Goddard Space Flight Center, on how to assemble the kit.



Alvin Darby of the University of District of Columbia works his way through the the assembly instructions.

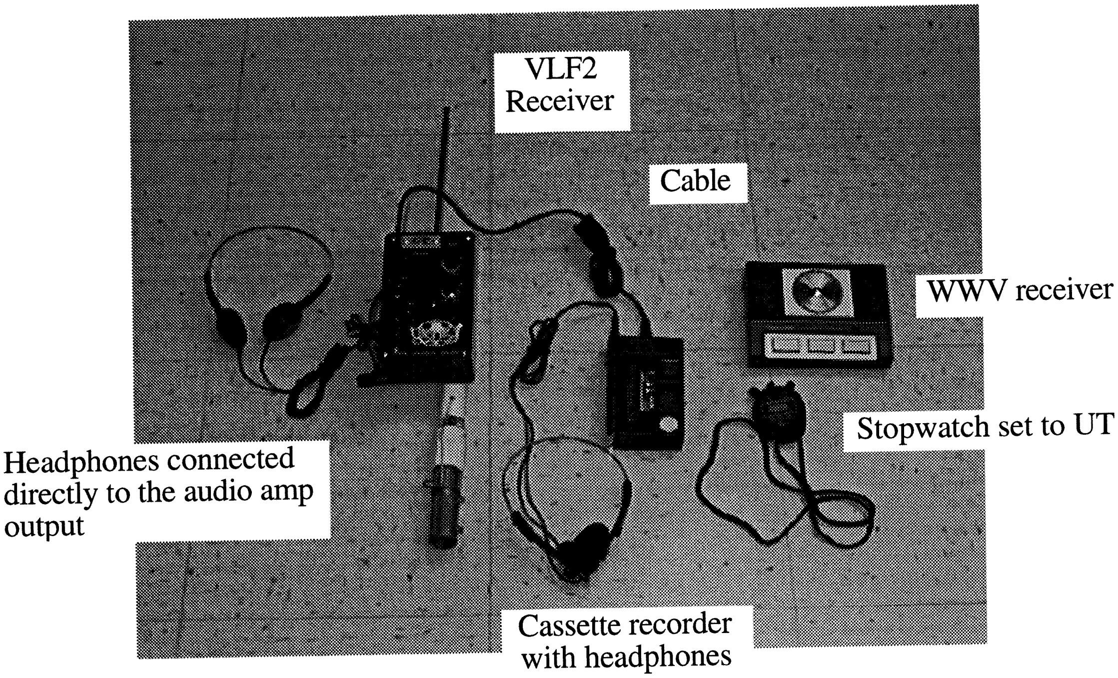


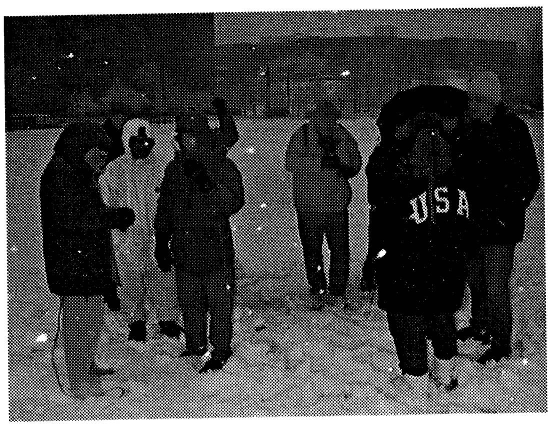
Allen Barwick of Woodrow Wilson High School in Washington DC and Fielding Gentry of Oakhill Milburn High School in Laurel, MD, try a little cooperative learning.



Benjamin Kleber, a student at Walter Johnson High School in Rockville, MD, solders a component.

Two students from Maryland School for the Deaf work together on parts identification.





Looking like an Artic expedition, the group gathered on the athletic field to record an early evening pass of MIR. This was the last activity of the day.

Bill Pine provides the counterpoise ground by holding the receiver in his (cold) hand. Benjamin Kleber listens and Alvin Darby provides much appreciated shelter

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.

North American observers:

Team #	Observer	Location
1	John Lamb, Jr. East Texas State University (Retired)	Belton, TX
2	Stephen G. Davis	Fort Edwards, NY
3	Don Shockey	Oklahoma City, OK
4	Mike Aiello	Croton, NY
5	Jean-Claude Touzin	St. Vital, QC, CANADA
6	Bill Pine Chaffey High School	Ontario, CA
7	Dean Knight Sonoma Valley High School	Sonoma, CA
8	Mike Dormann	Seattle, WA
9	Robert Moloch Eastern Elementary School	Greentown, IN
10	Bill Taylor INSPIRE	Washington, DC
11	Mark Mueller Brown Deer High School	Brown Deer, WI
12	Jon Wallace	Litchfield, CT
13	Bill Combs	Crawfordsville, IN
14	John Barry Seeger High School	West Lebanon, IN
15	Robert Bennett	Las Cruces, NM
16	Leonard Marraccini	Finleyville, PA
17	Kent Gardner	Fullerton, CA

European observers:

Team #	Observer	Location
E1	Flavio Gori	Florence, IT
E2	Silvio Bernocco	Vaccera, IT
E3	Fabio Courmoz	Aosta, IT
E4	Joe Banks	London, UK
E5	Renato Romero	Cumiana, IT
E6	Marco Ibridi	Finale E., IT
E7	Alessandro Arrighi	Firenze, IT
E8	Zeljko Andreic Rudjer Boskovic Institute	Zagreb, Croatia

Additions to the roster of INTMINS Observers:

New INTMINS teams, with their permanent team numbers and descriptions are shown below. INTMINS observers are described in the following format:

X. (team number) Name of observer — Location
Team Name
Longitude: of observation site
Latitude: of observation site
Description of observation site
Receiver: description of receiver used
Recorder: description of recorder used
Antenna: antenna type and description
WWV: WWV radio used (if any)
File code: used for naming data files for storage

North American Teams:

18. David Jones — Columbus, GA
Longitude: 77° 07' W
Latitude: 35° 00' N
Open field
Receiver: INSPIRE RS4
Recorder: CTR-69 Radio Shack
Antenna: Vertical E-field
WWV: SPR-4 Drake
File code: JONES GA

19. Larry Kramer / Clifton Lasky — Fresno, CA
Longitude: 119° 49' W
Latitude: 37° 01' N
"Wide Awake Ranch", low rolling hills, open terrain
Receiver: Homebrew
Recorder: Optimus STG-88
Antenna: 1" diameter, 40 ft. vertical
WWV: Specific Products Model WVTR
File code: K/L CA

20. Barry S. Riehle — Cincinnati, OH
Turpin High School
Longitude: 84° 15' W
Latitude: 39° 7' W
Cincinnati Nature Center
Receiver: INSPIRE RS4
Recorder: Sanyo
Antenna: 2m wire
WWV: Realistic
File code: RIEHLE OH

21. Phil Hartzell — Aurora, NE

Longitude: 98° 0' W
Latitude: 41° 0' N
Grass hill - over lake
Receiver: INSPIRE RS4
Recorder: Radio Shack CTR-69
Antenna: 100 ft. long wire - N to S
WWV:
File code: HARTZELL NE

European teams:

E9. Dr. Valery Korepanov — Lviv, UKRAINE

Lviv Center of Institute of Space Research of NASU
Longitude: 24° E
Latitude: 50° N
The south outskirts of Lviv-city, approximately 400 m above sea level
Receiver: INSPIRE RS4
Recorder: Karpaty 205-1 mono, N1
Antenna: 1.5 meter whip
WWV:
File code: KOREPANOV UKR

INTMINS-November/96 Data Analysis Report

by Bill Pine
Chaffey High School
Ontario, CA

The fourth session in the ongoing series of INTMINS operations was conducted in November 1996. Instruments were operated on board the MIR Space Station in accordance with the schedule published and distributed as a supplement to *The INSPIRE Journal*. INSPIRE observers attempted to record the VLF radio signal emitted by ISTOCHNIK, the modulated electron gun carried on MIR.

The modulation frequencies of ISTOCHNIK are 10 hertz and 1000 hertz (1 kHz). Since the 10 hertz signal is outside the design band of the RS4 receiver and usually obscured by manmade hum, the 1000 hertz signal is the one we are attempting to detect. ISTOCHNIK is operated for 10 seconds at 10 hertz then 10 seconds at 1000 hertz, alternating between these two frequencies each 10 seconds for two minutes.

Once again, analysis of data tapes has failed to reveal the presence of an electromagnetic signal from ISTOCHNIK. That leads to the question: Where do we (INSPIRE) stand in our investigation? One way to answer this question is to consider the possible descriptions of the radio signal produced by the electron gun. Any of the following is possible:

1. The signal is easily detected on the surface of the earth each time ISTOCHNIK is operated.
2. The signal is routinely detectable with more sensitive receivers than those available now.
3. The signal is detectable only under ideal natural radio conditions (whatever they may be!).
4. The signal is detectable only with a combination of ideal natural conditions and a more sensitive receiver.
5. The signal is detectable under the above conditions plus an increase in the power of the electron gun.
6. The signal is not detectable under any conditions.

We can pretty much rule out the first description since we have made several good efforts with no results. Scenario #2 is being addressed somewhat with the new INSPIRE VLF2 receiver. While the RS4 design is very good, some attempts were made to improve the signal-to-noise ratio and overall sensitivity. Scenarios #3 and #4 remain to be seen as we continue our efforts. Description #5 is an interesting possibility. While it is not possible to change the power of ISTOCHNIK now, it is possible that a more powerful electron gun may be part of the payload of MIR in the future or may be included on the International Space Station. If an electron gun of increased power is ever considered, an argument in its favor will be the existence of an experienced group of ground-based observers (INSPIRE!). Finally, scenario #6 may be correct. It would be disappointing if this were the case, but it is a possibility. We have by no means proven that the signal is undetectable under any conditions. We just haven't found it - yet.

Determination of the INTMINS Schedule

The process of setting the observation schedule is always exciting and a little nerve-wracking. In the fall of 1996, the process went something like this:

1. In mid-October, Bill Taylor created some maps of the orbital tracks of MIR during the last two weekends of November. To do this, the two-line orbital element set is used with an orbit tracking program. The problem with this technique is that is assumes that the orbital parameters are known precisely and that the orbit will not change. Of course, neither of these assumptions is true. The orbital elements are determined from ground based observations which involves uncertainties. The orbit of MIR changes constantly due to natural orbital decay and large changes in orbit may result from maneuvering of MIR.

2. A schedule was set of operations during the last two weekends of November. This schedule was designed to accommodate as much as possible the participation of high school observers. Operations occur between 1800 local time on Friday and 1800 local time on Sunday with early morning operations (before 5 AM local time) minimized. The schedule was also designed to provide passes near INTMINS observers who have submitted data in the past.

3. This schedule was sent to the printer on October 20 in time to be printed and included as an insert with the *Journal* which was mailed on November 1.

4. The schedule was sent to Olga Lapshinova, of the Energis Corporation, in Moscow to be programmed up to MIR.

5. Every couple of days the orbital elements were checked and new maps generated. Any changes in ground track were noted. If significant changes had occurred, adjustments in the schedule were considered. Any adjustment in the schedule would be for the purpose of keeping the ground track as close as possible to the track shown on the published schedule even if that meant modifying the times of operation. On October 23, significant changes in the ground track were noted and a modified schedule was sent to Moscow. It was too late to change the published schedule.

6. As November 1 came and went, the ground tracks stayed pretty stable. By November 12, the change was significant enough to warrant another adjustment to the schedule.

7. On November 26, between the two weekends of INTMINS Operations, a final change was made for the operations on the second weekend.

The net result of all of this changing was a final schedule that differed from the original by only a minute or two for each operation (and some had their times unchanged). As long as the actual operation time of ISTOCHNIK occurs during the 25-minute interval that is recorded and the ground track stays fairly constant the operation time will appear somewhere on the tape. The two-minute interval of actual operation is the segment that will be analyzed. The following table shows the original ISTOCHNIK start time and all of the subsequent modifications.

Operation Number	Original Schedule	Modified 10/23	Modified 11/12	Modified 11/26
23-1	0558	0601	0559	
23-2	1226	1229	1227	
23-3	1534	1537	1535	
E24-1	0207	0210	0208	
E24-2	0338	0340	0338	
24-3	1124	1127	1125	
24-4	1259	1302	1300	
24-5	1429	1432	1430	
24-6	1607	1610	1608	
30-1	0347	0351	0349	0348
30-2	0521	0525	0523	0522
30-3	0651	0656	0654	0653
30-4	1319	1323	1321	1320
E30-5	2214	2217	2215	2214
E30-6	2356	2359	2357	2356
E1-1	0130	0133	0131	0130
E1-2	0304	0307	0305	0304
1-3	0417	0421	0419	0418
1-4	0553	0555	0553	0552
1-5	0728	0732	0730	0729
1-6	1222	1226	1224	1223

Data Analysis Procedure

Analysis of data tapes consisted of making a 2-minute sound file coinciding with the actual operation time of ISTOCHNIK. This involved listening to the tape and following the log and time marks until the appropriate time, then recording the sound file on computer. The file was then used to create a frequency-time graph, or spectrogram. Using a screen-grab utility, images of the spectrograms were then transferred to Word files for storage, analysis and printing. A common sequence of spectrogram images was:

1. A picture of the entire 2-minute time. The initial frequency range is 0 - 11.025 kHz. This range uses half the CD sampling rate and includes the lowest OMEGA frequency (10.4 kHz). At this scale, the ISTOCHNIK signal should appear as an intermittent dash (10 seconds ON, 10 seconds OFF) at 1000 Hz.

2. A one-minute portion of the file was then cropped and enlarged. This minute was designed to include a time mark either at the beginning of the interval or at the end. This makes it easier for the observer to find the recorded segment on the data tape. The ISTOCHNIK signal will also be easier to see at this time scale.

3. Spectrograms of the above two time intervals were then made using a frequency range of 0-4 kHz. This reduced frequency range was chosen to make the 1 kHz frequency and the next couple of harmonics more easily visible.

INTMINS-November/96 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
E24-1	0208	South of England	2
E24-2	0338	Russia, south of Moscow	2
E30-5	2214	Northern Italy	4
E30-6	2356	Russia, south of Moscow	4
E1-1	0130	Northern Italy	3
E1-2	0304	Russia, south of Moscow	2

North American Passes

Pass	ISTOCHNIK Start Time	Path during ISTOCHNIK Firing	Number of Observers Recording Data
23-1	0559	Coast of SC, NC, south of DC	2
23-2	1227	Central NY, CT	1
23-3	1535	NM, west TX	3
24-3	1125	Eastern Ontario, QC CANADA	1
24-4	1300	Southern MN, IL, IN	1
24-5	1430	West of WA, northeast OR	3
24-6	1608	Off coast of southern CA	4
30-1	0348	Northern VA, PA, NY, VT, NH	5
30-2	0522	Northwest IA, southern MN, WI	2
30-3	0653	Northern CA, southeast OR	3
30-4	1320	CA (Bay Area), southeast CA	4
1-3	0418	West TX, central OK	3
1-4	0552	Coast of central CA, northeast NV	4
1-5	0729	West of WA, ID, northeast MT	2
1-6	1223	Southern NM, south TX	1

Summary of Passes Recorded

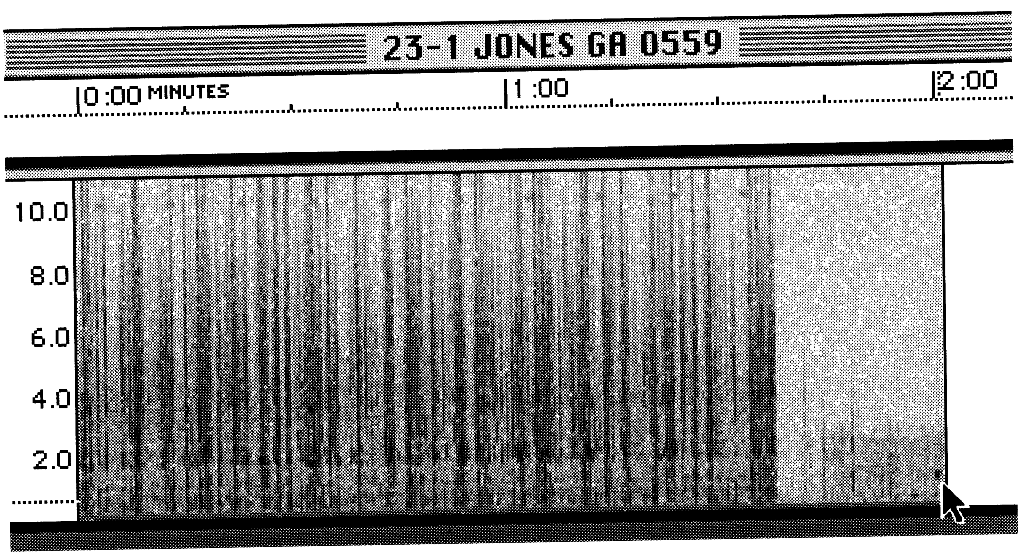
Team/Pass	E24-1	E24-2	E30-5	E30-6	E1-1	E1-2
E2			x	x	x	
E5	x	x	x	x	x	x
E6	x	x	x	x		
E9			x	x	x	x

Pass	11/23			11/24				11/30				12/1			
Team	1	2	3	3	4	5	6	1	2	3	4	3	4	5	6
1			x									x			
2								x							
3												x			
5		x		x				x	x						
6							x			x	x		x		
7						x	x			x	x		x		
8														x	
9					x	x									
15	x		x				x	x		x			x	x	
17						x	x				x		x		
18	x							x							
19											x		x		
20								x							
21			x						x			x			x

INTMINS Data

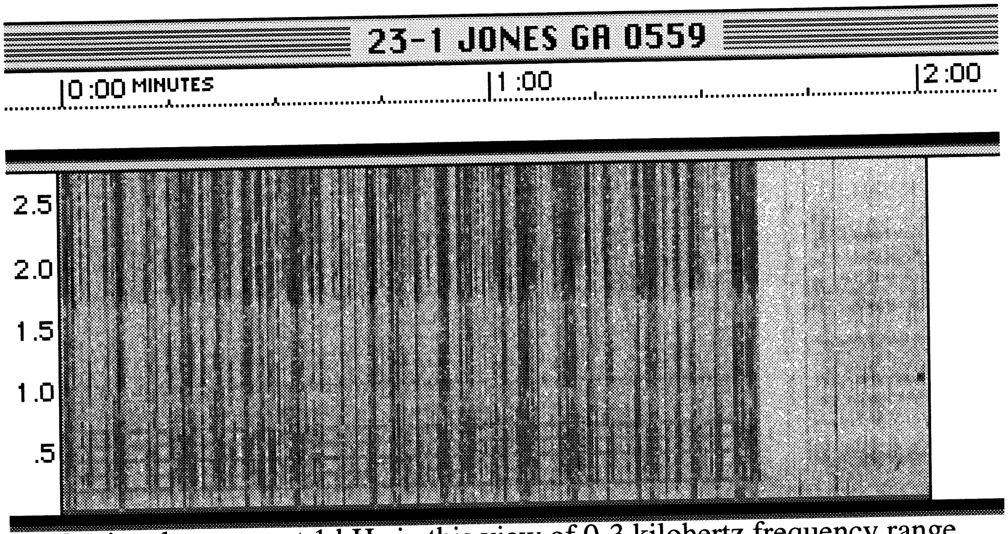
The following spectrograms are taken from the data tapes submitted by INSPIRE observers. The first view shown will be that of the entire two-minute interval analyzed. This first view will contain the file name identifying the observer and the start time of the recording. Subsequent views will be of parts of the interval or with a reduced frequency range. If the start time of the spectrograph differs from that of the data file, it will be indicated. Refer to the time scale at the top of the spectrogram and the frequency scale to the left to determine the parameters for that view.

23-1

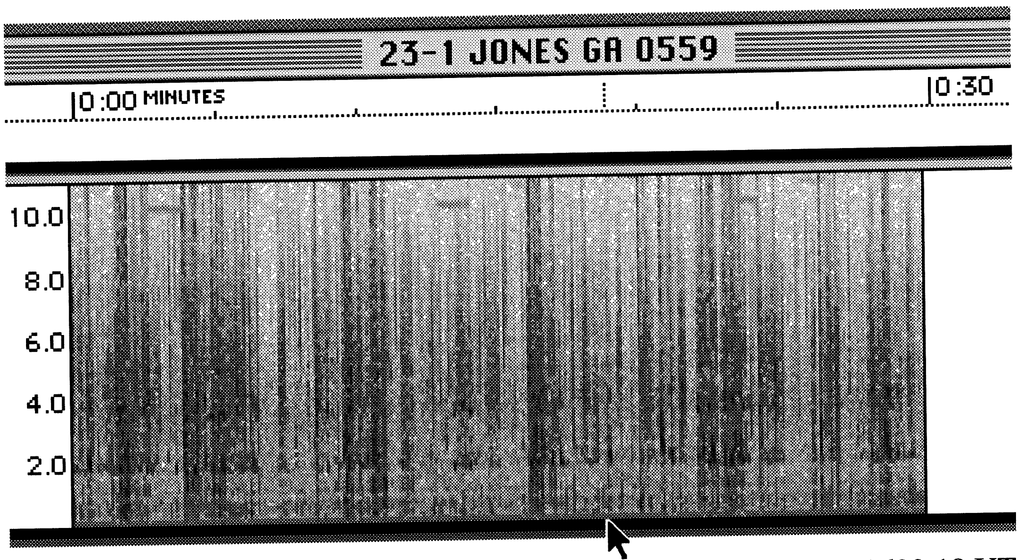


David Jones, Columbus, GA — Team 18

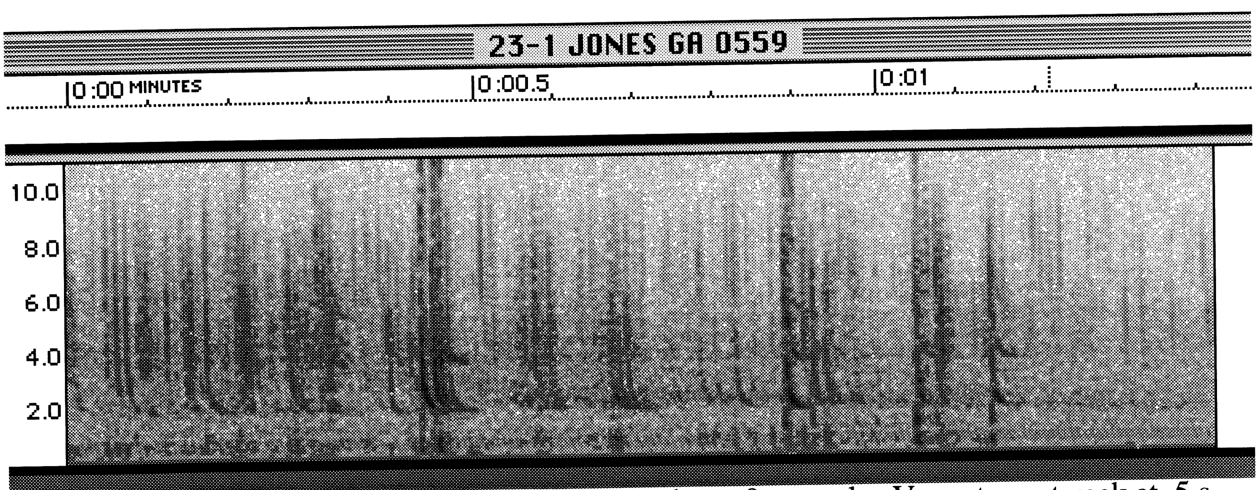
The arrow indicates the WWV time tone at 0601 UT. Dense sferics are present, OMEGA is visible and many tweeks were recorded.



No signal appears at 1 kHz in this view of 0-3 kilohertz frequency range.

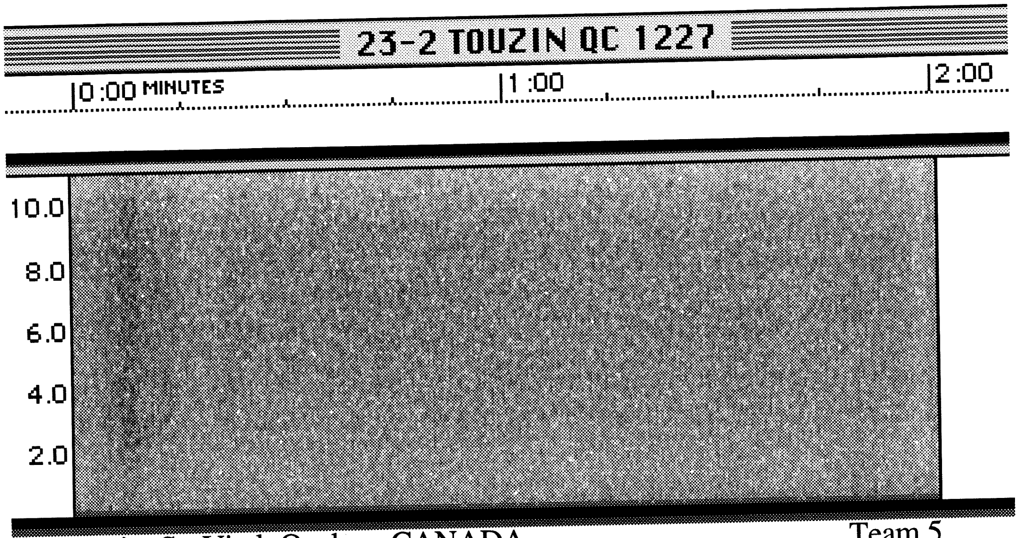


A 30 second interval starting at 0600. Arrow points to a whistler at 0600:18 UT

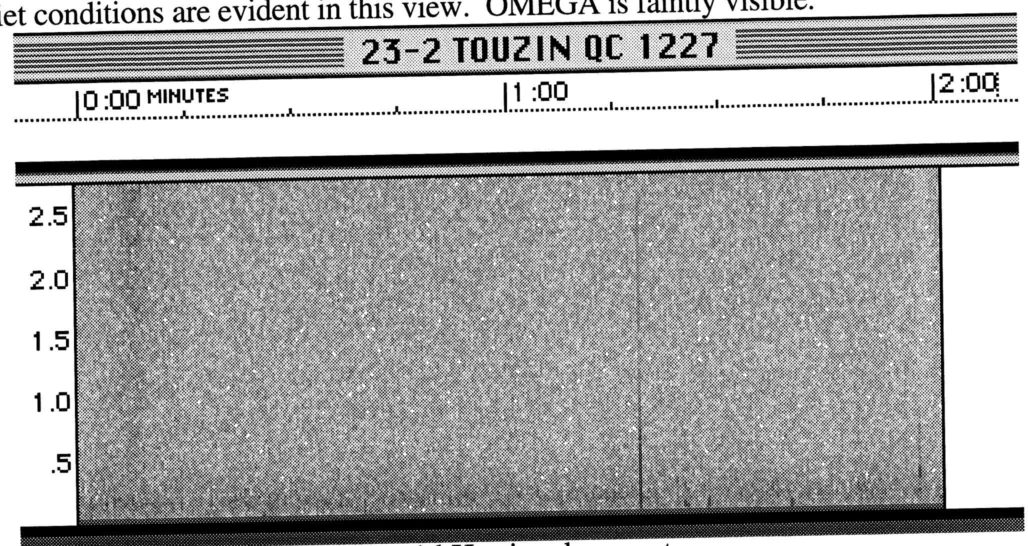


Closeup of above. Whistler is faintly audible at about .9 seconds. Very strong tweek at .5 s.

23-2

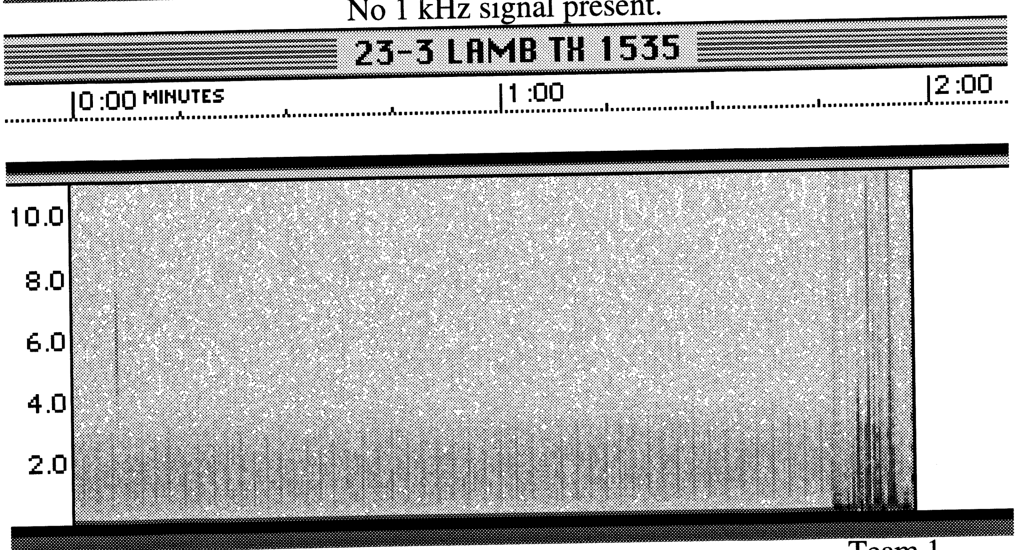


Jean-Claude Touzin, St. Vital, Quebec, CANADA Team 5
Very quiet conditions are evident in this view. OMEGA is faintly visible.

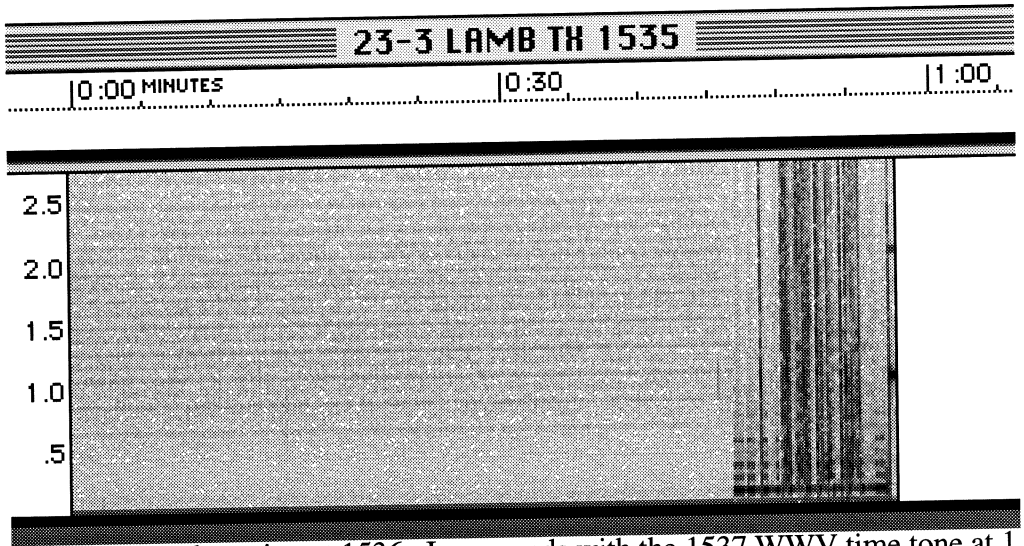


No 1 kHz signal present.

23-3

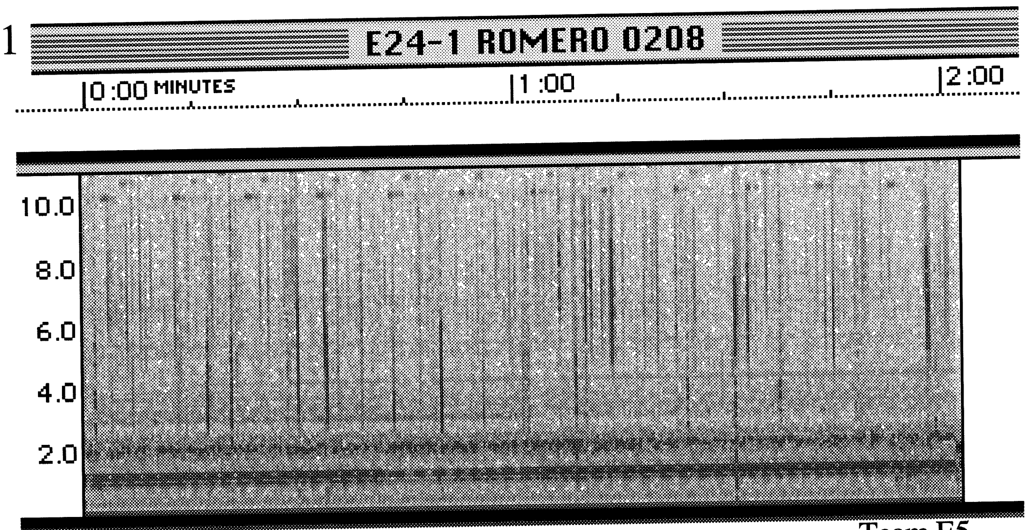


Dr. Jack Lamb, Belton, TX Team 1
Also shows very quiet conditions.



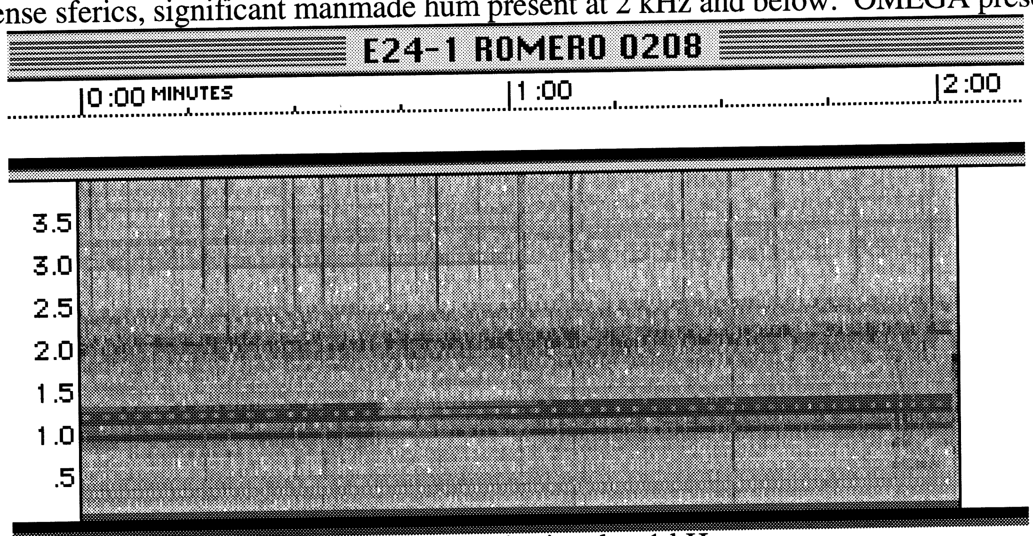
One minute interval starting at 1536. Image ends with the 1537 WWV time tone at 1 kHz.

E24-1

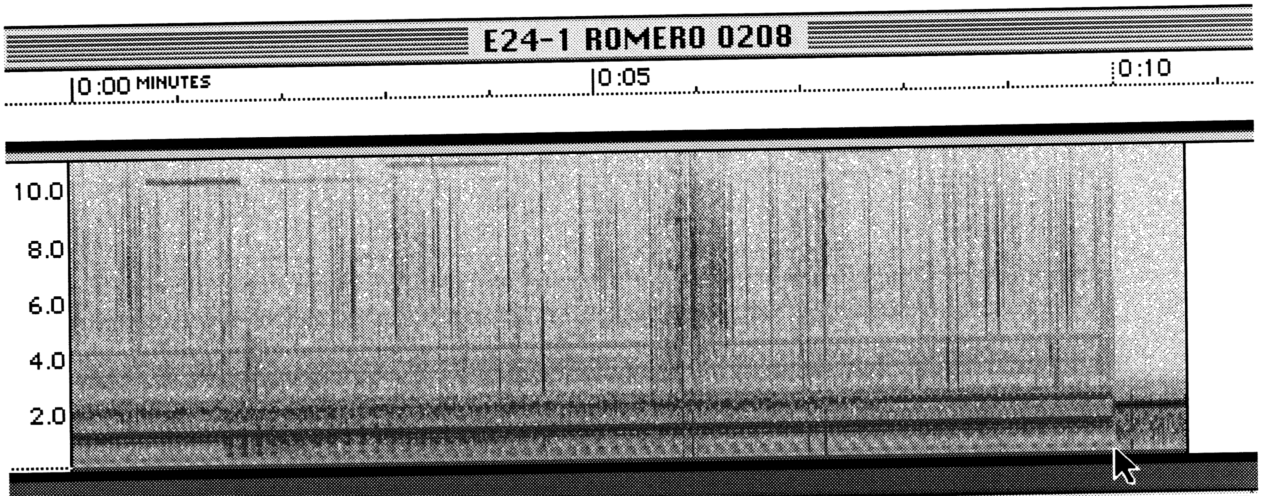


Renato Romero, Cumiana, ITALY — Team E5

Fairly dense sferics, significant manmade hum present at 2 kHz and below. OMEGA present.



Strong manmade signal at 1 kHz.



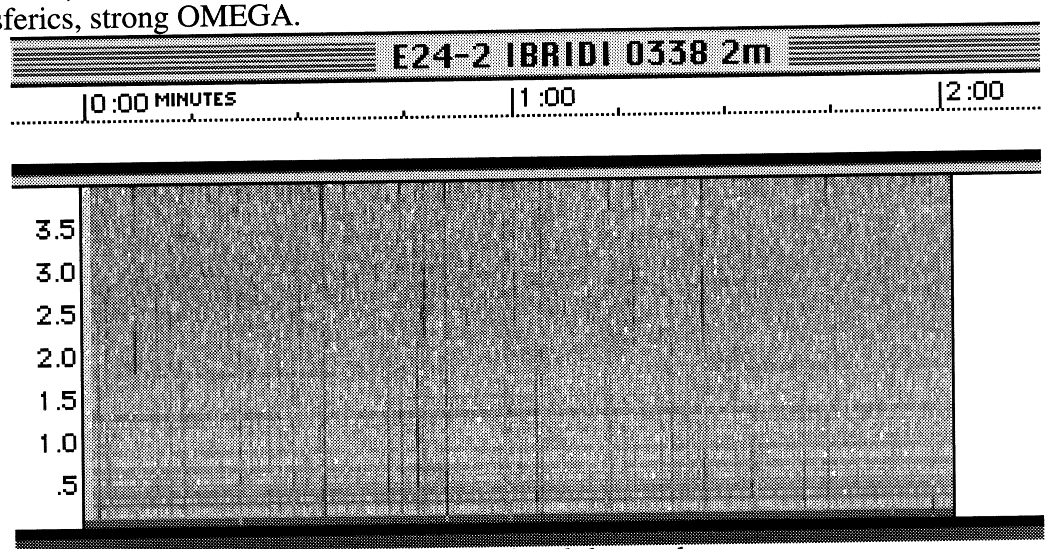
Ten second interval starting at 0209:50. Arrow shows the start of the time signal code at 0210 UT.

E24-2

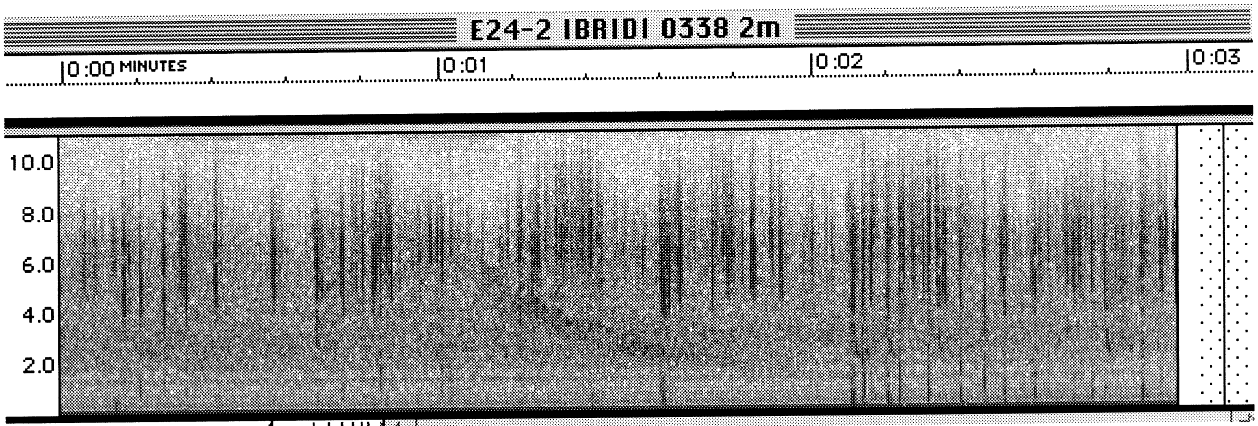
Marco Ibridi, Finale, E., ITALY

Team E6

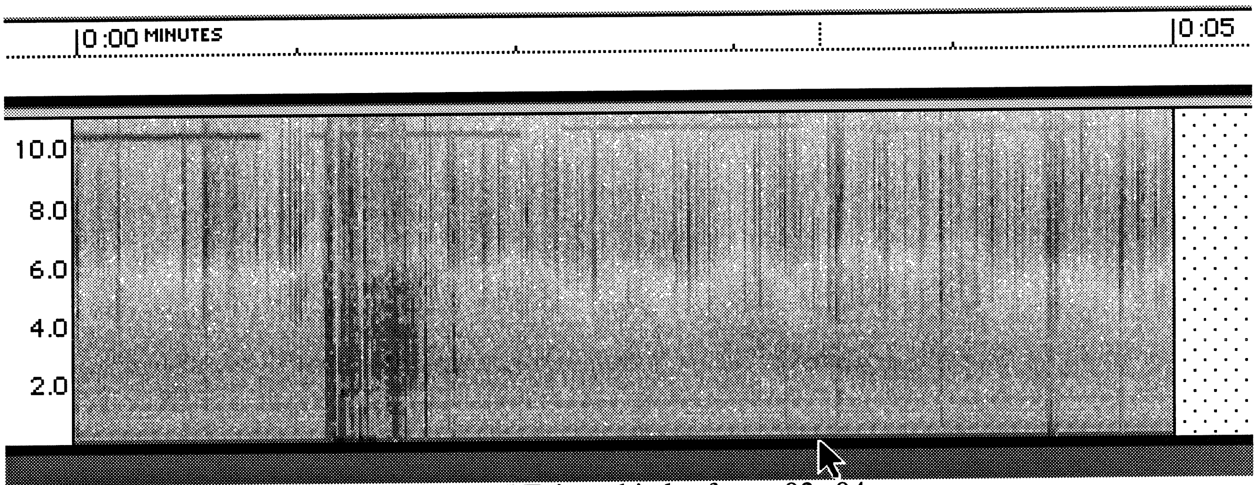
Dense sferics, strong OMEGA.



No 1 kHz signal detected.

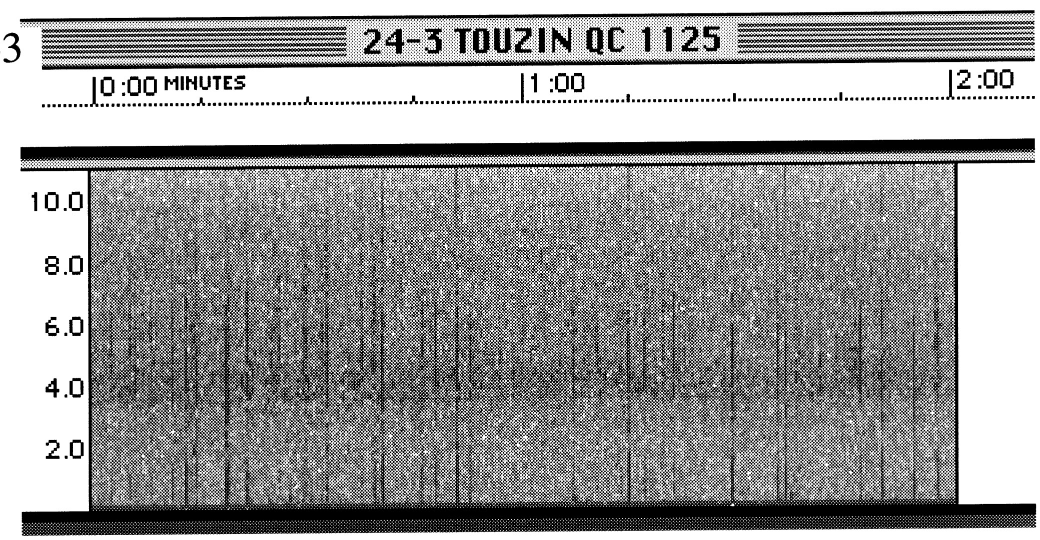


Nice whistler at 0338:19 UT. Whistler is dispersed from :01 s to :02 s.



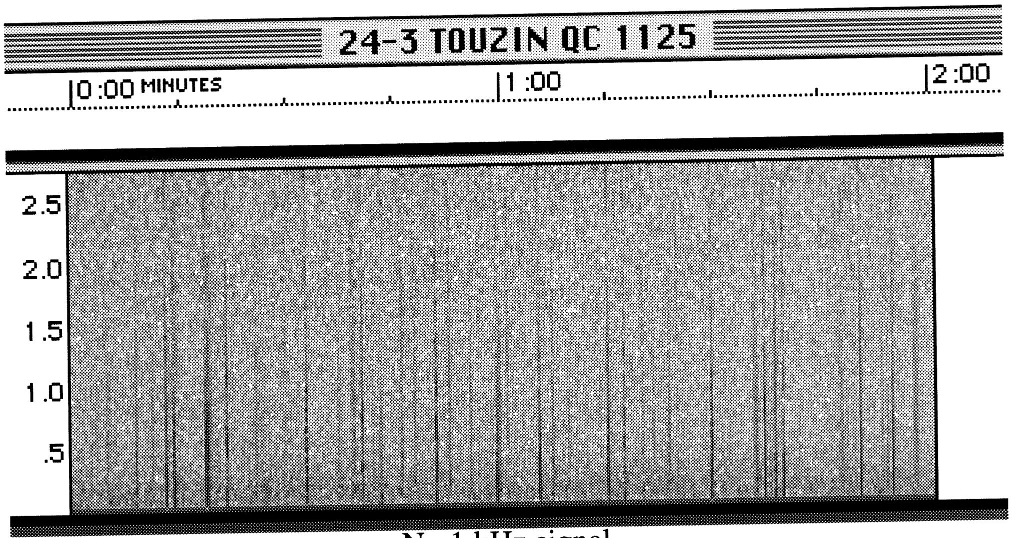
0345:20 UT Faint whistler from :03-:04 s.
May be two-hop whistler originating from sferics at :01-:02 s.

24-3

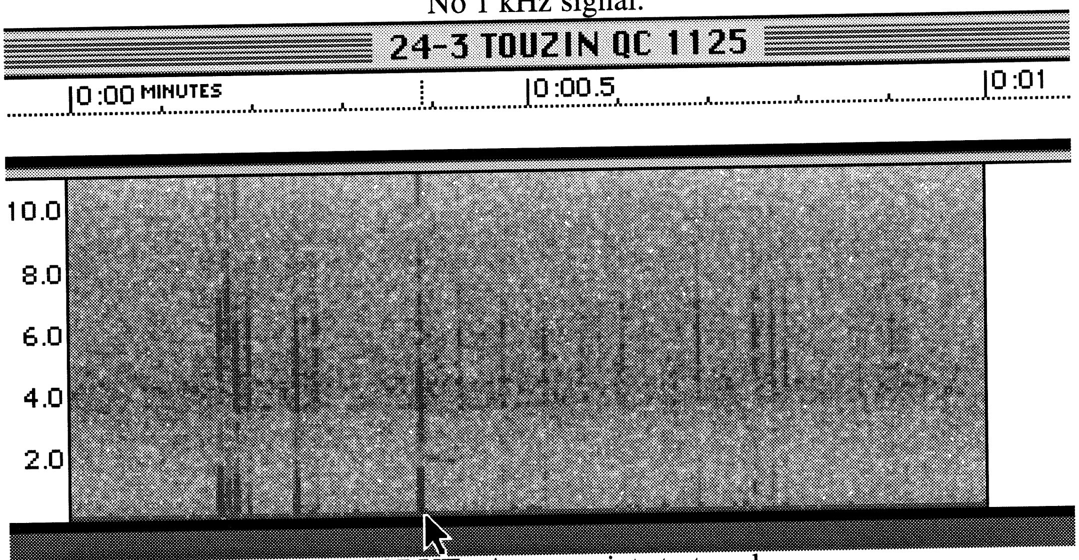


Jean-Claude Touzin, St. Vital, Quebec, CANADA
Fairly dense sferics.

Team 5



No 1 kHz signal.

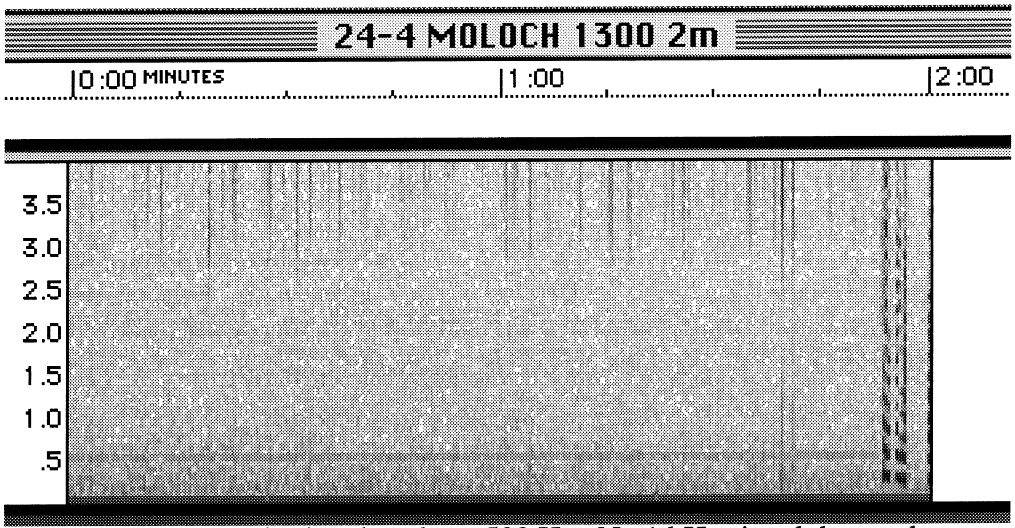


1125:37 UT Arrow points to tweek.

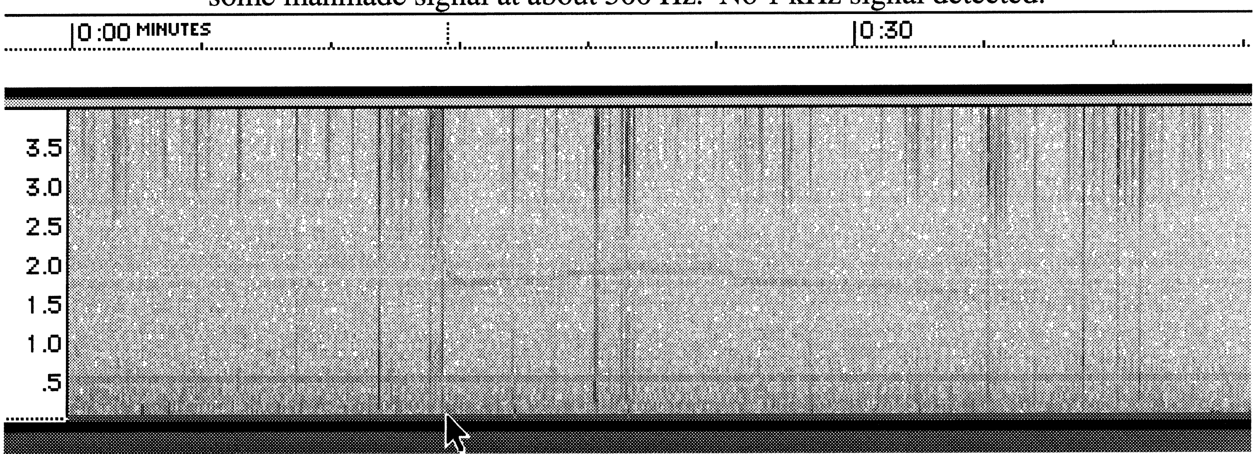
24-4

Robert Moloch, Eastern Elementary School, Greentown, IN — Team 9

Sferics present. Arrow points to voiceprint of "mark" at 1302 UT.

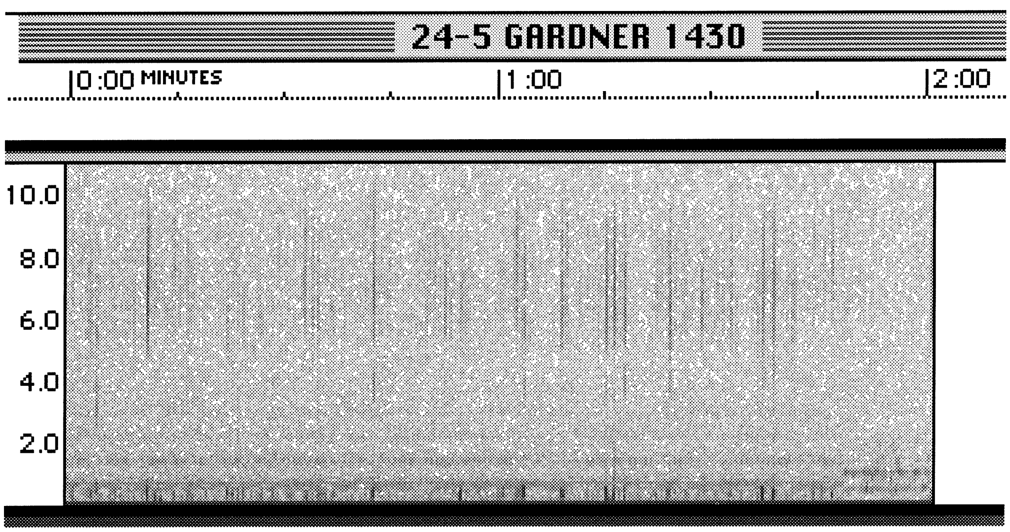


some manmade signal at about 500 Hz. No 1 kHz signal detected.



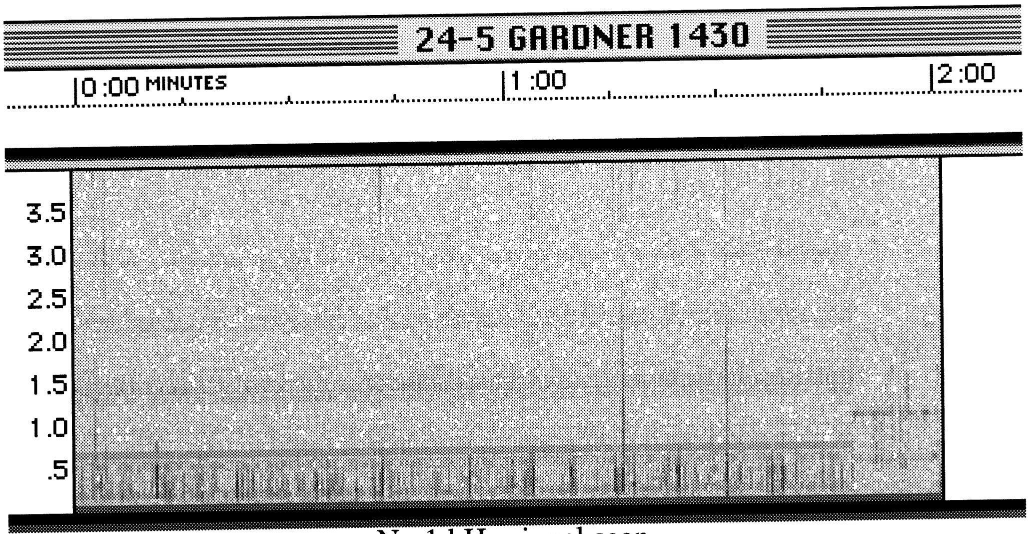
Wavering tone starts at arrow. This is the signal from the ignition system of a car.

24-5



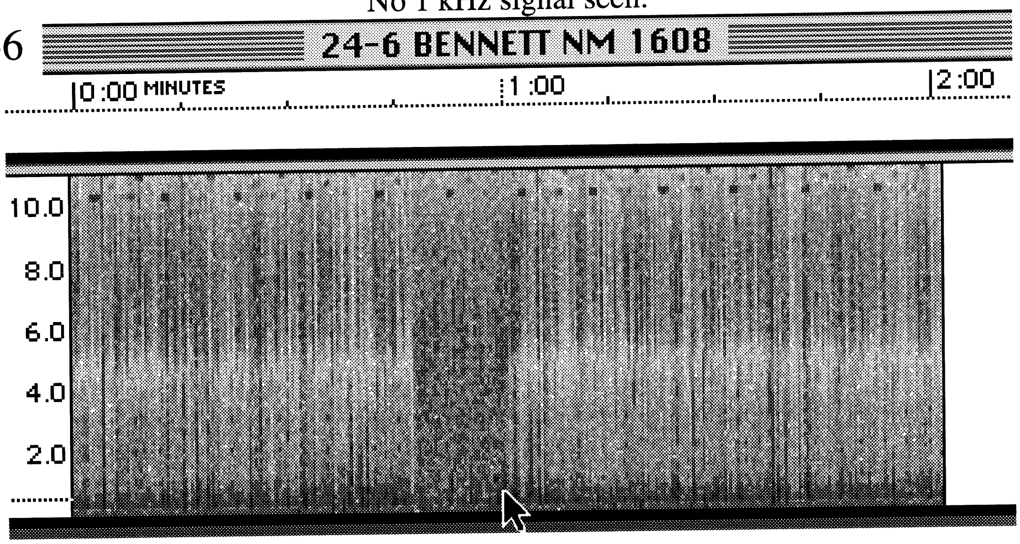
Kent Gardner, Fullerton, CA — Team 17

Sferics present, some low level hum.

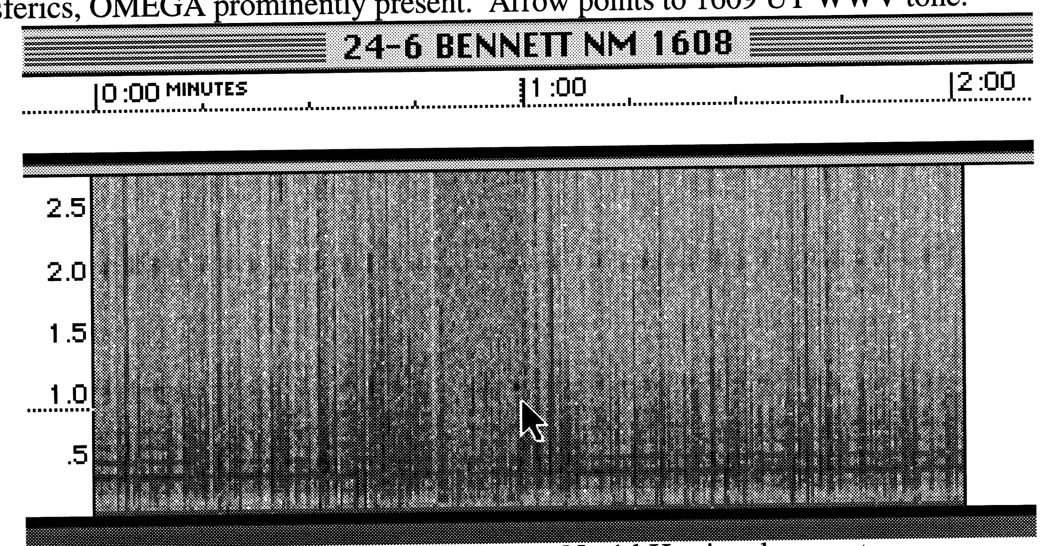


No 1 kHz signal seen.

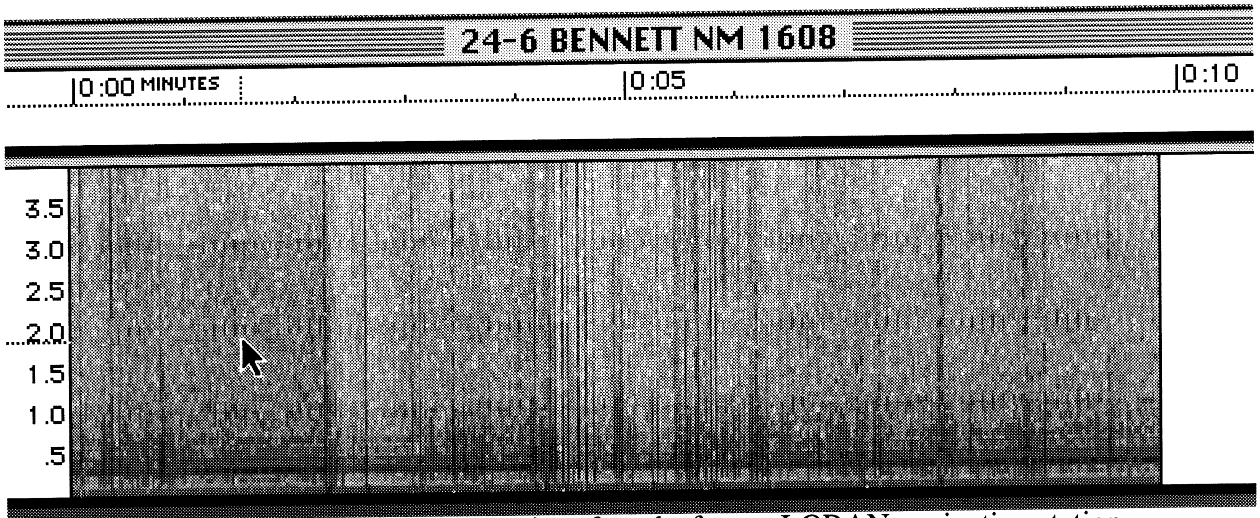
24-6



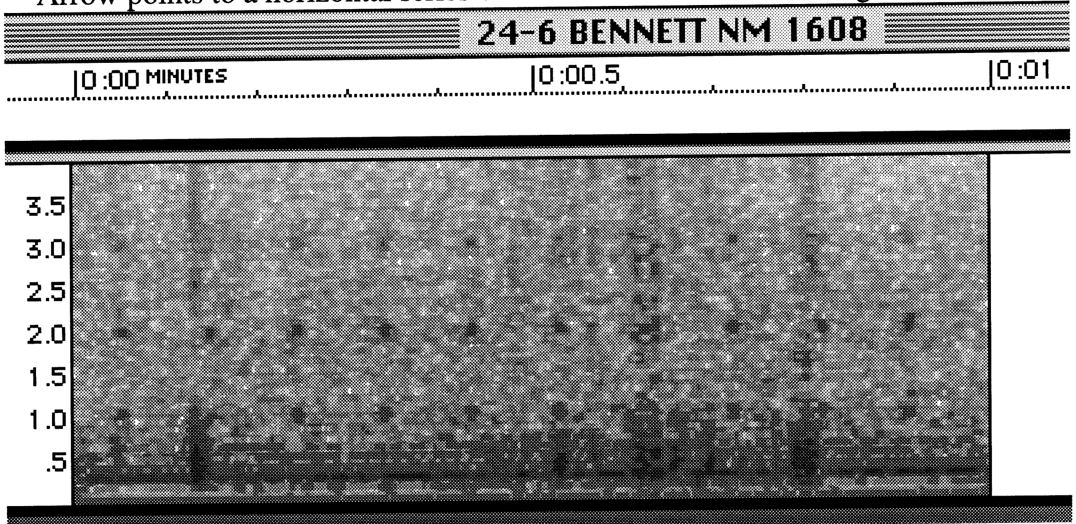
Robert Bennett, Las Cruces, NM Team 15
Dense sferics, OMEGA prominently present. Arrow points to 1609 UT WWV tone.



Arrow points to WWV tone. No 1 kHz signal present.

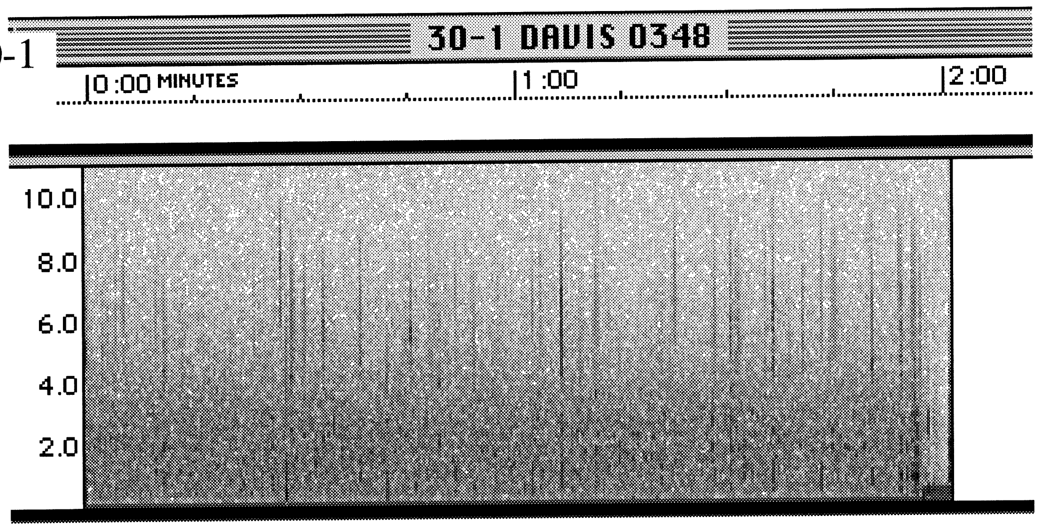


Arrow points to a horizontal series of marks from a LORAN navigation station.



Closeup showing LORAN signals at 1, 2 and 3 kHz. Sounds like a rapid clicking.

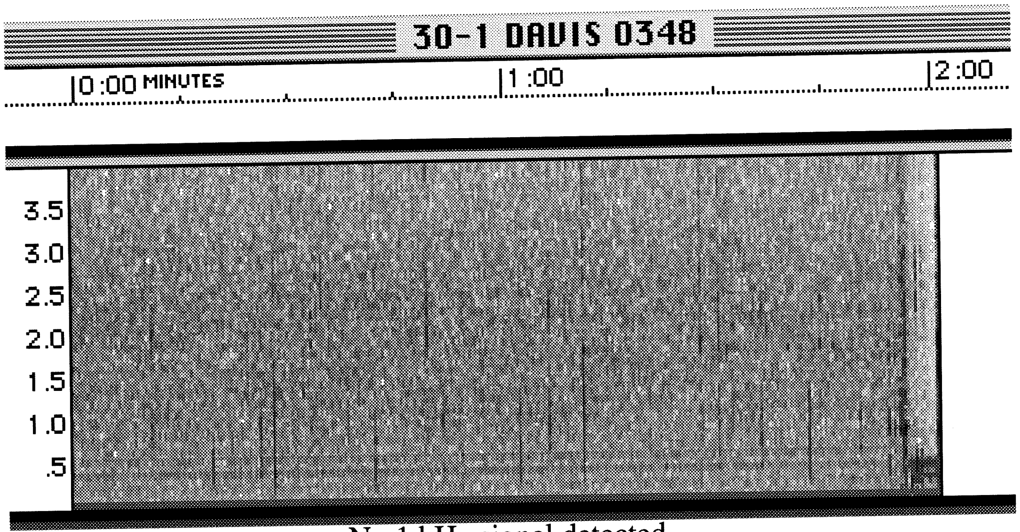
30-1



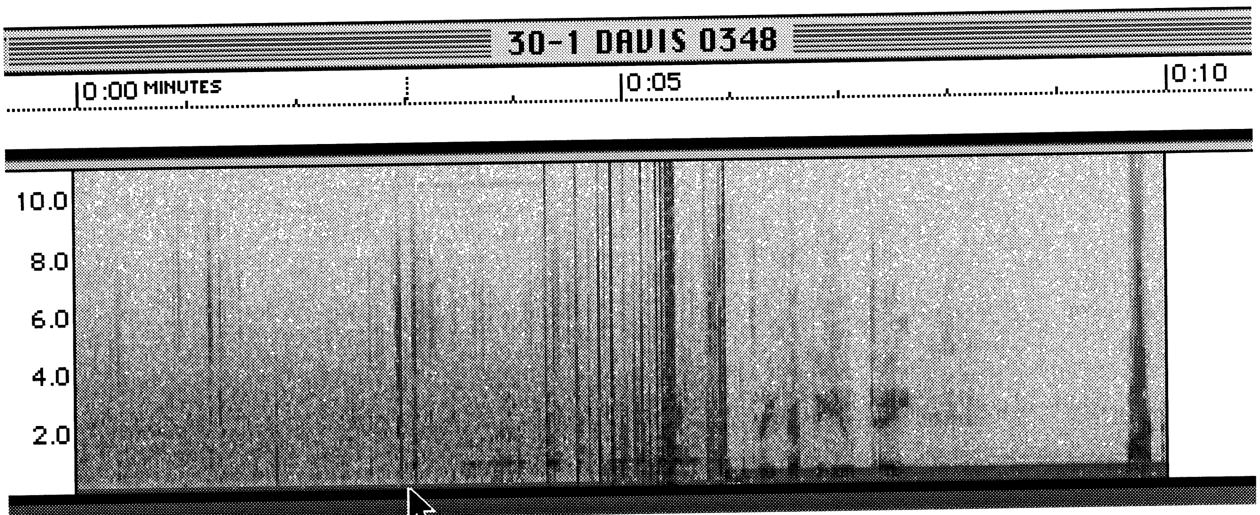
Stephen G. Davis, Fort Edward, NY

Team 2

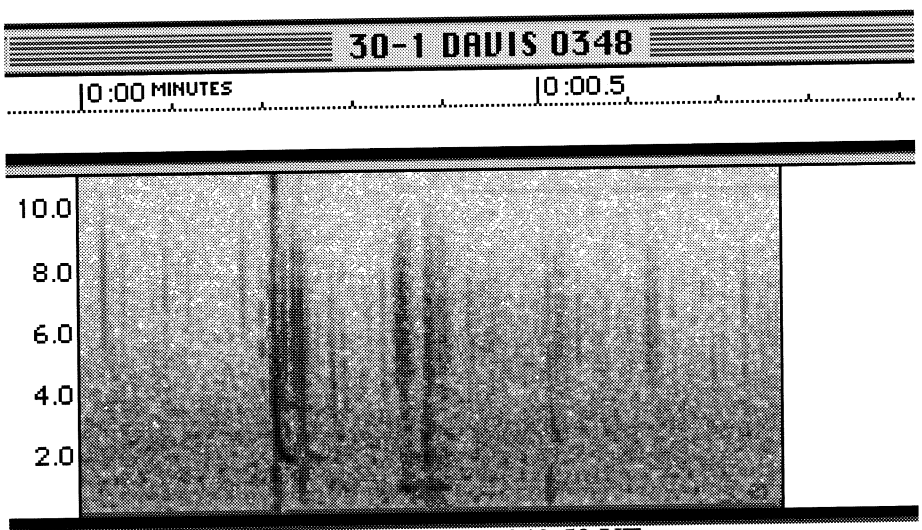
Sferics present. File ends with a voice time mark at 0350.



No 1 kHz signal detected.

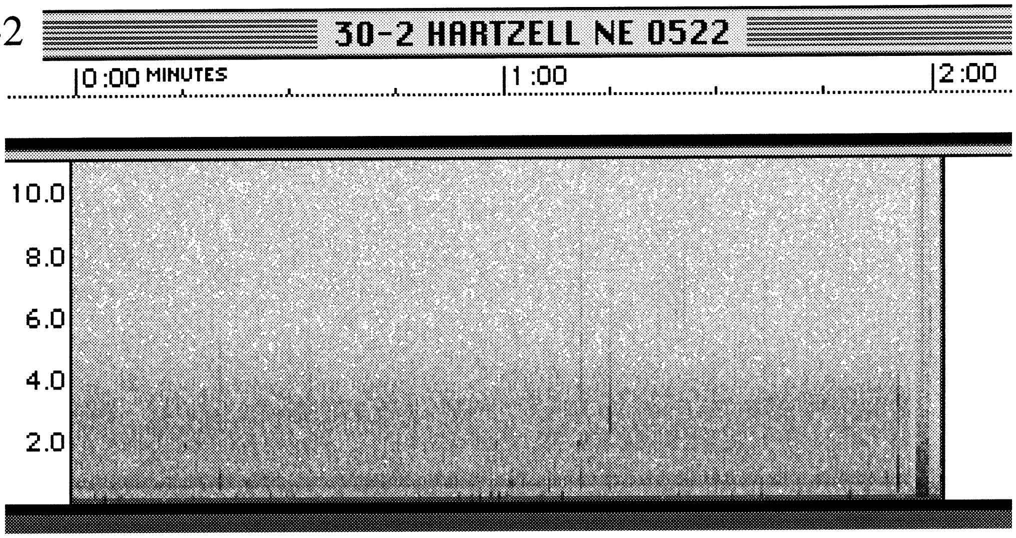


0349:50, 10 seconds. Arrow points to tweek. Voiceprint of time mark ends with "mark at :10 s.



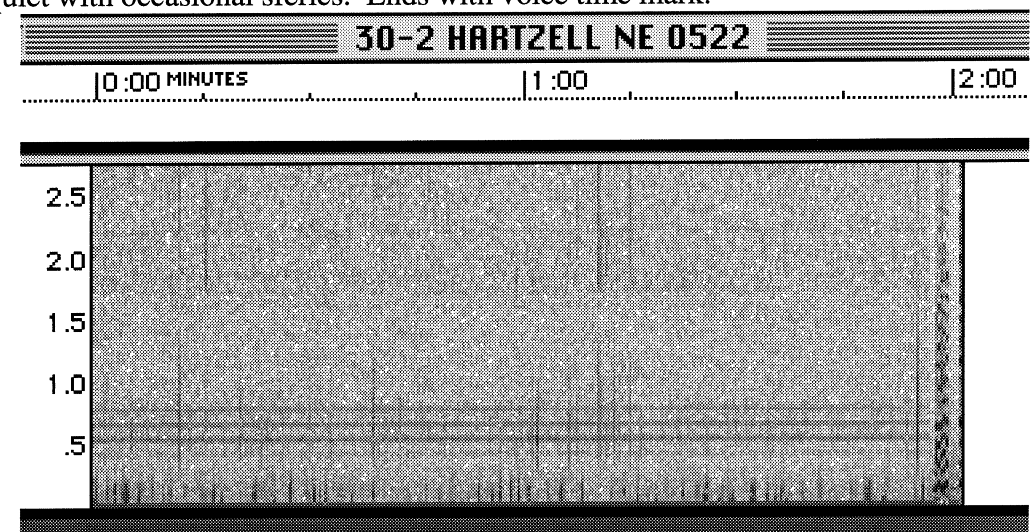
Strong tweek at 0349:53 UT

30-2

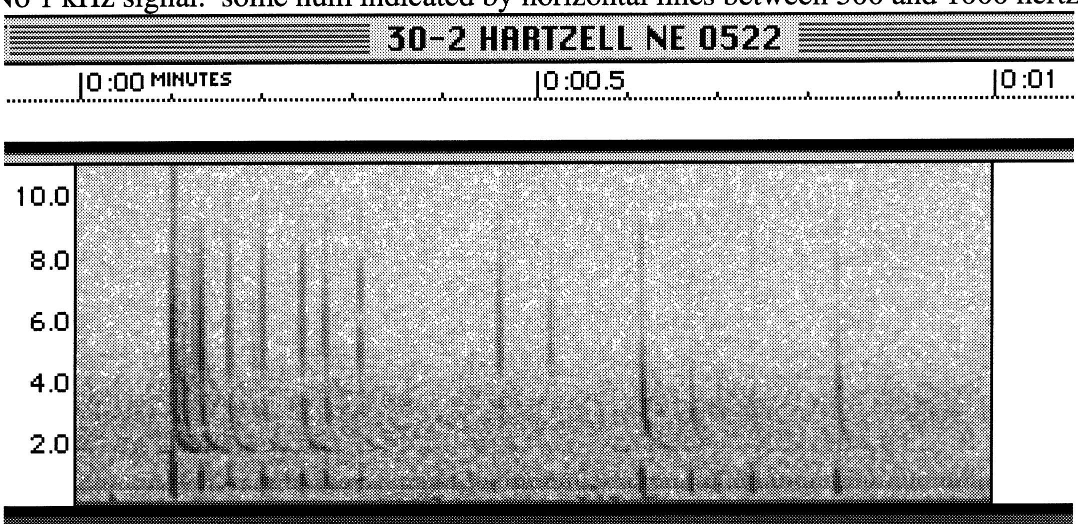


Phil Hartzell, Aurora, NE Team 21

Fairly quiet with occasional sferics. Ends with voice time mark.

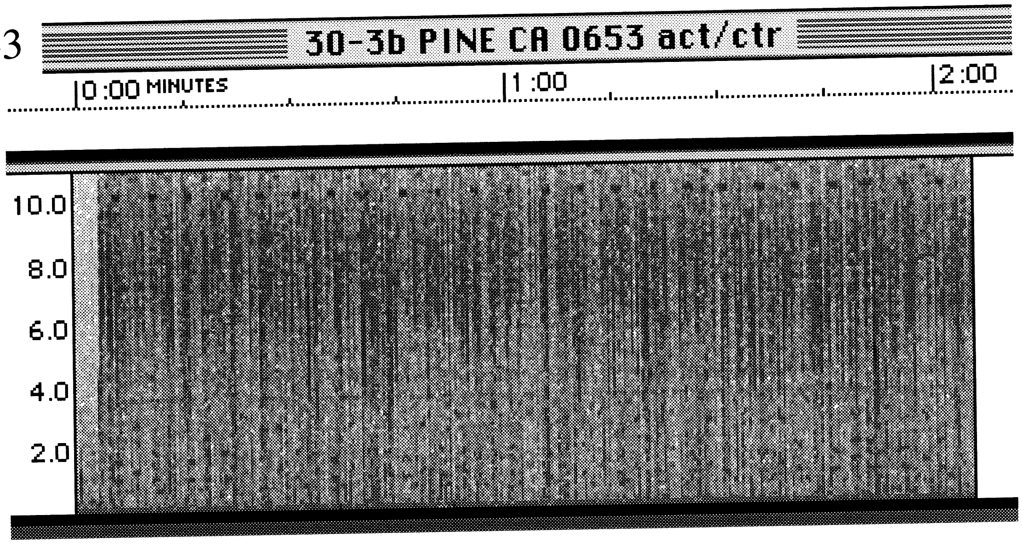


No 1 kHz signal. some hum indicated by horizontal lines between 500 and 1000 hertz.



Burst of tweeks at 0523:13 UT

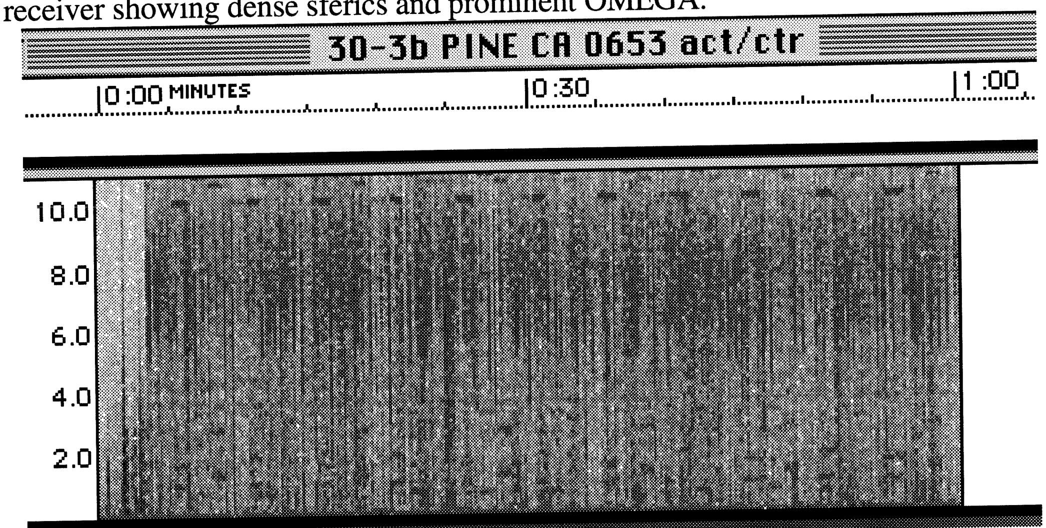
30-3



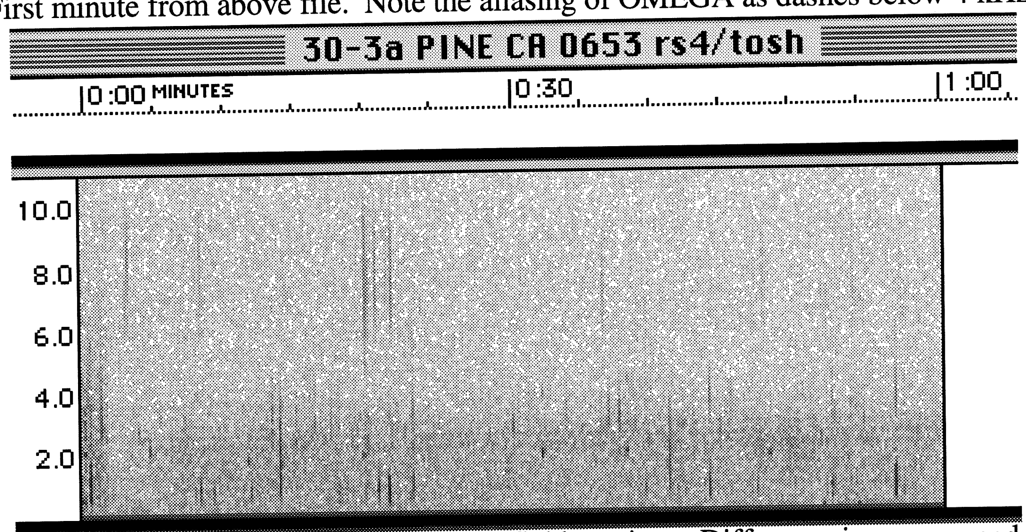
Bill Pine, Chaffey High School, Ontario, CA

Team 6

B-field receiver showing dense sferics and prominent OMEGA.

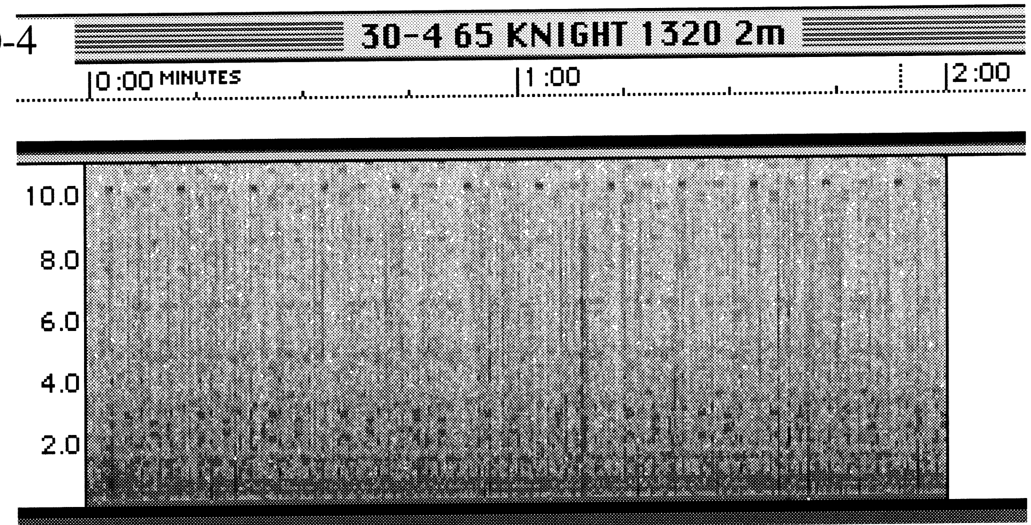


First minute from above file. Note the aliasing of OMEGA as dashes below 4 kHz.



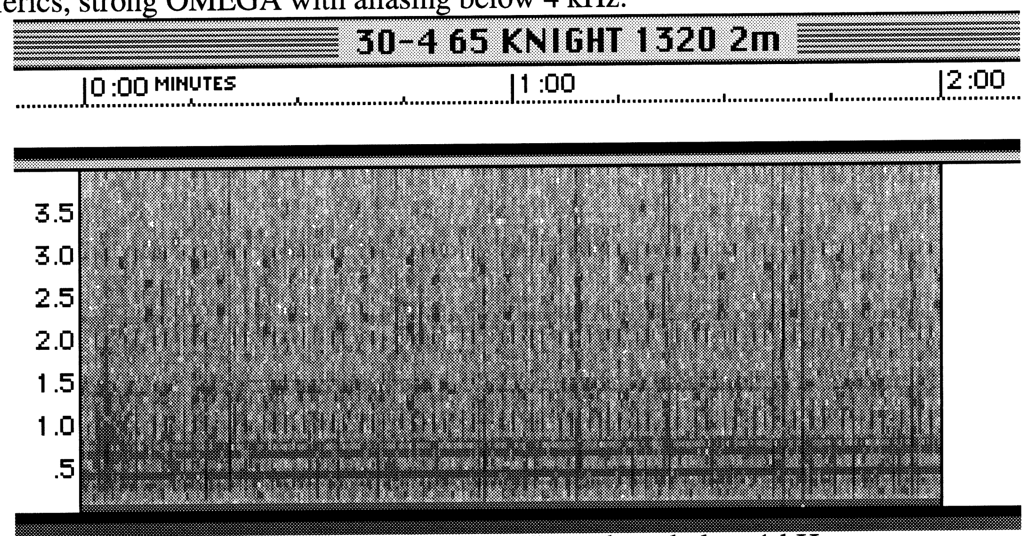
Same interval as above using an RS4 E-field receiver. Difference is pronounced.

30-4

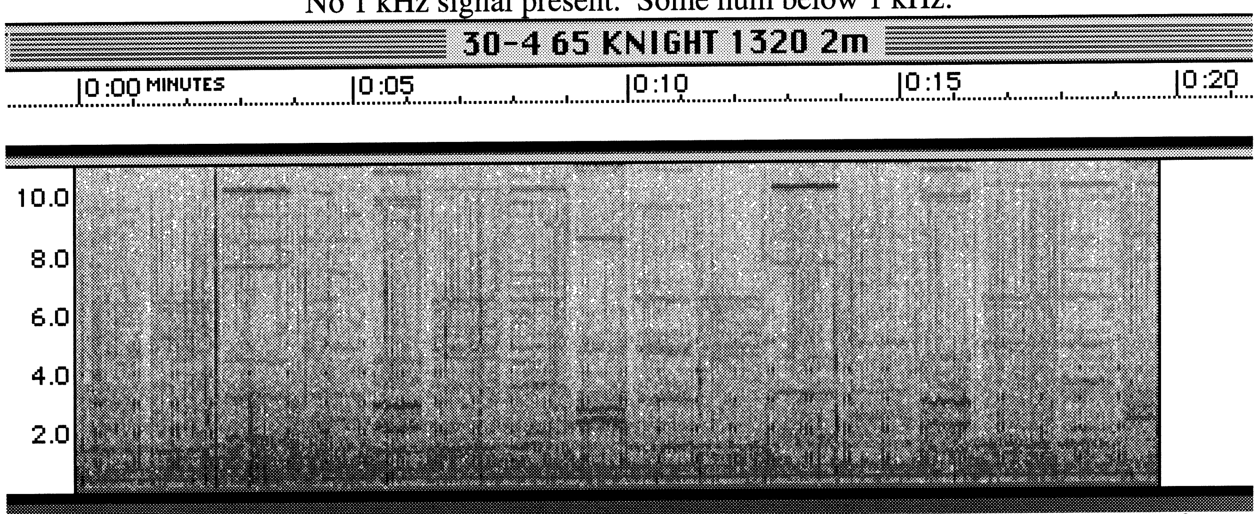


Dean Knight, Sonoma Valley High School, Sonoma, CA Team 7

Dense sferics, strong OMEGA with aliasing below 4 kHz.

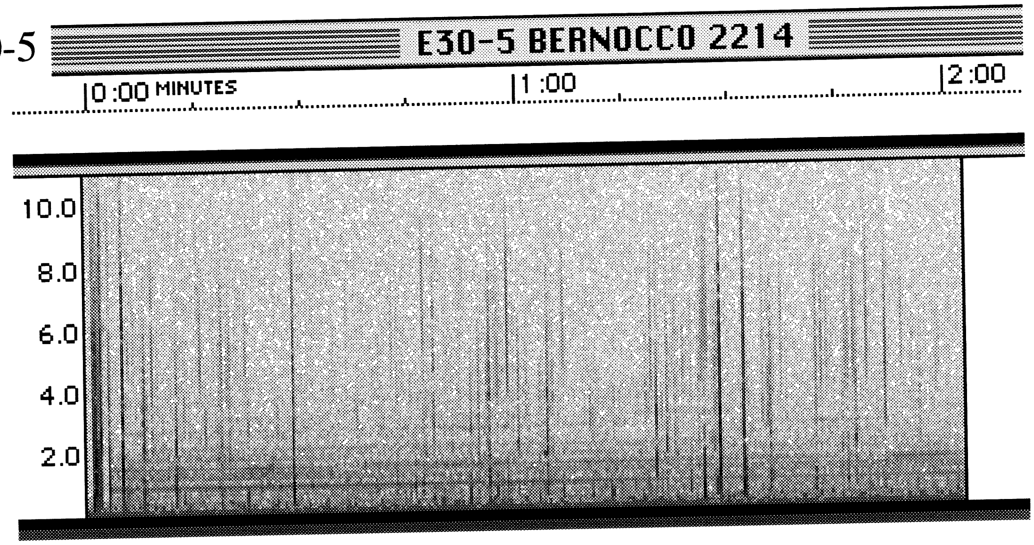


No 1 kHz signal present. Some hum below 1 kHz.

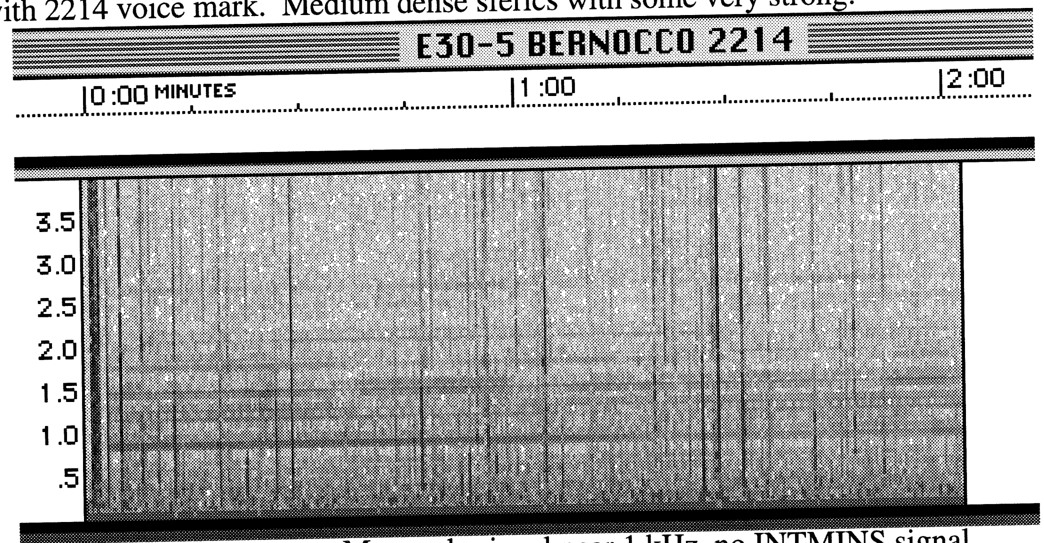


Three OMEGA stations present. Dashes at lower frequencies are aliasing signals that result from the digital sampling process.

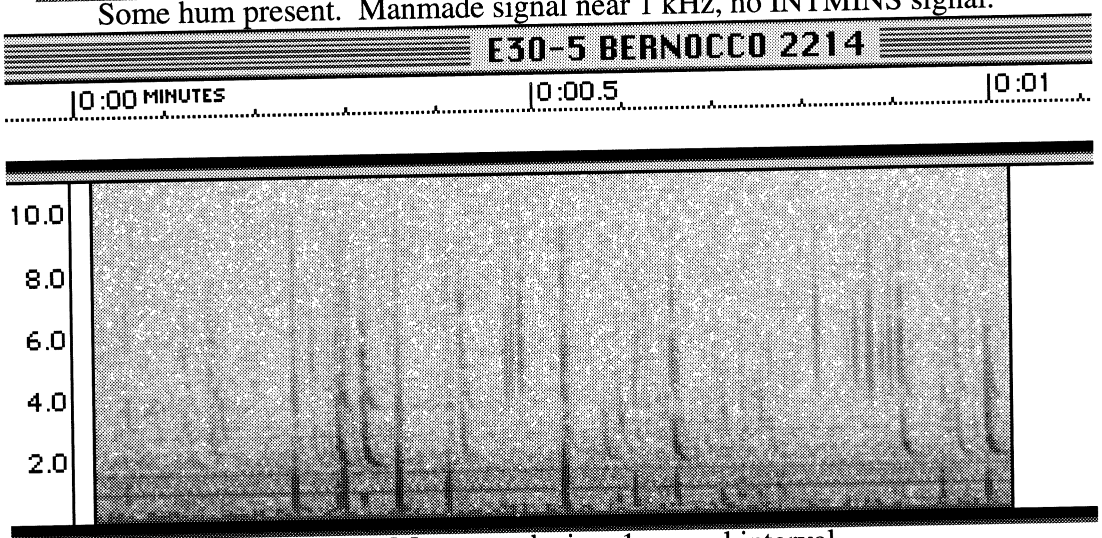
E30-5



Silvio Bernocco, Vaccera, ITALY Team E2
Starts with 2214 voice mark. Medium dense sferics with some very strong.

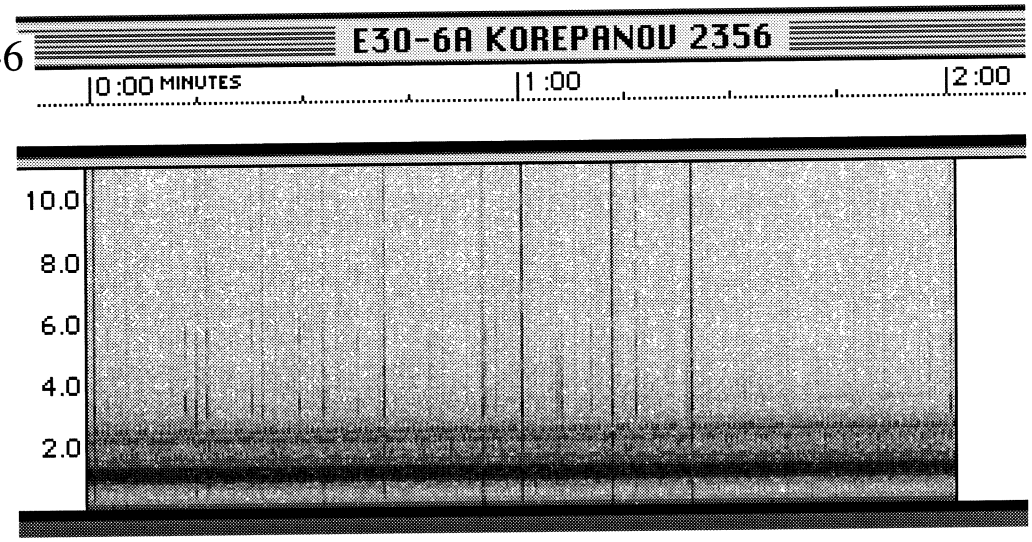


Some hum present. Manmade signal near 1 kHz, no INTMINS signal.

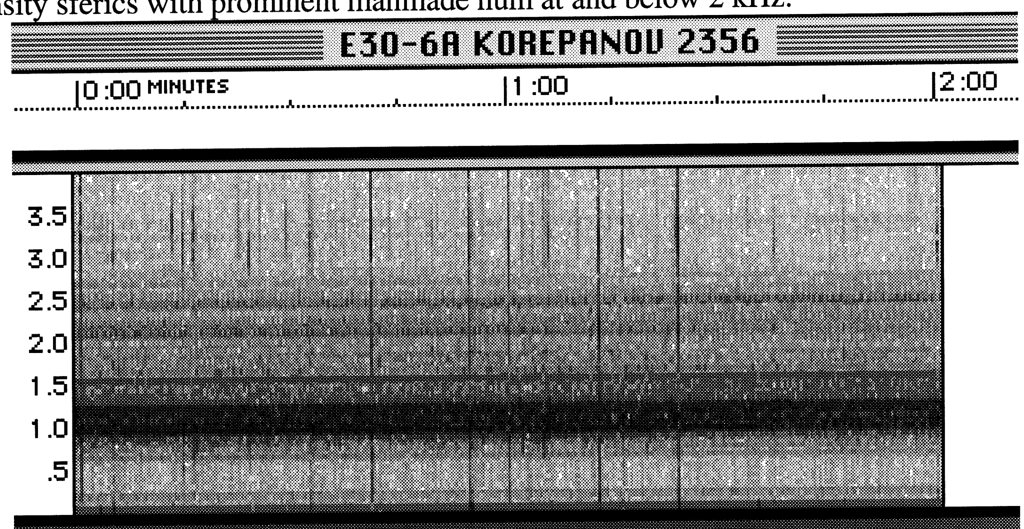


2214:07. Many tweeks in a 1 second interval.

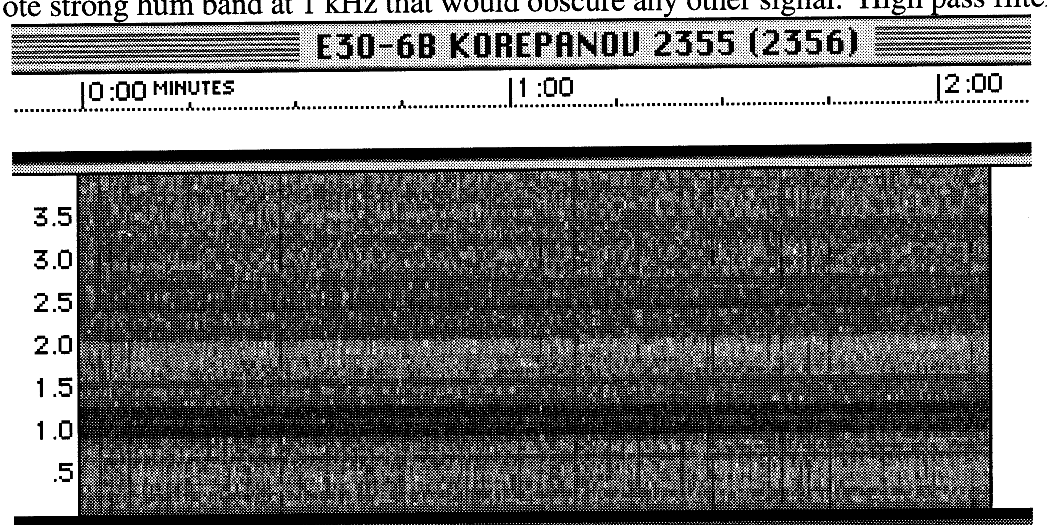
E30-6



Dr. Valery Korepanov, Lviv Center of Inst. of Space Res. of NASU, Lviv, UKRAINE   Team E9
Low density sferics with prominent manmade hum at and below 2 kHz.



Note strong hum band at 1 kHz that would obscure any other signal. High pass filter.



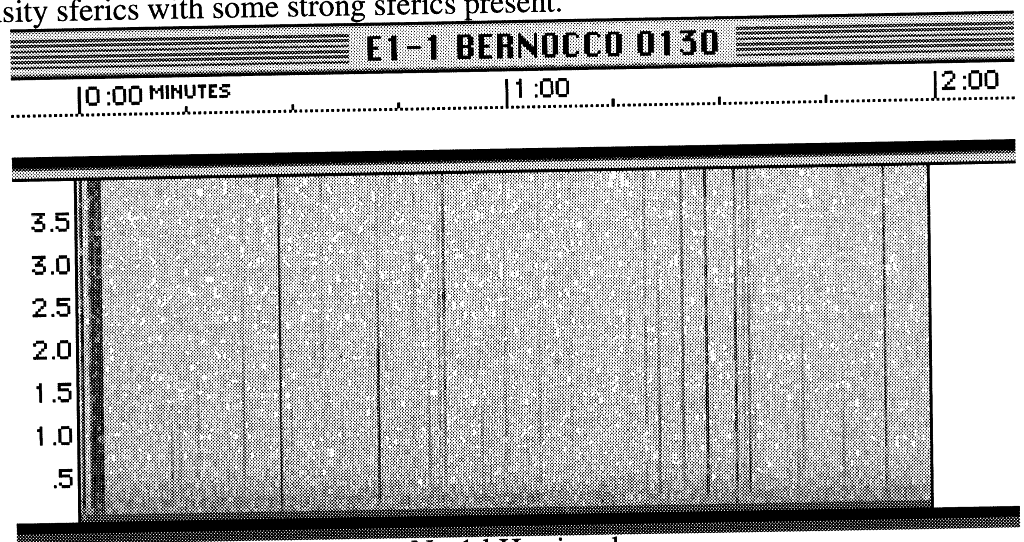
Same as above using band pass filtering (no filter). Some differences in spectrographs.

E1-1

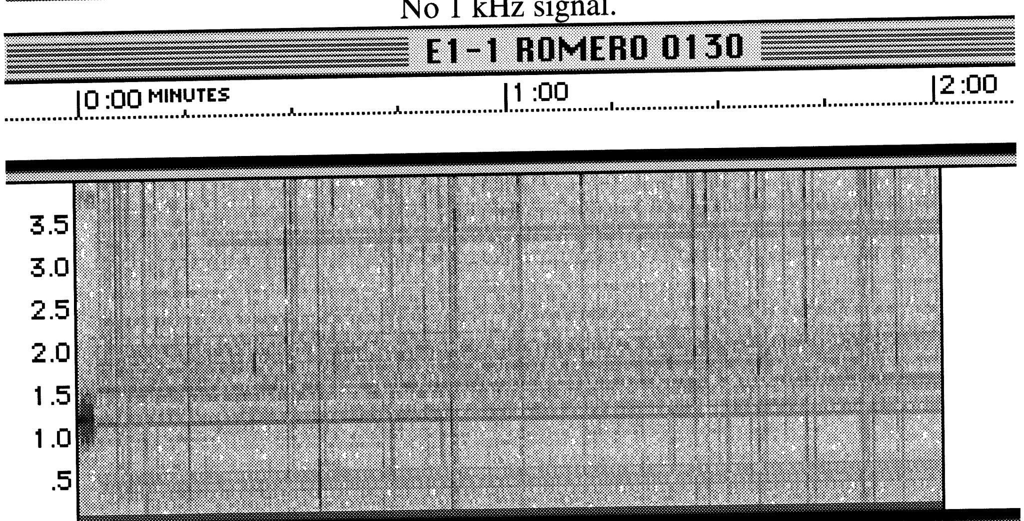
Silvio Bernocco, Vaccera, ITALY

Team E2

Low density sferics with some strong sferics present.

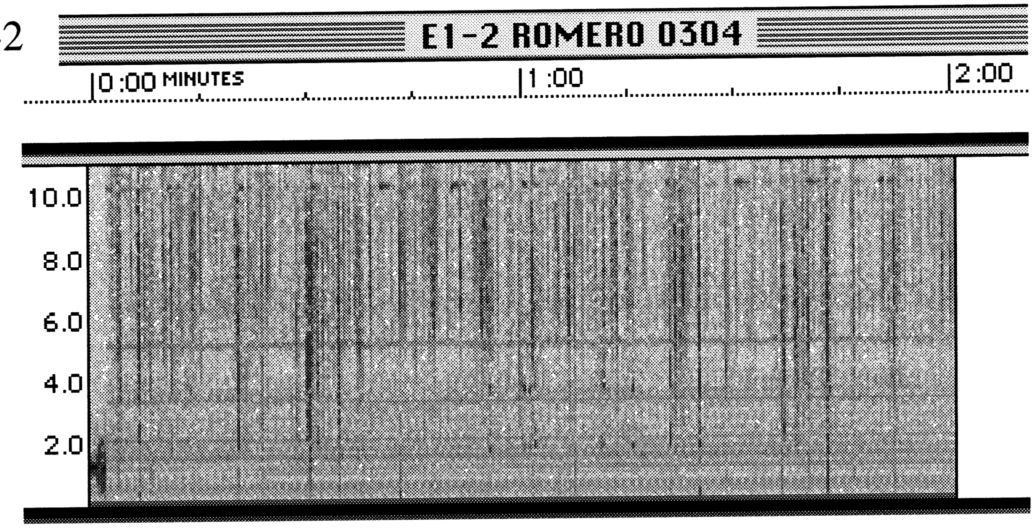


No 1 kHz signal.



Same as above from Renato Romero showing similar activity.

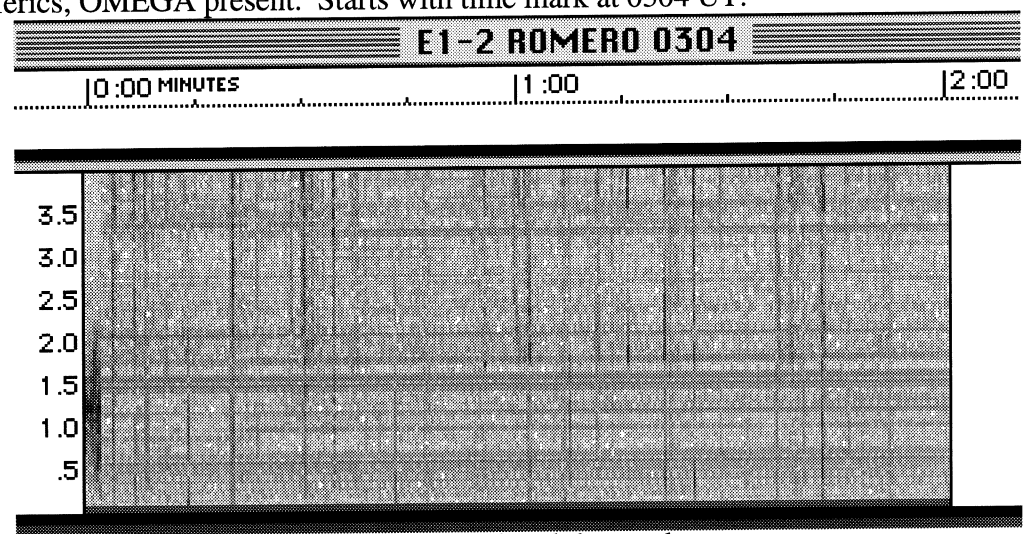
E1-2



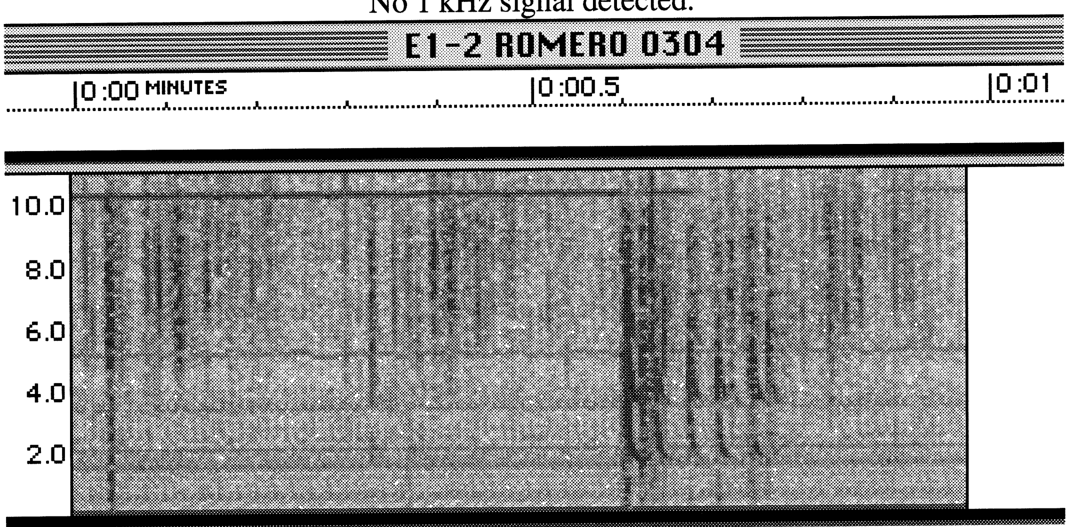
Renato Romero, Cumiana, ITALY

Team E5

Dense sferics, OMEGA present. Starts with time mark at 0304 UT.

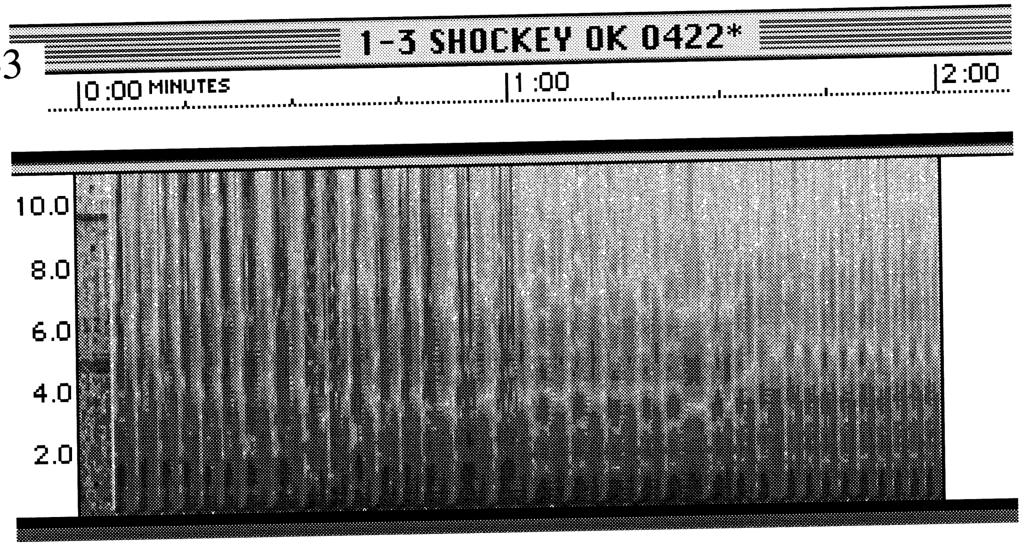


No 1 kHz signal detected.



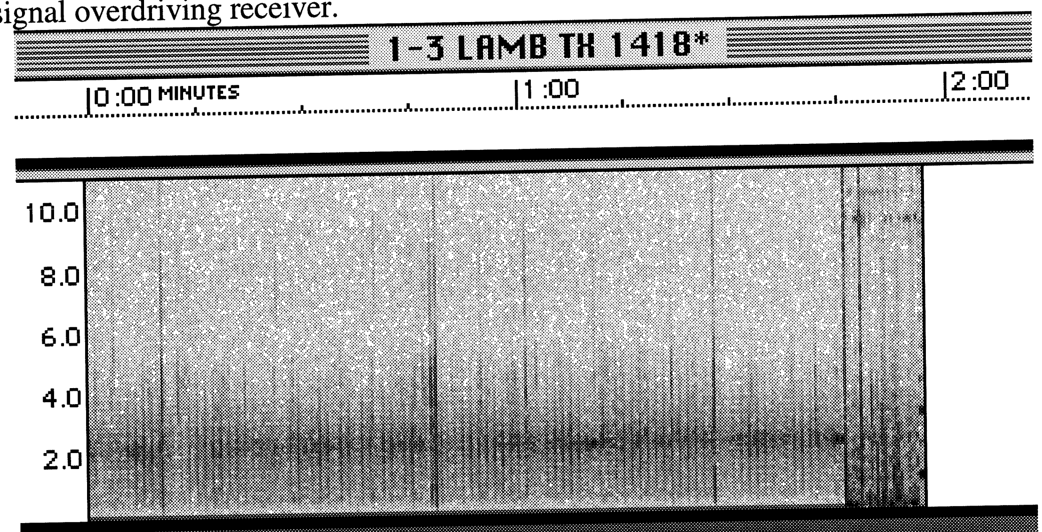
0304:11 Tweeks in a burst: more than 8 tweeks in .2 seconds.

1-3

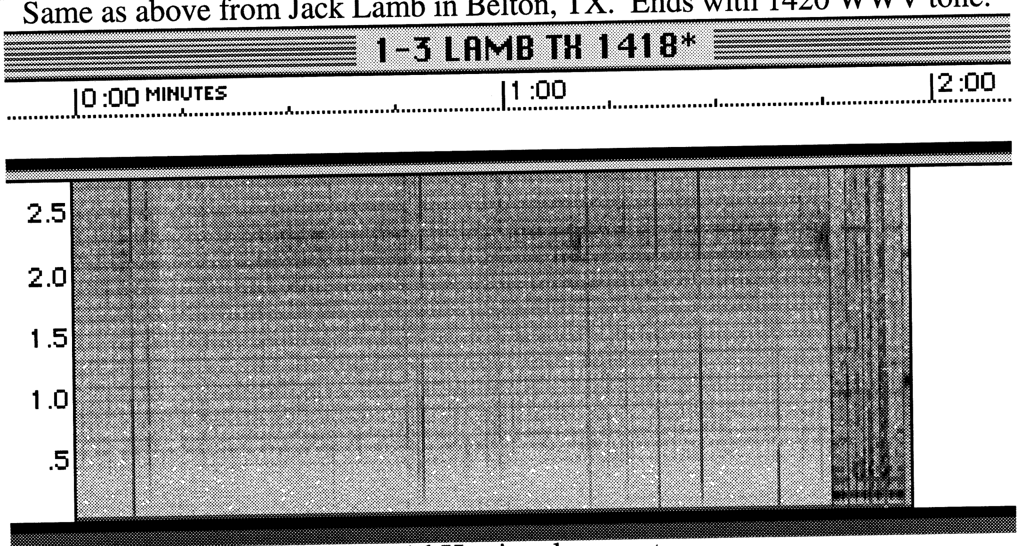


Don Shockey, Oklahoma City, OK
Strong signal overdriving receiver.

Team 3

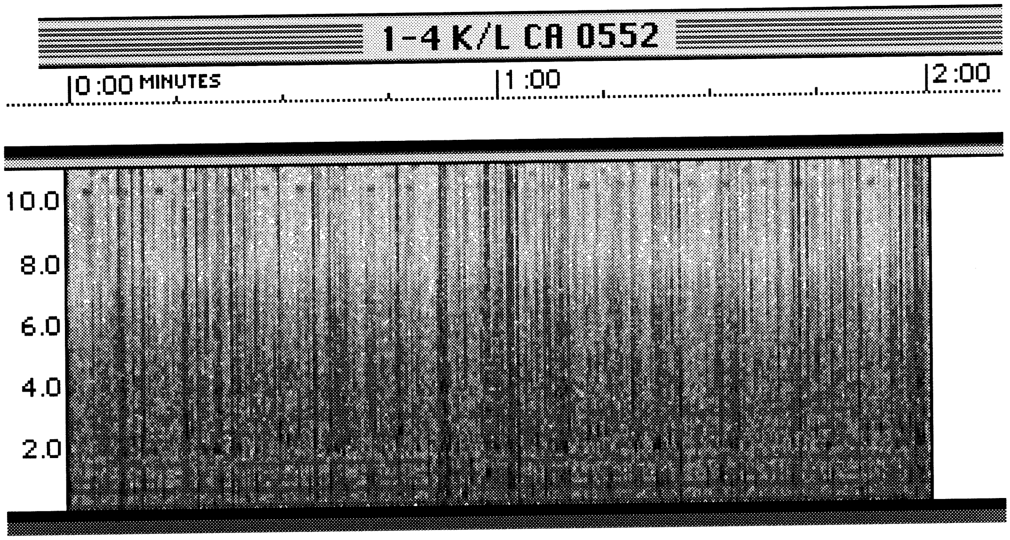


Same as above from Jack Lamb in Belton, TX. Ends with 1420 WWV tone.



No 1 kHz signal present.

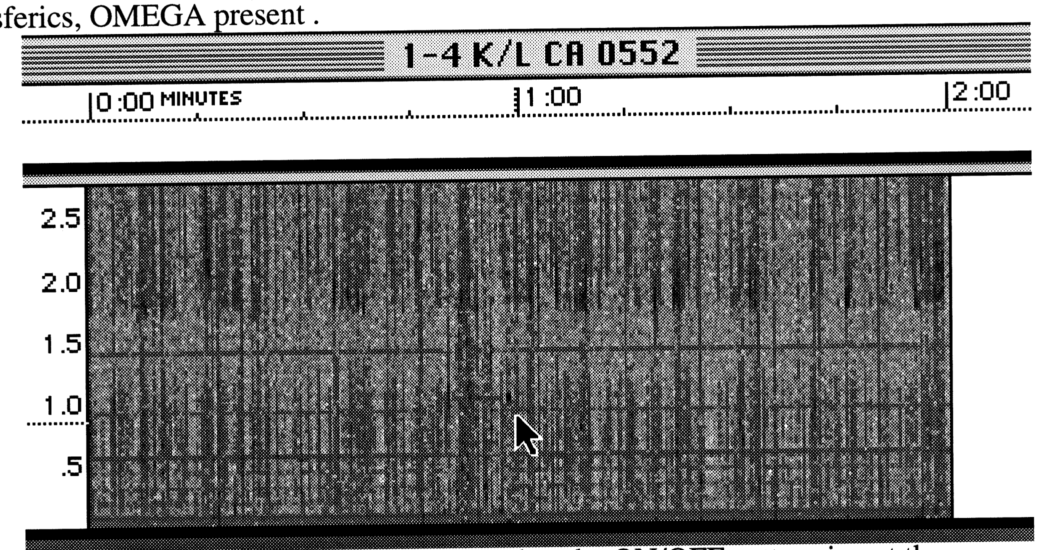
1-4



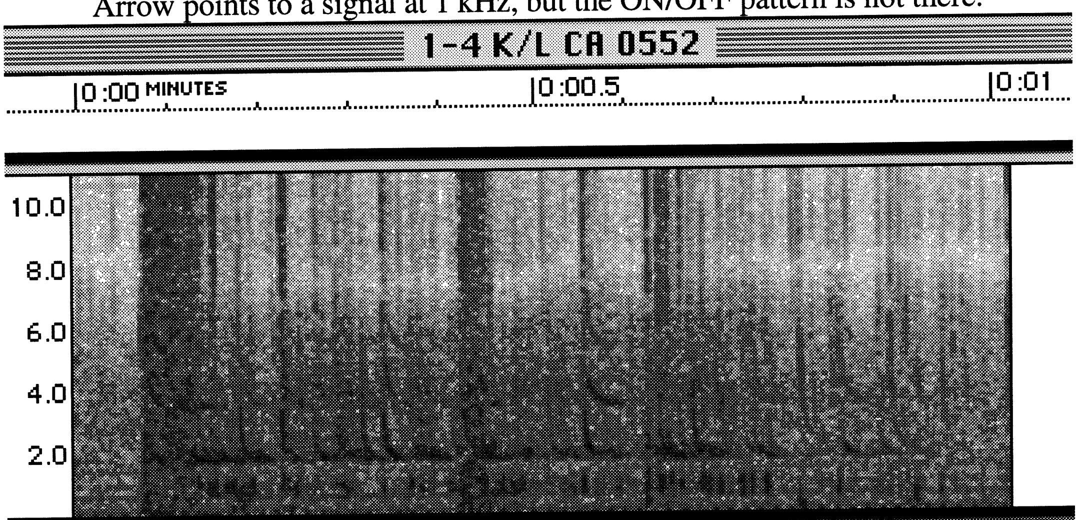
Larry Kramer/Clifton Lasky, Fresno, CA

Team 19

Dense sferics, OMEGA present .

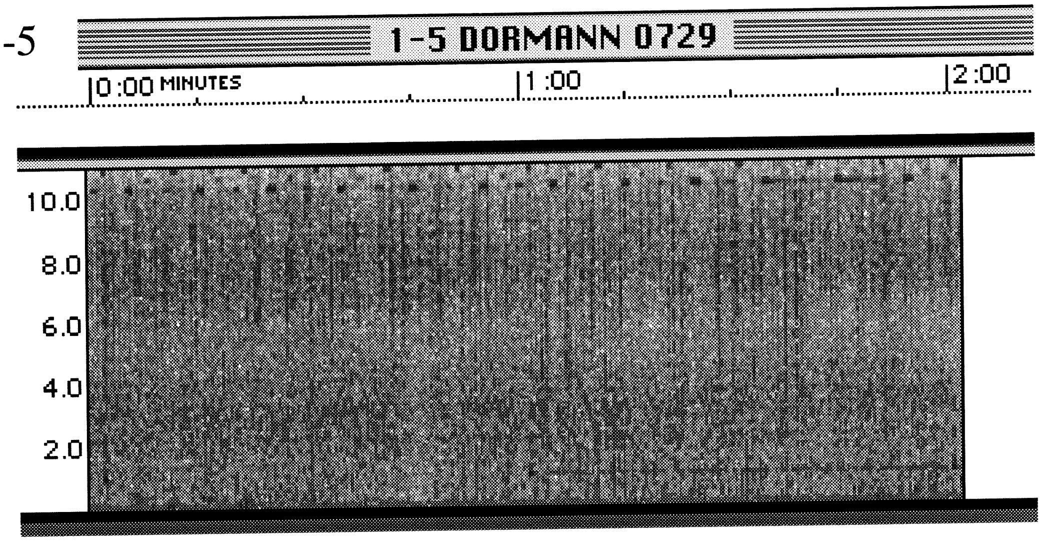


Arrow points to a signal at 1 kHz, but the ON/OFF pattern is not there.



0552:10 Many tweeks. Note the harmonic of the tweek hook at .55 s, 4 and 6 kHz.

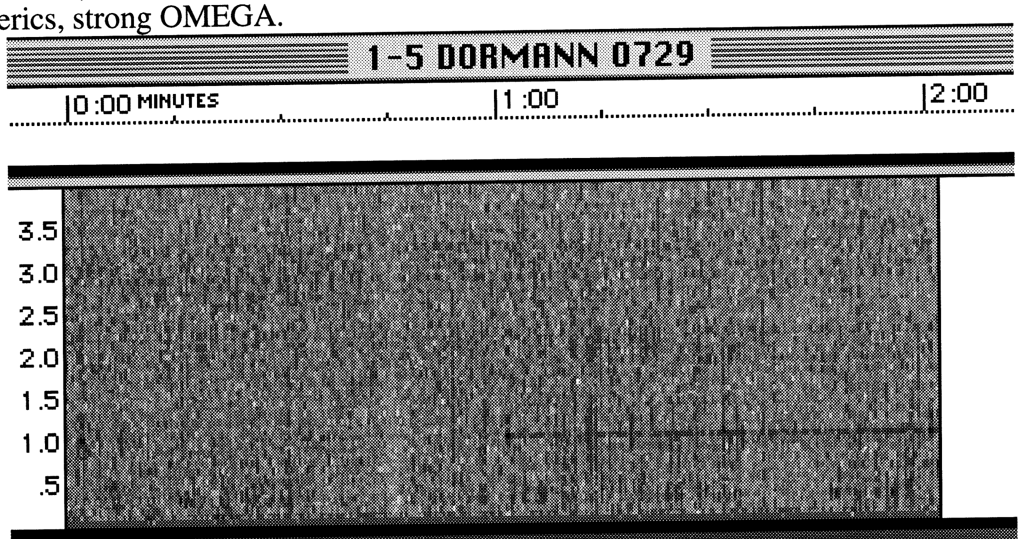
1-5



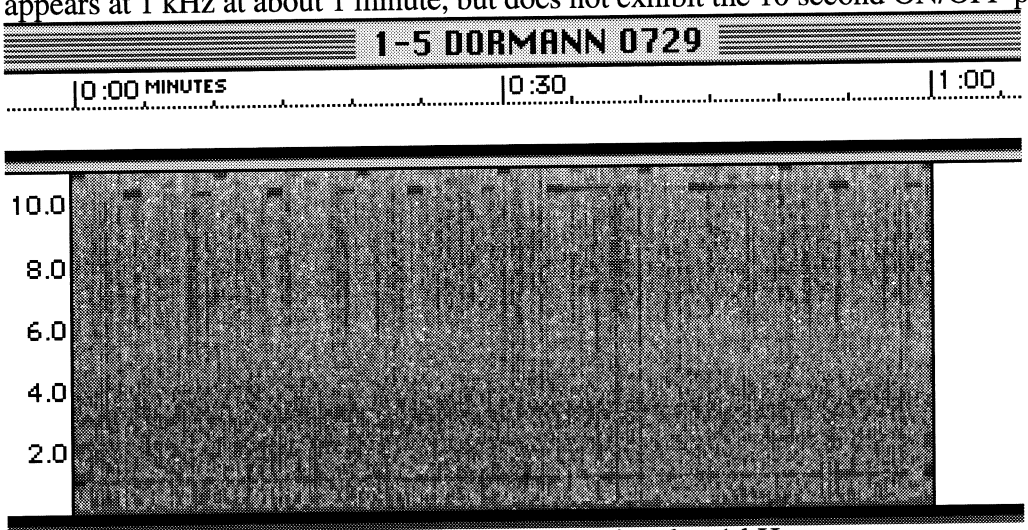
Mike Dormann, Seattle, WA

Dense sferics, strong OMEGA.

Team 8

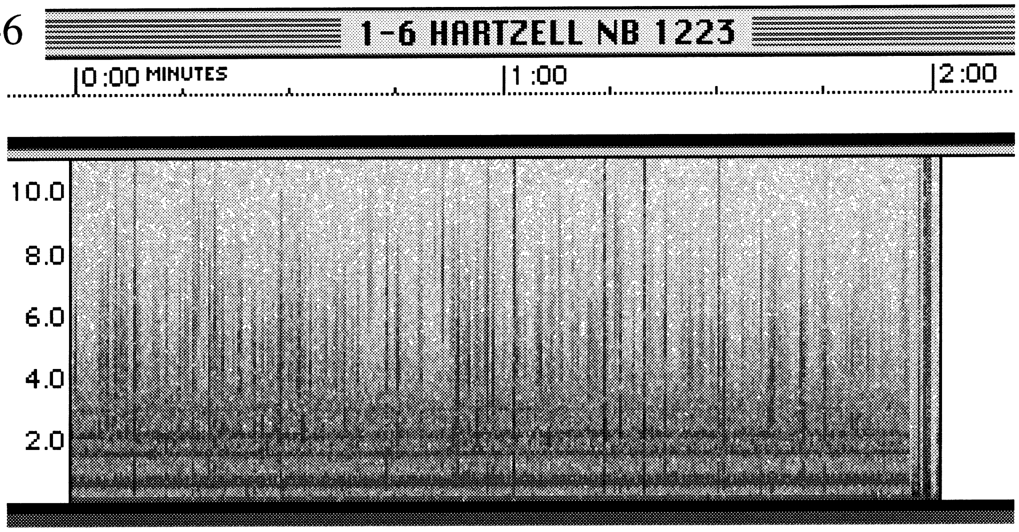


Signal appears at 1 kHz at about 1 minute, but does not exhibit the 10 second ON/OFF pattern.



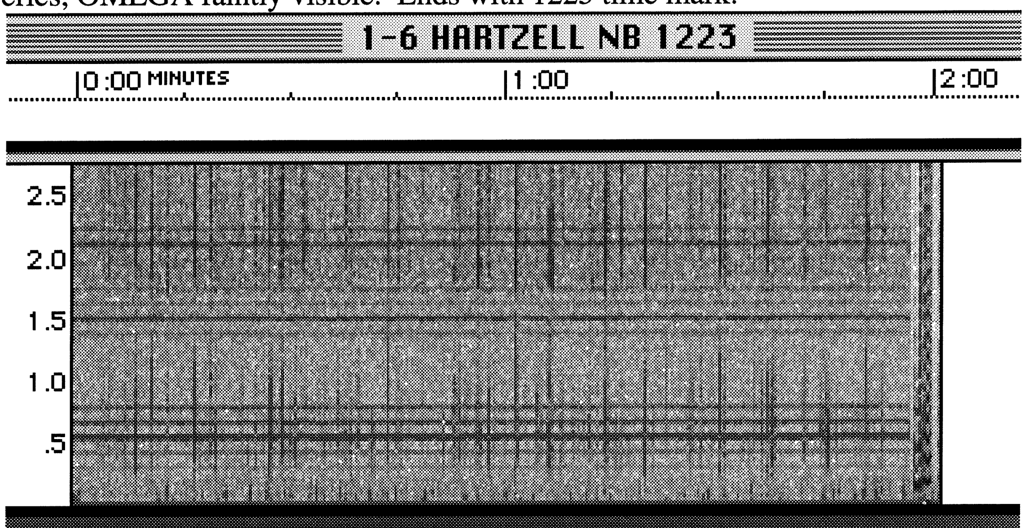
0730, 1 minute. Note steady signal at 1 kHz.

1-6

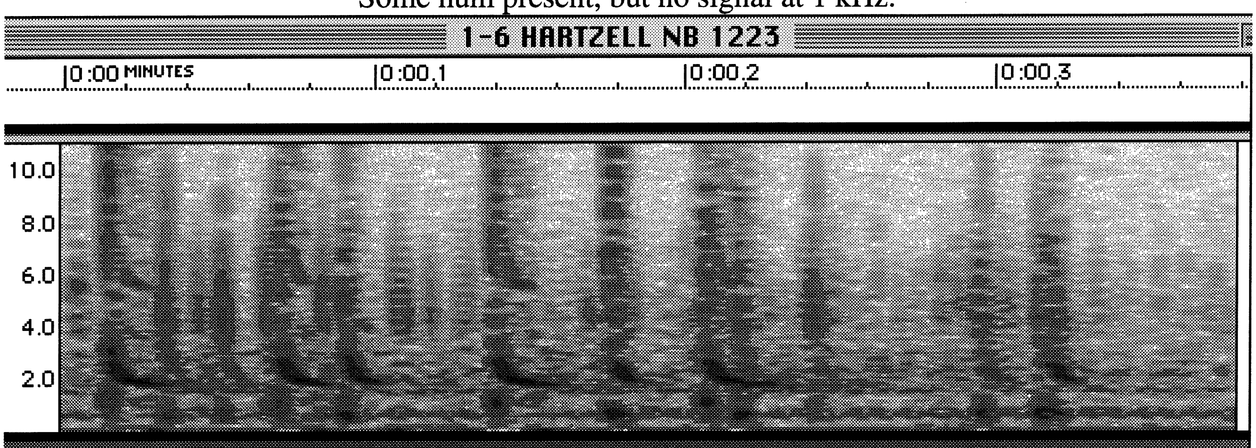


Phil Hartzell, Aurora, NE Team 21

Dense sferics, OMEGA faintly visible. Ends with 1225 time mark.



Some hum present, but no signal at 1 kHz.



1224:03 UT Closeup of a burst of tweeks with hooks at just below 2 kHz and also prominent hooks at the second harmonic just below 6 kHz.

This completes the data analysis report for the November 1996 INTMINS Operation.

NOTE: **The following is a copy of the letter sent to observers who contributed data for the Fall 1996 INTMINS Operations.**

Dear INTMINS Observer,

Thank you for your contribution to the Fall 1996 INTMINS observations. Enclosed you will find your returned data tapes and a copy of the spectrographs of your data. The following is a description of the data analysis process and the resulting spectrographs.

1. Data is received by analyst (Pine). A sequential number is assigned indicating the operation and the order in which data is received. For example, 11/96-5 would be the fifth set of data received for the fall operations. Data is analyzed in the order received. The only exception to this is the spring operations: data from school teams is analyzed and returned first so the results can be known by students before the end of school.

2. Data tapes are listened to and a two-minute sound file made of the ISTOCHNIK operating period. The actual time of operation of ISTOCHNIK may be different than that scheduled in the operation plan due to changes in the orbit of MIR. The sound file is assigned a file name consisting of the operation number followed by the name of the chief observer followed by the starting time of the sound file. While the file is being monitored, an analysis log is kept which consists of the following:

11/96-9 Dean Knight Team 7

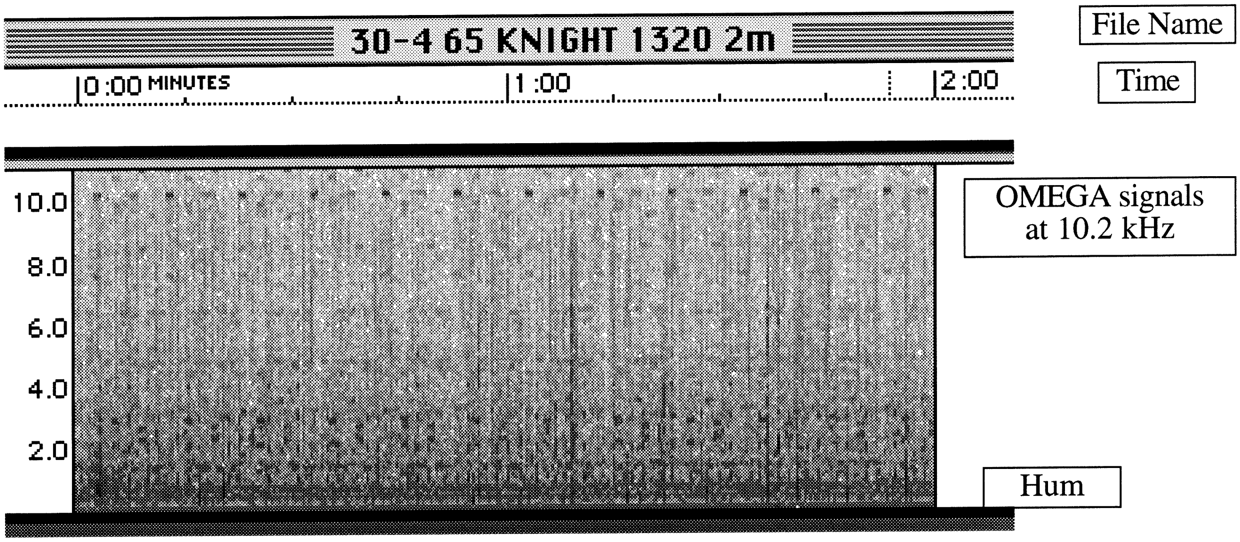
Sonoma Valley High School

Recorder Count	Watch Reading	UT Time			Pitch	S
012	0:00	1320	M - WWV	S, T, OMEGA	+1.5	4
060	1:01	1321	M - voice		+2	

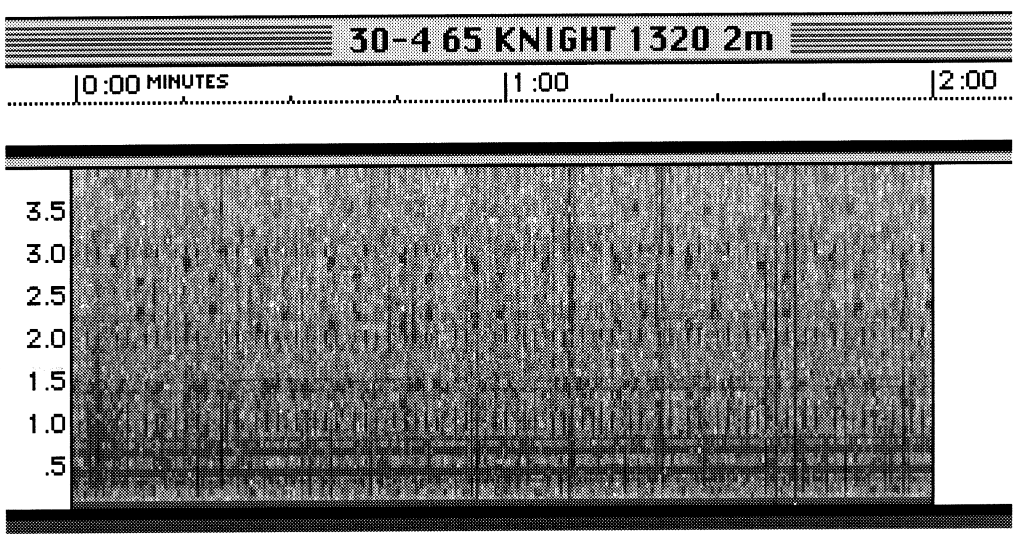
At the top left, the sequential data number information is entered. The next lines are for team identification information. At the upper right, the permanent team number is recorded. The information in the log consists of:

Recorder Count:	the counter reading on the Marantz recorder used for analysis. (Different recorders use different types of counters, so this number may not be the same on your recorder.)
Watch Reading:	I run a stopwatch to check tape speed against time marks on the tape.
UT Time:	As indicated on the time marks and data log.
(blank line):	For logging events and information from the tape.
Pitch:	The Marantz has a "pitch" adjustment which is used to find the proper tape speed to keep the time marks in synch. A "+" indicates that the tape was sped up on the Marantz (the most common situation). A "-" indicates the tape was slowed on the Marantz to stay in synch.
S:	The sferic density level on a scale from 0-5. ("0" is perfectly quiet; "5" is a steady roar of sferics. From 2-4 is common.)

3. An image is captured of the entire 2 minute file using a frequency range of 0-11025 Hertz (0-11 kHz). An image is made of the same time interval using a 0-4 kilohertz range. This is the image that may reveal the presence of the ISTOCHNIK signal. The fundamental frequency of the electromagnetic signal matches the frequency of modulation of ISTOCHNIK, but there is some theoretical evidence that the third harmonic (3 kHz) may be most prominent. A 0-4 kHz range includes this harmonic. (Note: some data in this set of operations was analyzed using a frequency bound of less than 3 kHz.)

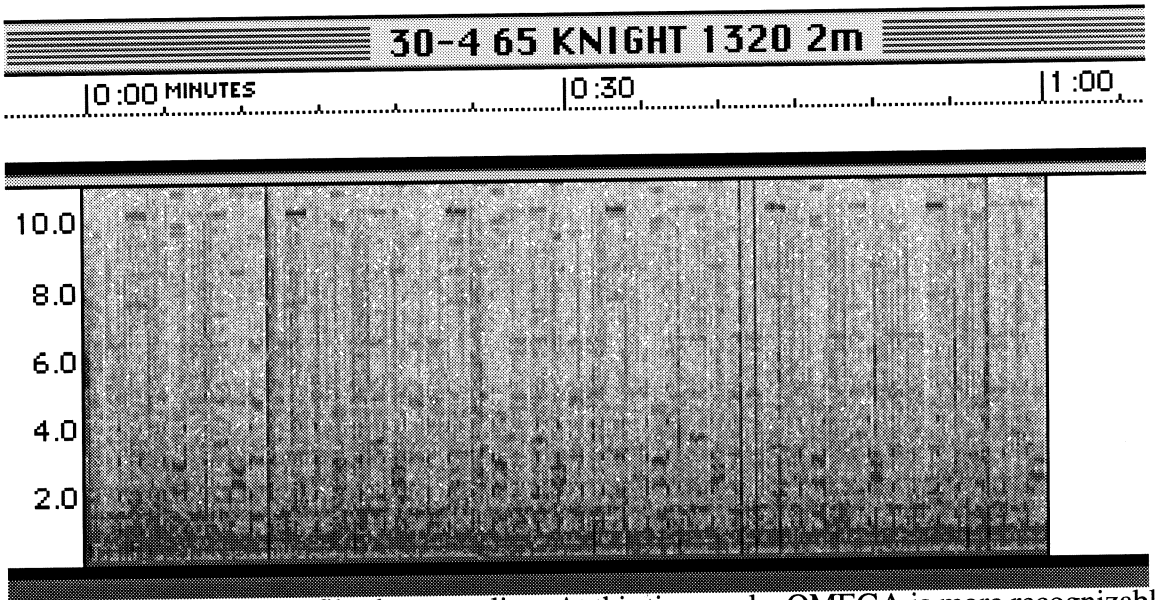


Sample data file image. This data was taken by Dean Knight's students in Sonoma Valley, CA. The file is of data taken with one of the three receivers that Dean's students set up (identified as #65). The start time for ISTOCHNIK operation is 1320 UT for operation 30-4 on November 30. Visible at the top is a series of dashes from a couple of OMEGA stations just above 10 kHz. Also visible at lower frequencies are some similar dashes called aliasing, which is an artifact of the sampling process in the digitizer and indicates a very strong OMEGA signal. Horizontal bands at low frequency represent 60 Hz hum and its harmonics. This site is very quiet.



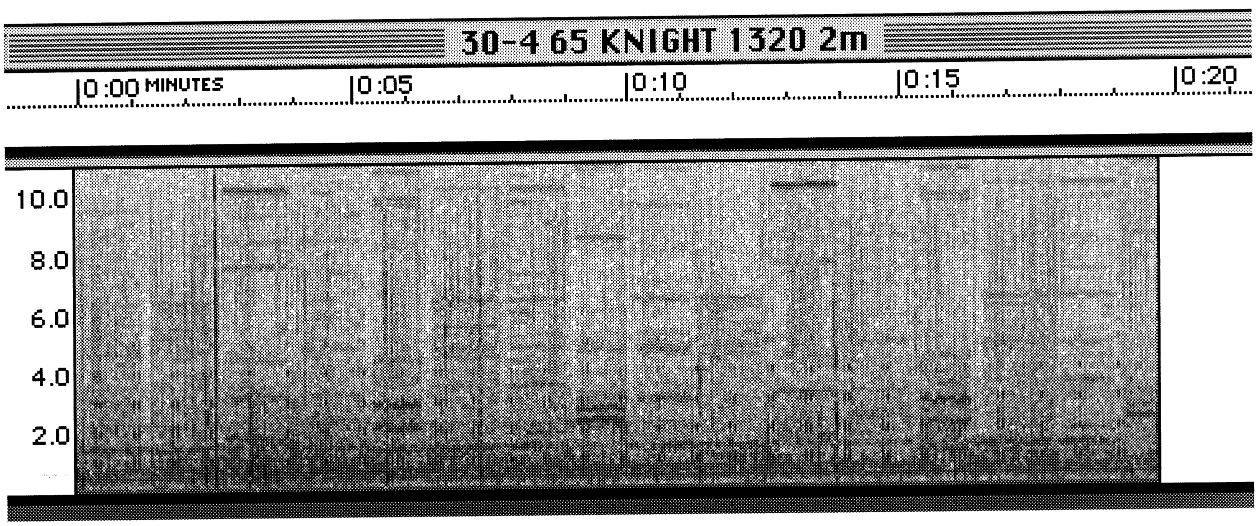
The above file using a 0-4 kHz frequency range. The ISTOCHNIK signal should appear as a series of dashes 10 seconds long indicating electron gun operation separated by 10 seconds of no signal. No signal is apparent at 1 kHz, 2 kHz or 3 kHz.

4. The file is then cropped to include either the first or second minute and an image captured using 0-11 kHz and 0-4 kHz. This completes the basic set of images for each data tape.

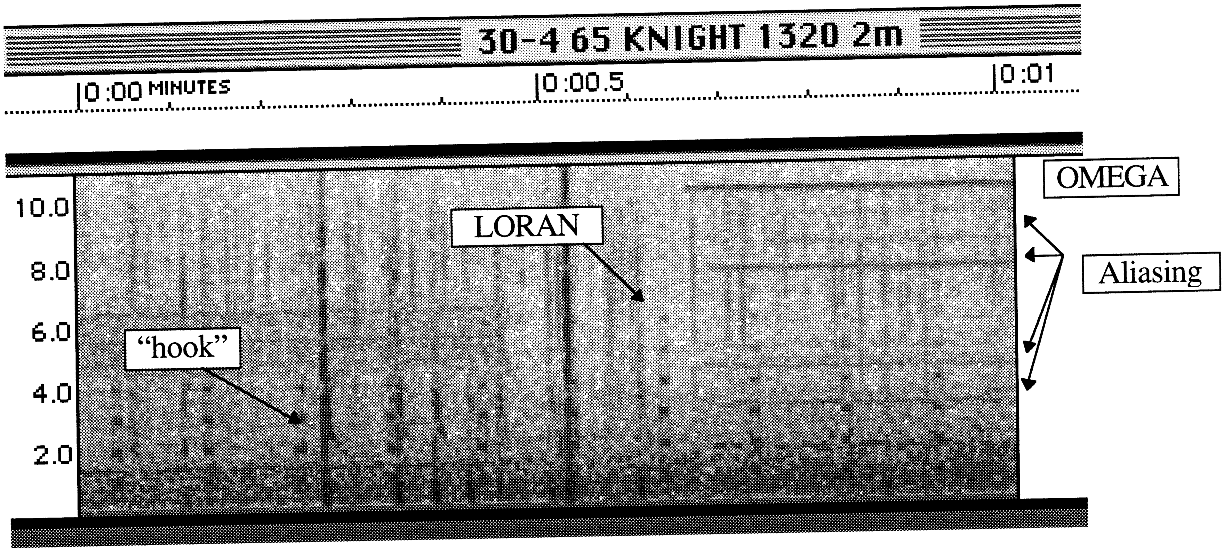


The first minute of the data file shown earlier. At this time scale, OMEGA is more recognizable. Note that the file name does not change even though the time interval has been cropped. You have to look at the time bar to see the length of the spectrograph in the image.

5. Any interesting parts of the data file are then investigated and images taken. Also any items of interest noted in the log of the observer are also investigated and images taken. Examples of items noted by observers include whistlers, tweeks and "strange sounds".



A 20 second sample starting at 1320 showing details of OMEGA. Three stations are visible: a strong dash at about 3 seconds, a weak dash at about 7 seconds and a slightly stronger dash at about 8-9 seconds. Dashes which appear at frequencies below 10.2 kHz are the result of aliasing.



Finally an image starting at 1320:02 UT showing a strong tweek between .2 and .3 seconds. Tweeks can be identified by the "hook" at around 2 kHz. LORAN signals, a navigational aid, sound like a clacking noise and show up on the spectrograph as a vertical series of dots occurring periodically.

6. A Word file is then made containing all of the images from each observer including explanatory captions. This file is used for creating the articles in the *Journal.*

7. Last, the data tapes are returned accompanied by a printed copy of the Word image file and the analysis log sheets.

To save postage, the data logs are not returned. It is suggested that you make copies of your data logs before submitting your data for analysis.

Thank you for your continued participation in INTMINS and for your support of INSPIRE.

By the way, if you are wondering if the signal from ISTOCHNIK has been detected, the answer is "Not yet!". I plan to keep looking and I hope you do, too.

Thanks again,

Bill Pine

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

email: pine@nssdca.gsfc.nasa.gov
pinebill@aol.com
pine@chs.chaffey.k12.ca.us

Notes From the Field

Communications from INTMINS Participants

Edited by Bill Pine
Chaffey High School
Ontario, CA

Data submissions are often accompanied by notes and messages from INTMINS participants describing various aspects of their experiences as observers. As an ongoing feature, some of these communications will be summarized in *The INSPIRE Journal*. The following summaries are in the approximate order in which the data was received by INSPIRE.

Team 3 Don Shockey Oklahoma City, OK

Probably this recording session should have been skipped. Bad roads slowed travel such that it wasn't possible to get anywhere near the site until almost T-time. So, it seems best to make the best of it, regardless of the nearby phone line or power line.

Out of the experience, it became clear that, in a pinch, a ground isn't necessary. Placing the antenna rack and pole atop my Jeep will do the trick just fine and the receiver pumps enough signal to reach a recorder inside the Jeep. Second, wrapping the receiver in tape will permit operating just short of under water. Third, WWV reception when there is a line of weather near or between the receiver and Ft. Collins, Colorado, (the location of WWV - ed.) is unreliable enough that a separate antenna system will be necessary. Good weather is no problem. Also, it will be necessary to find a site that can be reached on all-weather roads. Two miles of 4-wheel drive is something I probably should not have tried, but did anyway. The log tells the tale and it is enclosed. Regardless, I look forward to the spring sessions. It's always an adventure.

Thanks for the contribution, Don.

Team 1 Jack Lamb Belton, TX

Jack has been a faithful contributor to INSPIRE since 1992. He was assisted in his data gathering by his grandson, Matt Haley.

Jack writes:

I would like a nice description of exactly what we are doing or trying to do with our recordings. People ask me what I am doing with that weird looking radio and I am having trouble explaining exactly what we are about. As I understand it, we are trying to establish a way to communicate with space craft using low frequency radio. I do not know why w are trying to do that. Can you help educate me in this area? I might be able to drum up some interest at the University of Mary Hardin-Baylor where I am now teaching if I knew more about the project and how to get them excited about it.

Well, Jack, here is my attempt to explain my understanding of what we are doing. First off, the goal is not to improve communication with space craft. Current communication using various radio frequencies (none of them VLF) works just fine as you thought. The real tie in is with whistlers. Since whistlers are a product of the way the magnetic field of the earth (the magnetosphere) interacts with radio waves, improving our understanding of this interaction may increase our knowledge about the magnetosphere. Since whistlers are generated by lightning, which is random and of unknown (but large) power, it is hard to do controlled experiments with them. The electron gun on MIR (ISTOCHNIK) is essentially a manmade lightning generator of know power and controllable operation. If we can detect the electromagnetic waves generated by the electron gun as it is turned off and on 1000 times per second (1 kilohertz) we can them examine the effect of the magnetosphere on where the signal goes and how it is processed.

The bottom line is we are endeavoring to add to the scientific knowledge about the magnetosphere. What is important to me is that this is an area where the answers to many questions are not known (and some of the questions are not known yet, either!). It is rare for high school students and interested amateurs to be able to contribute to science at this level. Testimony to the validity of the efforts made by INSPIRE are our grant support from NASA and our agreement with the Russian Space Agency (IKI). Hope this helps and thanks for your long-time support.

Team 18 David Jones Columbus, GA

Thursday morning I left Columbus, Georgia with all the gear packed in the diesel's trunk. How long the trip, I didn't know. Airline distance to the Croatan National Forest is 450 miles. The forest is more a prairie marsh than a forest. The Indians referred to it as "pocosin" for swamp-on-a-hill. I had recorded INSPIRE there in the spring of 1992.

At the waterfowl impoundment the nearest power line is three and one-fifth miles. I had seen the forest from an airplane at night; a huge black hole among thousands of scattered lights. The INTMINS map showed the midpoint of operation 23-1 roughly there. I remembered an aluminum culvert in a dike between two impoundments. That could be the earth ground. The acid water and ancient submerged trees suggested conductive soil. The few standing trees were acres apart, stunted and misshapen pines. While near the coast, it was far enough away to avoid the likely manmade interference concentrated there.

I crossed middle Georgia to near Savannah then followed the coastal highway towards Jacksonville, North Carolina. At Savannah the car began to lose power and not shift automatically unless I raised my foot. I could only go about fifty, but the sun was down and fifty is reasonable going northeast up the coast.

The wind swerved the car and heavy rain fell occasionally. I began to wonder if I would ever get to the waterfowl impoundment. I did get to Jacksonville and argued with the motel operator about jacked-up prices. I paid them anyway. Friday morning I started the car easy enough but had to drive very slowly to avoid stalling out. I bought a set of fuel filters but didn't touch anything except to blow backwards through the fuel tank line. It seemed ok. Obsessed with recording, barely getting there was good enough for me. When the car would only go thirty-five, I began to wonder it my decisions were right. In a few miles I came to the dirt road to the waterfowl impoundment. The owner had put up a formidable gate and a no-trespassing sign. I checked the security of the lock anyway and started driving around searching for another way in. A rough-looking deer hunter on foot said I would have to detour thirty miles back through Maysville. The diesel kept running, if slowly.

The wildlife people had moved the next gate so that I couldn't approach the waterfowl impoundment by car. I got out the forest service map. There was another gate a few miles away. That's where I finally stopped. The cold front had passed and the winds chilled me. It was still many hours till one A.M. and I checked out the equipment and found some hum. It wasn't overwhelming. That indicated I had a sensitive setup. The previous night's storm made mucho sferics although the storm was far out in the Atlantic by now. I wonder if the astronauts would look out and see the lightning show. The loran-C was strong but surprisingly it would decrease later after sundown. On the RS-4 I selected whip instead of long-wire, no filter and gain max. After sundown the wind died and the sferics became tweaks. Not checked carefully, the coax from the WWV receiver to the RS-4 didn't work. You will be able to hear me pick up the recorder to place the mike near the radio speaker. The clanking sound on the initial announcement is the antenna wires striking the mast when the wind was strong. In the cold air I used an old trick to increase the conductivity around the three copper-clad ground rods. There are a few tower lights on the horizon. The clouds are so thin that the full moon looks veiled. The clouds are not high because the city of New Bern and the base at Cherry Point glow on their bottoms. The clouds are racing towards the southeast. No frogs or crickets chirp, but the ducks splash and one duck seems to be laughing at me. His down would be useful. A raccoon came by as if I were no threat at all.

I am expecting ISTOCHNIK two minutes early at midnight-fifty-six eastern. I wonder if the spacecraft will cross the moon. No use watching for it. Already I am thinking of taking down the antenna and getting warm. The ionosphere will be thin by one-A.M. so when I listen to 1O MHz WWV to check the indexes, it has faded out. In a panic, I check the equipment, then find WWV again at 2.5 MHz. A Jolly Green Giant helicopter whops by. The thin clouds disappear and frost forms on the car roof. A pickup parks about a mile away and the ceiling light goes on then off. Why would anyone be out here on a cold night? Please keep your ignition switched off. A diesel locomotive blows for a grade crossing signal in the direction of Cherry Point. Finally the T time arrives.

I hurriedly take down the antenna and pull out the ground rods. I can't stop long even though I would like to go to bed. The car may not restart. Just a few miles shy of Wilmington it stops itself. Now I change the filter since I have nothing to lose by breaking the pump prime. It restarts.

Coming back to Columbus the air is warm and the sun shining.

David

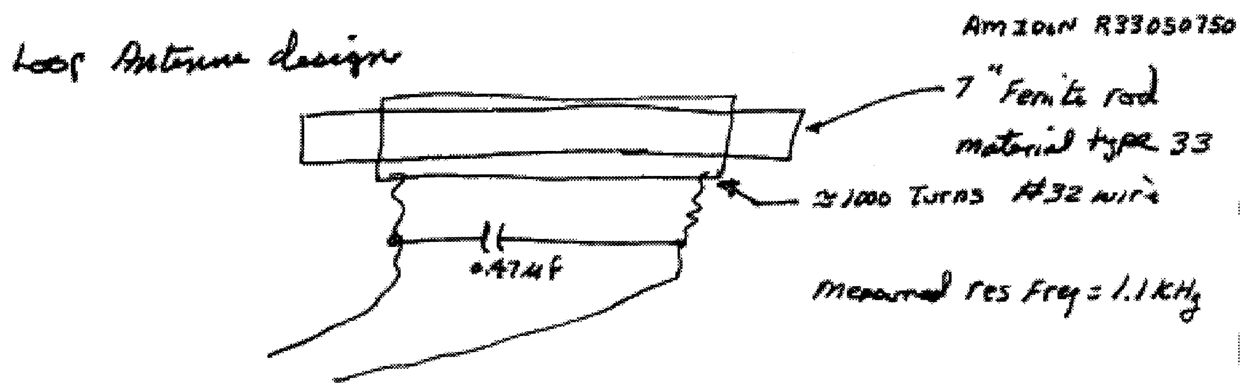
David's account of his observations closer to home for Operation 30-1 was less eventful. His observation site then was on a remote part of Fort Benning, GA. Other than the need to identify himself to military police, everything was routine. Good work, David!

Team 15 Robert Bennett Las Cruces, NM

Yesterday during recording of mission 23-3, I noticed the level of activity with the 6' whip antenna to be much less than I expected based on prior recordings. I rigged a 300' long wire to try to increase sensitivity. The long wire ran approximately east-west. The west end was 10' above ground and the east end was 4' above ground. I used fence posts to mount a short pipe to support the antenna. The level of activity with the 300' long wire was much more than without it. However, I got better performance in April 96 at about the same time of day with just a 100' long wire.

The first part of the tape for 30-3 is with a loop antenna on a modified RS4. After the first part, I changed to the vertical 6' whip antenna. Observations on the loop antenna:

1. The loop eliminates just about all of the sferics. I only hear noise background and an occasional strong tweek.
2. Next time I will try connecting a longwire to the loop. That way the loop basically becomes a band pass filter centered on 1.0 kHz.



Let us know how this works out. I know I have not investigated all of the antenna possibilities - mostly because a telescoping whip antenna is so easy to use!

Team 19 Clifton Lasky / Larry Kramer Fresno, CA

We saw MIR during the 30-4 pass. It was very bright as it passed by the stars eta and delta (Algorab) in the constellation Corvus.

Another matter we should clear up is our site location. As you may have noticed, the latitude and longitude we gave is not in Fresno, it's in Madera. The Wide Awake Ranch is private property and the owner has been nice enough to let us observe there as long as we didn't hurt his cows (he didn't really understand what all the equipment was for). It's the only spot we could find that was 3 or 4 miles from power lines, within an hour's drive.

The owner doesn't understand, and what must the cows be thinking ...

Team 5 Jean-Claude Touzin St. Vital, Quebec, CANADA

I recorded pass 23-2, 24-3, 30-1 and 30-2. Note however that pass 30-1 and 30-2 are maybe unusable because while I rewound the tape it broke. I repaired it and sent it to you without trying it because I was afraid I would break it again. I do not remember having broken a tape before. Well, that's life!

Pass 29-3 was rather cold here. I do not think that I heard ISTOCHNIK despite the fact that I saw MIR almost right above me while I was recording 29-3.

I did raise the gain of my receiver quite a lot. I now want to install variable filtering for low and high pass so that I can adjust myself to changing conditions. This is less of a problem for me since I have oriented my loop for lowest hum and I am far from the AC line.

I also raised my bridge a good one and a half feet to prevent flooding in the springtime. But I noticed that the beavers were busy working at their dam downstream. Well ...

The repaired tape worked fine. I admire Jean-Claude's ability to deal with adverse weather conditions and uncooperative wildlife.

Team 20 Barry Riehle Cincinnati, OH
Turpin High School

Barry was assisted in his data gathering by Melissa Eng, Nikki Nime and Debra Sawyer.

Team 7 Dean Knight Sonoma, CA
Sonoma Valley High School

This year was a bit more unusual. The 30-3 and 30-4 passes were part of an overnight campout since one pass was <u>so</u> late and the other <u>so</u> early. The kids loved it. Many had tents, but some of us wanted to watch the stars, so we put up with the morning frost all around us. The 1-4 pass was late (sort of) and only those souls willing to hike and set up the equipment in the rain and darkness made the trip. We hoped the moisture did not get to the electronics - too much of a hope for 2 of our 3 receivers. At least the really hard rain did not occur until we were hiking back tom our cars.

(Last year we hiked as long as 1 hour to get away from power lines. Sometimes this was at night across creeks for some passes. This year we found an electrically "quiet" area that could be reached by driving a couple of miles back into the hills of Glen Ellen and then only hiking in about 10 minutes over level terrain - big improvement!)

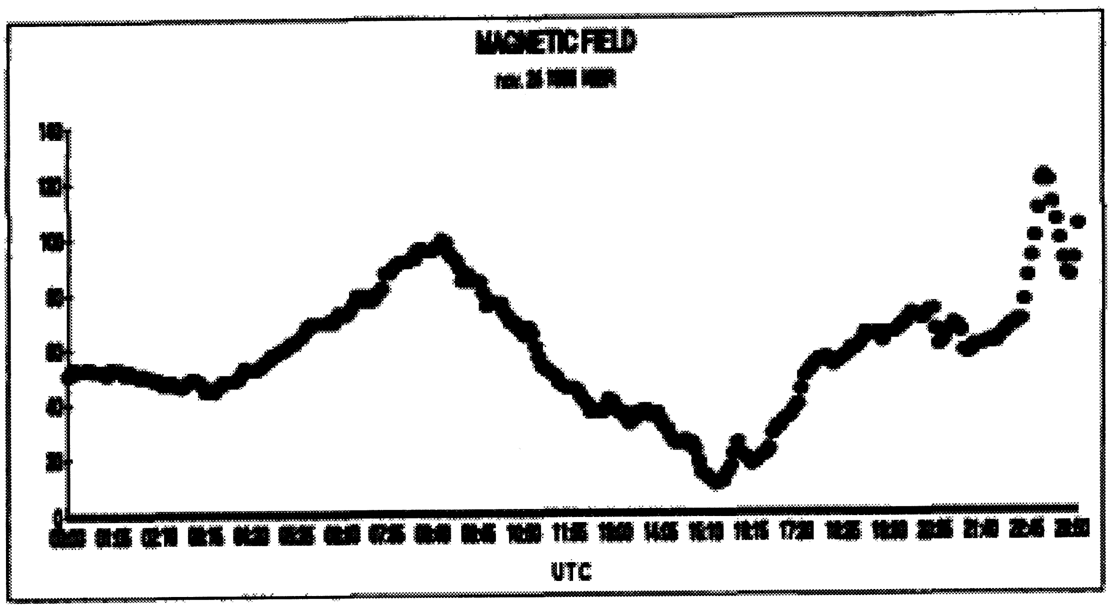
On one of the passes we actually saw the MIR Station at the tail end of the operation (30-4). It appeared about 2 minutes later than expected (5:21 AM) directly overhead. It had just emerged from the earth's shadow. Pretty exciting!

The operating time for ISTOCHNIK was adjusted from a start time of 1319 UT (5:19 AM PST) to 1320 UT. When it appeared high in the sky the operation had been underway for a minute (instead of 2 minutes) and it continued as it passed over you. The time on the tapes that was analyzed was from 1320-1322 UT.

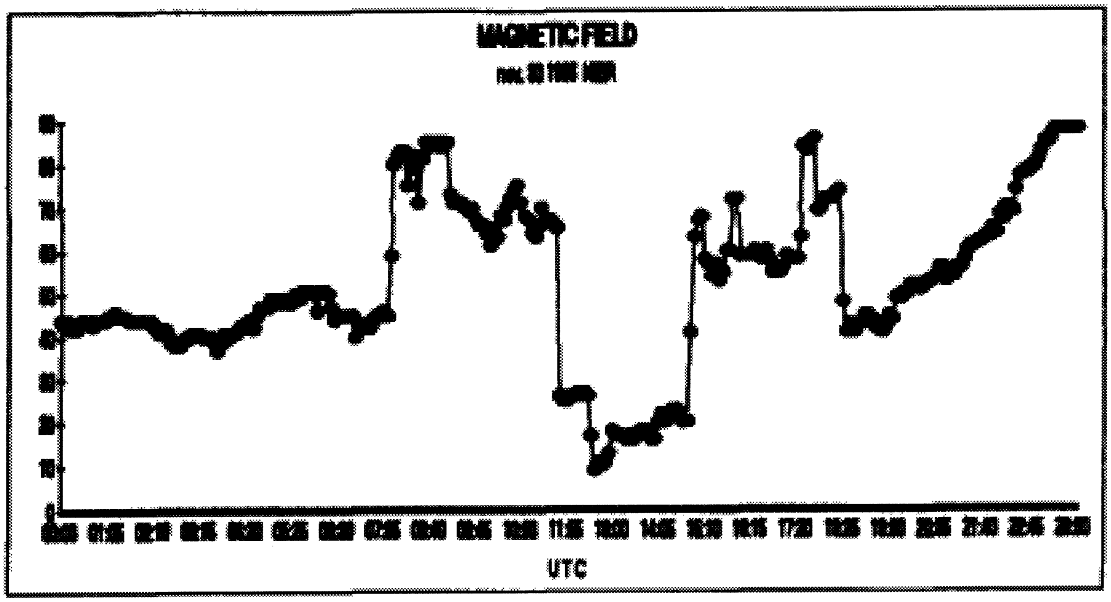
Bret Allen (3)
Whitney Baker (5)
Evan Baldinger (2)
Jenna Barkley (4)
Jimmy Barrot (3)
Alex Benward (3)
Megan Boden (3)
Kelly Bonbright (1)
Betsy Bradbury (2)
Kaitlin Burn (2)
Bryan Carlson (3)
Sabrena Carrington (4)
Meghan Coleman (1)
Stephen Coleman (2)
Juan Cruz (2)
Ryan Daffurn (4)
Chris Daley (1)
Joe Doherty (2)
Brad Duncan (2)
Stephanie Du Pont (1)
Brianna Egnew (2)
Alex Evaschuk (2)
Tony Faley (4)
Ellen Fitspatrick (2)
Lauren Flaherty (2)
Mark Gamelin (4)
Abe Gardner (3)
Rebekah Gonzalez (4)
Loren Graves (1)
Beth Gullikson (2)
Jenna Halthouse (1)
Peggy Henry (1)
Valerie Henry (1)
Amanda Higi (3)
Megan Klenow (2)
Jenni Knight (2)
Kaitlin Layher (2)
Camille Lucia (1)
Danielle Marshall (1)
Tom McKeever (2)
Katy McNulty (2)
Michelle Mendel (4)
Katherine Merritt (2)
Mike Moore (4)
Katie O'Leary (1)
Nathan Prziborowski (3)
Lea Rosemurgy (2)
Matt Ryan (2)
Pat Ryan (2)
Jenny Scafidi (2)
Meg Sou (1)
Gloria Stovall (2)
Sarah Swint (2)
Camille Varin (2)
Skye Vendt-Pearce (2)
David Vetrone (2)
Travis White (4)
Carrene Wojciechowski (1)
Cassie Wojciechowski (1)
Yvonne Young (2)

Team E6 Marco Ibridi Finale E., ITALY

Marco has sent along some graphs of the magnetic field measurements on November 24 and 30.



Gear : Magnetometer ELIRCAS home-brew software DAR I4IBR
sensor : FGM-3 Flux-Gate (Data-acquisition)
Speake & Co.Ltd. U.K.



It is interesting to note that the variation has approximately the same high and low points at corresponding times of day, but the variation is very different on the two days. Thanks, Marco.

Team 9 Robert Moloch Greentown, IN
Eastern Elementary School

Did note a strange ascending tome which seemed to fade out at approximately 1308 UTC, or 21 minutes 05 seconds into the tape recording. You might check this out and let us know what you think it was. This was the best pass (24-4) for us today or on previous INTMINS Projects due to the fact that MIR was almost directly overhead.

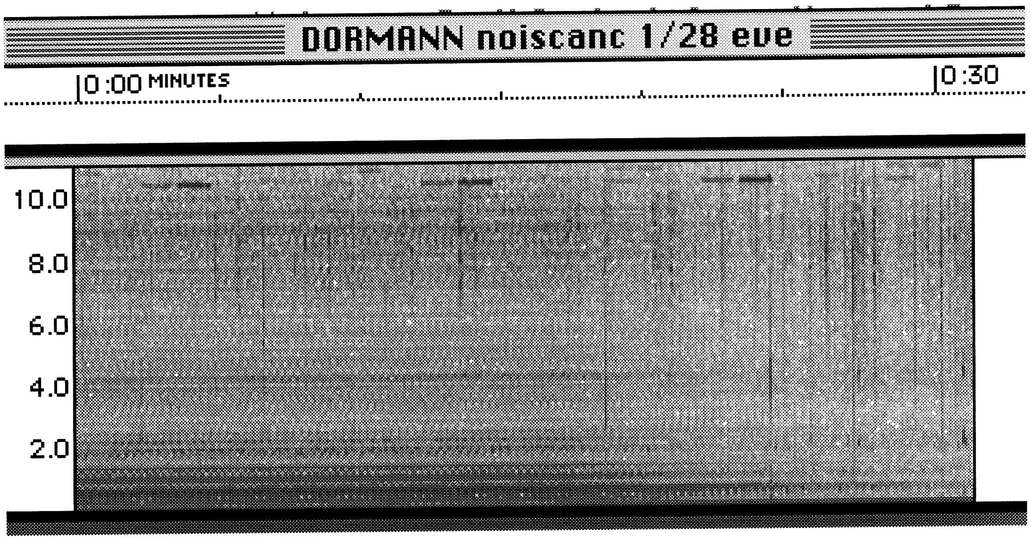
I think the signal you refer to was from the ignition system of a car.

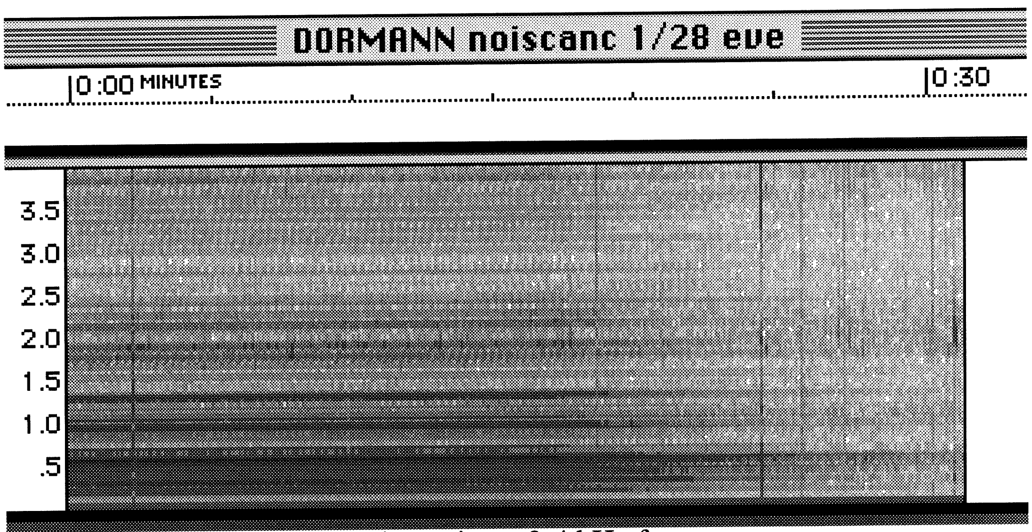
Adults on the Eastern Elementary Team included Robert Moloch N9SGQ, Radio Club Sponsor, Roger Grady K9OPO and Charles Sponaugle N9LYY. Student participants included Brooke Harden (for both pass 24-5 and 24-5), Jon Cranor (24-4), Josh Custer (24-5), Sarah Carpenter (24-5) and Jamison Haussman (24-5)

Team 8 Mike Dormann Seattle, WA

Mike has sent several pages of output using Excel to analyze INTMINS data. He also sent a tape demonstrating the performance of a noise canceler he has designed. The noise canceler responds to periodic (manmade) signals by generating the opposite wave form of the periodic signal. The result is a cancellation of the periodic waveform only. This is very different from a filter which would attenuate all signals in a certain frequency range. The noise canceler eliminates the hum only leaving the other signals intact.

The following spectrogram shows the operation of the noise canceler. Look at the horizontal bands which represent AC hum and its harmonics. About 15 seconds into the segment the noise canceler is turned on. It takes about 5 seconds to identify the periodic hum and generate the component necessary to cancel it. By 25 seconds into the segment, most of the hum lines have disappeared. When listening to the tape, the effect is striking. The natural (and nonperiodic) emissions seem to rise out of the background as the hum diminishes. Notice that the OMEGA signals remain intact since they are not of sufficient duration (around 1 second for each dash) to cause the noise canceler to generate the canceling waveform.





Same as above but using a 0-4 kHz frequency range.

Team E9 Dr. Valery Korepanov Lviv, UKRAINE
Lviv Center of Institute of Space Research of NASU

The investigators who participated in data recording were Ihor Docenko, Fyodor Doudkin and Andrey Marusenkov.

Team 17 Kent Gardner Fullerton, CA

Kent sent a copy of a videotape of a program about the Shoemaker-Levy Comet impacts with Jupiter and the Galileo Jupiter mission. He writes,

> ... It has a short segment on the Spacecraft Galileo flying past earth listening to lightning-caused whistlers. You can hear whistlers on the sound track. Whether they came from Galileo exactly or were substituted from earth-bound observations, I don't know. This brings up a question: What equipment does Galileo have that receives these frequencies and what purpose did it serve in its work?
>
> When the collisions occurred I tried to record any changes in radio signals coming from Jupiter, but was unsuccessful in coming up with any data that was meaningful.

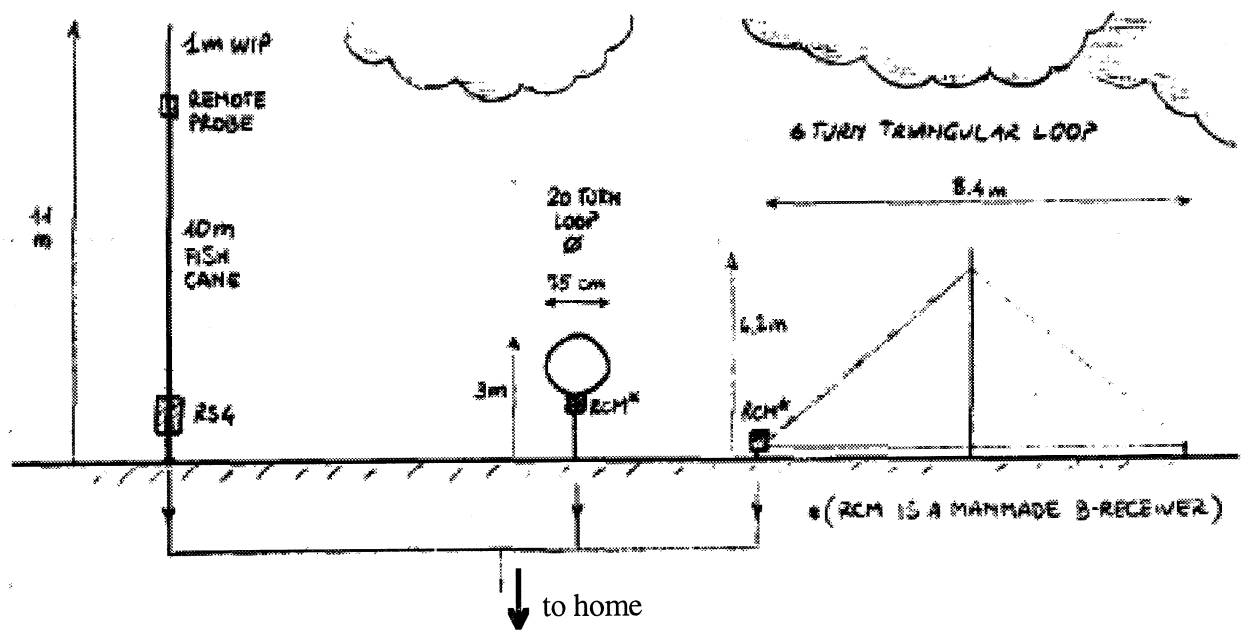
The following excerpt is from the JPL Web page on the Galileo mission:
(URL: http://www2.jpl.nasa.gov/files/fsheets/galileo.txt

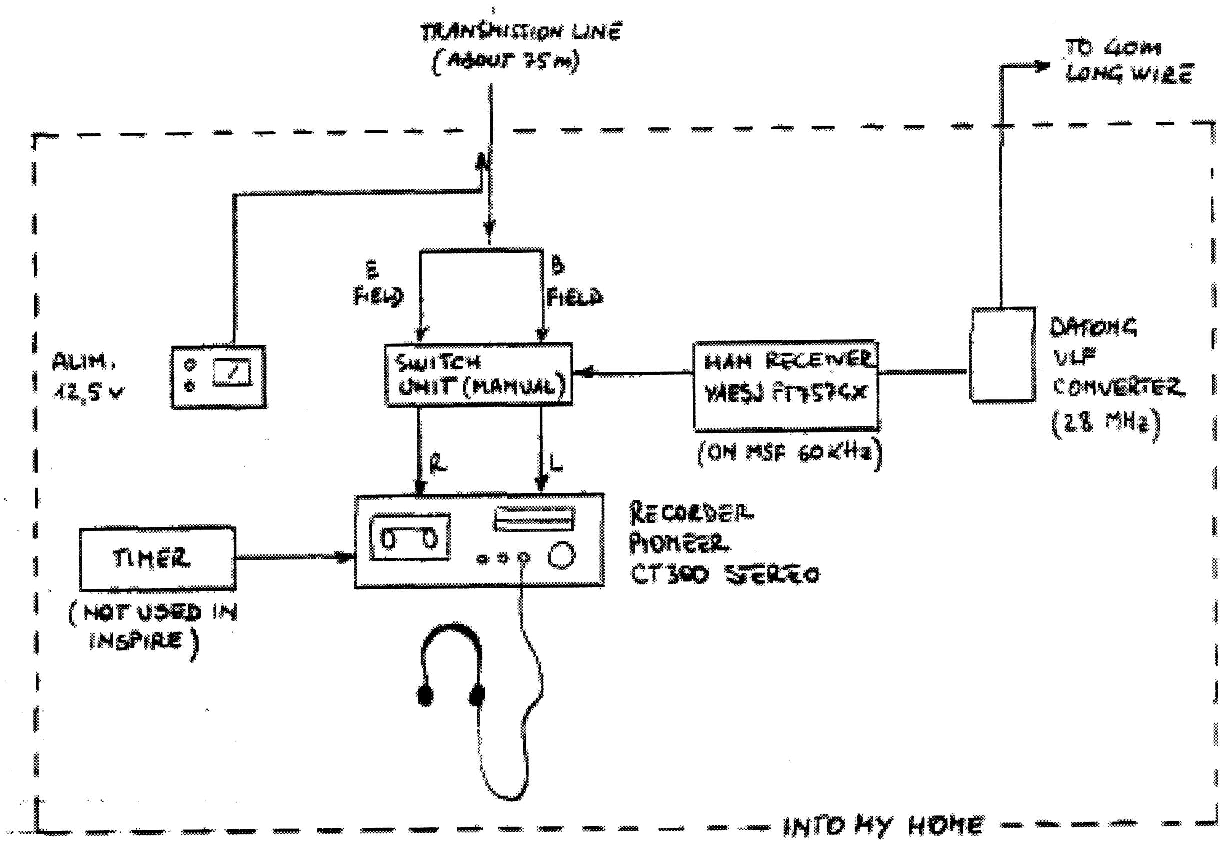
> Probe instruments include an atmospheric structure group of sensors measuring temperature, pressure and deceleration; a neutral mass spectrometer and a helium-abundance detector supporting atmospheric composition studies; a nephelometer for cloud location and cloud-particle observations; a net-flux radiometer measuring the difference, upward versus downward, in radiant energy flux at each altitude; <u>and a lightning/radio-emission instrument with an energetic-particle detector, measuring light and radio emissions associated with lightning and energetic particles in Jupiter's radiation belts</u> (so that this instrument begins measuring some hours before the probe reaches atmosphere).
> (Underlining added. - ed.)

Whistlers have been detected on Jupiter by the Voyager probes in the early 1980's. The reason for carrying this type instrument is basically the same as the reason we are conducting our investigations: to try to improve our understanding of the planetary magnetic fields and how they process electromagnetic signals. Thanks for the videotape, Kent.

Team E5 Renato Romero Cumiana, ITALY

Renato sent a diagram of his observing station. The setup consists of an antenna array outdoors connected by a 75 meter cable to his home.





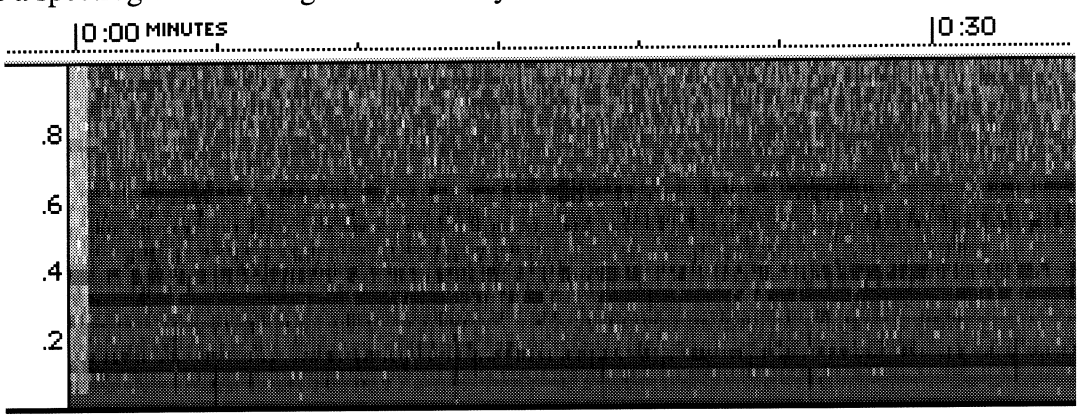
This is quite a setup, Renato. It's no surprise that you produce such good data!

Team 2 Stephen G. Davis Fort Edward, NY

Steve sent an additional tape and asked:

Here is a special request. There is an extra segment recorded after the INTMINS data of some local environmental noise pollution which has been disturbing the neighborhood for some time. Would you supply some spectrographs of the data? The noise is a steady high pitch coming from the stack of Environmental Soil Management, Inc., of New York which burns contaminated oil dirt. There is a large fan exhausting the gases, and it sound like somebody blowing across the top of a Coke bottle.

Here is a spectrogram of the signal recorded by Steve:



This spectrogram just shows the frequency range up to 1 kHz, which is where the noise seems to be found. Large fan motors would certainly put our a pretty strong electromagnetic signal with frequencies related to the rate of revolution of the fan motor.

Team 6 Bill Pine Ontario, CA
Chaffey High School

We used the November INTMINS operations to field test the new VLF2 receiver. The receiver worked well and we had good success with all observations (including the usual equipment related problems). We recorded passes 24-6, 30-3, 30-4 and 1-4. Chaffey students making data recordings included:

Jill Anthony
Victoria Avalos (2 trips)
Blake Hunter
Shazia Khan
Brad Olsan
Eugene Tarigan
Monika Witecka

For the early morning pass on the Saturday of Thanksgiving weekend (30-4) there was not a lot of interest from my students, so I did not plan a trip from school. If I go straight up to the mountains from home, it takes about an hour less time total for the trip, which was fine with me. Since it was Thanksgiving, all three of my daughters were home. Katie (24) was home from the San Francisco Bay Area where she works as Assistant Director of Development at a private school; Mandy (20) was home for the weekend from University of California Riverside; and Sarah (17) still lives at home. In addition, Mandy's boyfriend, Dennis Cox, was staying with us for the weekend. I invited all of them and they all accepted. At 4:30 AM we were up and on the road.

Only two out of three receivers could be coaxed to life, but the tapes were started on time. Just before MIR was due to appear, we looked to the northwest to see who would be the first to spot it. At that very moment we saw the brightest meteor I have ever seen. It was like a bright magnesium flare that traveled from about 50 degrees altitude to about 20 degrees in the northwest sky. It was so bright that the light seemed to persist in the sky for some seconds. It is also the first time that everyone present saw the meteor. It is far more common for someone to say "Look at that!" and for everyone else to say "What?"

About the time our eyes adjusted back to the dark, MIR popped out of the shadow right on schedule and passed nearly straight overhead. It was visible for about 7 minutes and finally faded from view in the low eastern sky. It was nice to note that MIR was following the revised schedule that we had projected when modifying the operation times.

After the tapes were completed, we packed up amid a growing dawn and headed down the hill. Thirty minutes later everyone under 30 was back asleep and I was contentedly reading the paper in a very quiet house.

Data Log Cover Sheet (copy as needed)

INSPIRE Observer Team ______________________ Receiver ________

Operation ____________

Date __________ Tape Start Time (UT) ____________

****

Operation details:

Tape start time: ________ UT ________ local

Operation start time: ________ UT ________ local

Operation type: ____________________

Operation stop time: ________ UT ________ local

Tape stop time: ________ UT ________ local

Equipment:

Receiver ______________________

Recorder ______________________

Antenna ______________________

WWV radio ______________________

WW V reception:

____

____

____

Site description: ____

Longitude: _____° _____ ' W Latitude: _____° _____' N

Local weather: ____

Personnel: ______________ ______________ ______________

______________ ______________ ______________

Team Leader address:

Name ______________________

Street ______________________

____

City, State, Zip, Country ______________________

INSPIRE Data (copy as needed)

INSPIRE Observer Team ______________________________ Receiver ________

Operation ________________

Date ____________ Tape Start Time (UT) ____________

****

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
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________
________	______________________________	S: 0 1 2 3 4 5	__________