The INSPIRE Journal

Volume 1 Number 2 May 1993

Editor: Bill Pine

DATA ANALYSIS ON PC COMPATIBLES!

In this issue you will find am article on a data analysis hardware/software product for the IBM PC and compatibles. The product consists of a 12-bit analog to digital conversion card and the supporting software. Called "AD12-X1", it was created by Brian Baker of San Diego, California, originally for use in voice analysis. Included in the capabilities of the software is the ability to create frequency-time graphic representations called "sonograms". This is the key feature needed for the analysis of VLF radio signals and whistler-hunting.

Brian is very interested in VLF signal analysis and has expressed a willingness to modify the software to add some features specifically to support VLF signal analysis.

Many of you have expressed interest in being able to analyze data on your IBM-compatible computers. I am happy to be able to report that we have found a product that will serve your needs well now - and maybe even better in the future!

VLF OBSERVATIONS IN ITALY

I have heard from Flavio Gori of Firenze, Italy, and he has reported on some of his VLF monitoring activities. Flavio was the INSPIRE European FAX Contact in 1992 during the flight of STS-45.

Flavio described some coordinated listening exercises involving Ezio Mognaschi in northern Italy, Jim Mandaville in Saudi Arabia and Flavio and Marco Ibridi in central Italy. The results are being analyzed and Flavio will write an article for the Journal.

Flavio and Jim also did some coordinated monitoring when Flavio was in the Maldive Islands recently. The Maldives are located near the equator southwest of India. Flavio reports that this is a "very quiet site".

Flavio has had four articles published in Italian periodicals. The articles have appeared in:

1. "Radiorama", the newsletter of his radio association,
2. "PROGETTO" and
3. "CQ ELETTRONICA", which sell in magazine shops, and
4. "Bolletino di Geodesia e Scienze Affini", a scientific publication of the Military Geographic Institute.

Flavio sent a copy of the last article of which he is justly proud. The four page article entitled "Progetto NASA SEPAC/INSPIRE" was in Italian, which limited my comprehension somewhat, but I certainly appreciated Flavio's efforts. We can look forward to hearing more from our European contingent.

ABBOTSFORD, WI - A HOTBED OF VLF ACTIVITY!

In this issue of the Journal you will find several articles by Mike Schoenfuss (N9GHZ), advisor of the Abbotsford (WI) High School INSPIRE Team. Mike and I have communicated regularly since early in the INSPIRE Project. A while back Mike asked what he could do to help INSPIRE and I suggested that he write for the Journal. Mike took me up on that in big style - and I appreciate it!

UPDATES ON PREVIOUS JOURNAL ITEMS:

Orbit Tracking Software

Dave Ransom sent a copy of his PC-compatible "STS Orbit PLUS" (STSPLUS) satellite tracking program. I have been using his STS Orbit program for shuttle tracking during recent shuttle missions and I have been impressed with its performance.

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Data Analysis on IBM PC Compatibles

By Bill Pine

Editor, The INSPIRE Journal

Analysis of data collected by INSPIRE participants for the ATLAS-SEPAC experiments on board Space Shuttle Atlantis (STS - 45) in the spring of 1992 was done on a Macintosh computer using a hardware/software package called MacRecorder. The problem with this configuration is that the computer required is a high priced Mac II, a computer not widely available in schools. IBM compatible PCs are more widely available in schools and homes, so the search was begun last spring for signal analysis software and hardware that could run on PCs.

In order to be able to compare the output of various programs with that of the Macintosh, an audio tape of natural radio samples was created. This tape was excerpted from "Introduction to Natural Radio", which was created by Michael Mideke for INSPIRE (and included in the INSPIRE kits) from signals he had collected in his research. Several copies of this samples tape were created so that we could be sure that exactly the same signals were being inputted into the analysis programs. The fact that the samples tape is three generations removed from Mike's originals means that there was some degradation of signal quality, but the quality is identical on all copies. For the purposes of this article, only the first 10-15 seconds of the first segment of the samples tape have been used. All printer output is reproduced full size.

The key feature of analysis software is called a "sonogram". A sonogram is a frequency-time spectrograph which depicts the frequencies present as a function of time. On a sonogram, lightning "sferics" appear as vertical lines (all frequencies occurring at once) while whistlers appear as sweeping curves that start at high frequencies and progress smoothly to lower frequencies over the period of a second or so.

This article is divided into four sections:

1. "AD12-X1" - an evaluation of a data analysis product for IBM PCT compatibles.
2. "Sound Blaster" - an investigation of an off-the-shelf signal analysis package.
3. "MacRecorder" - a description of the Macintosh compatible data analysis product.
4. "Comparison" - comparing the features of the AD12-X1 and MacRecorder.

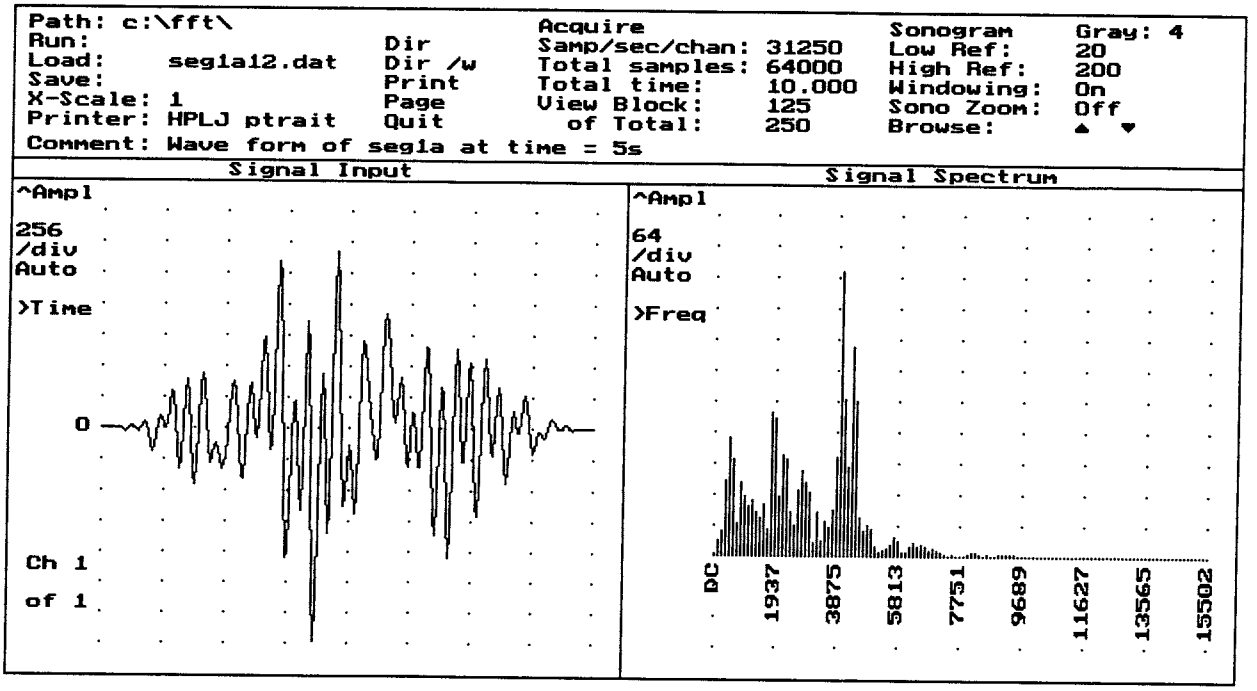


Figure 1a

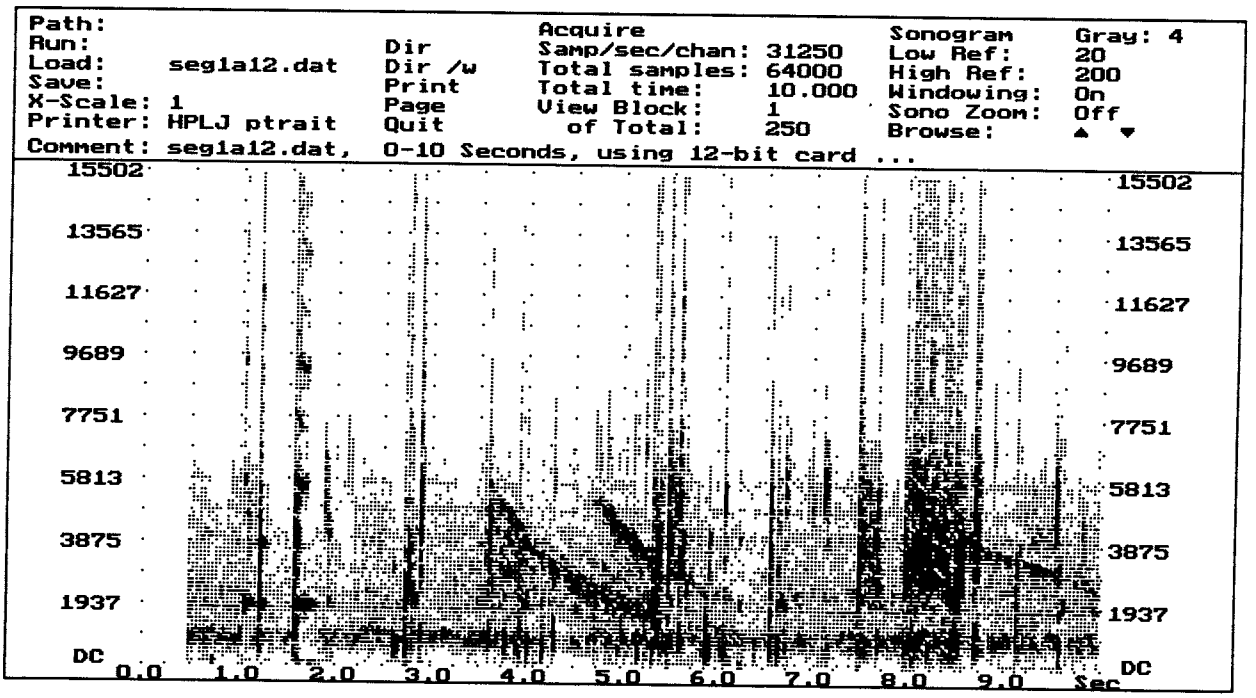


Figure 1b

Figure 1. Display screens of the AD12-X1

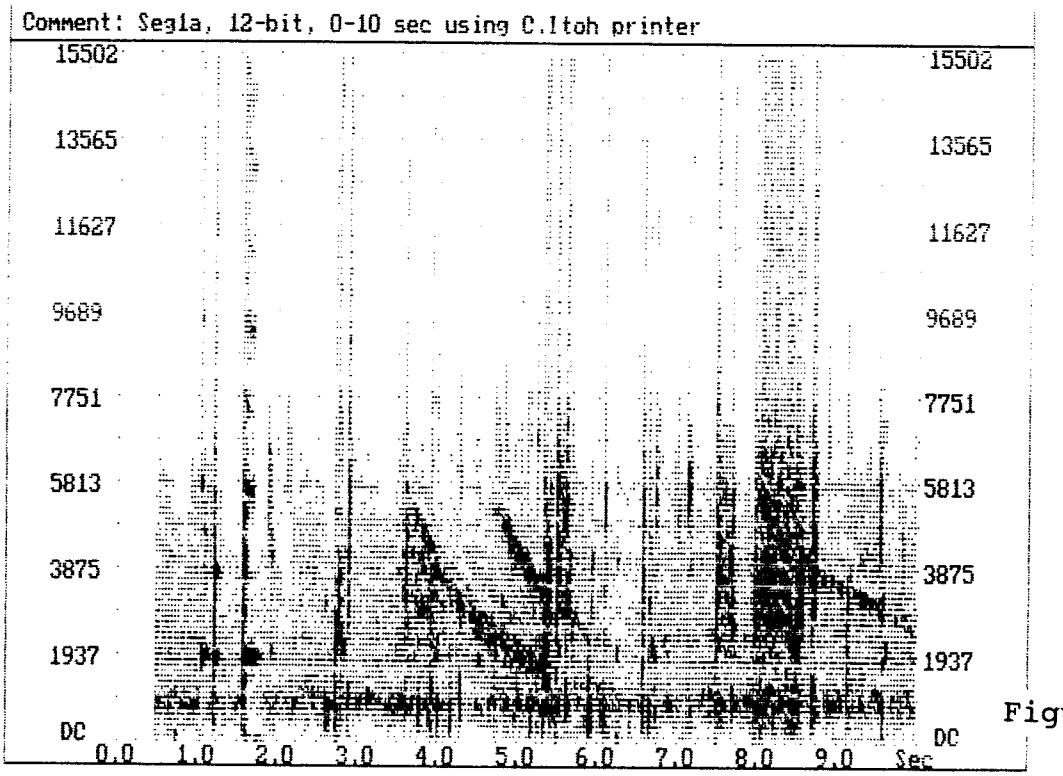


Figure 3a

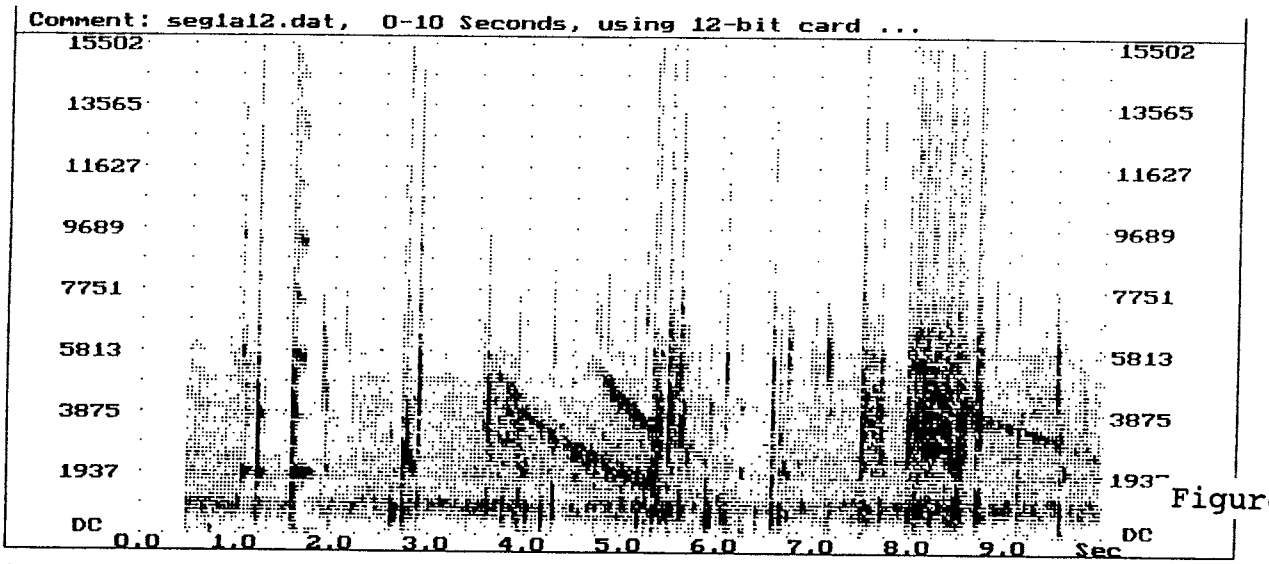


Figure 3b

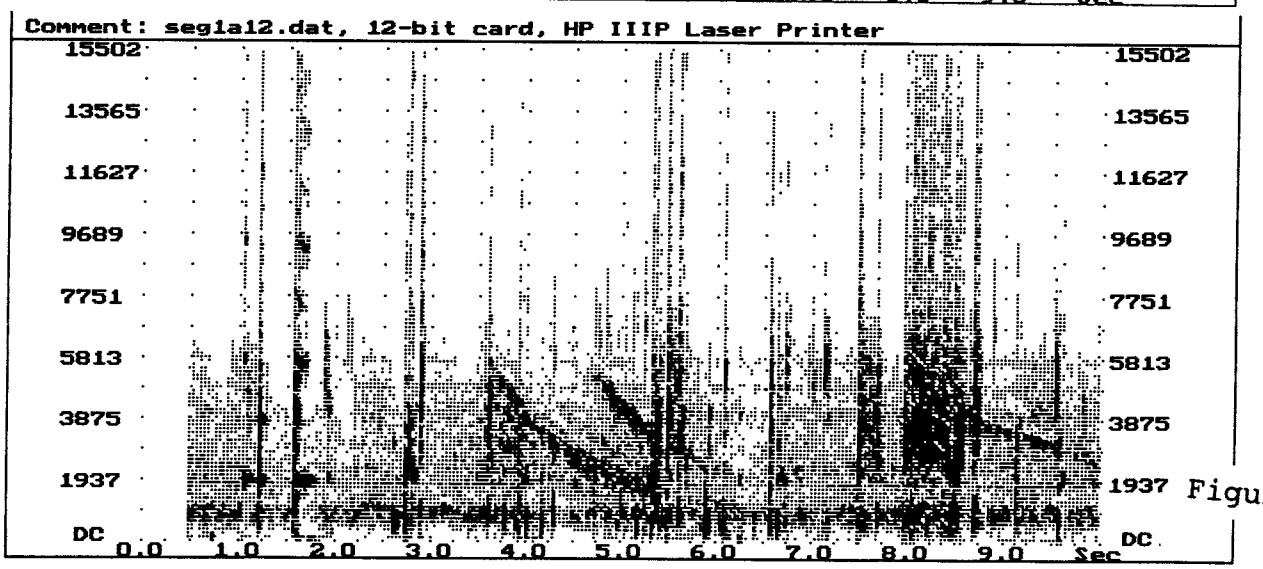


Figure 3c

Figure 3. Comparison of output from different printers.

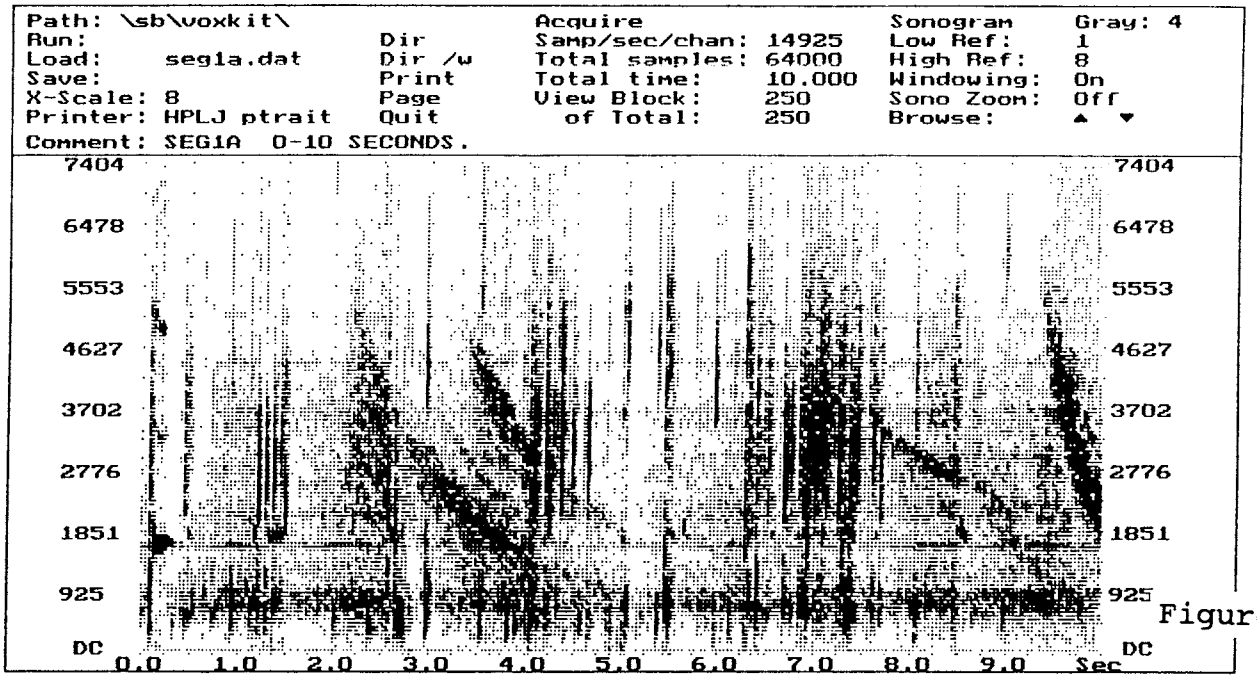


Figure 4a

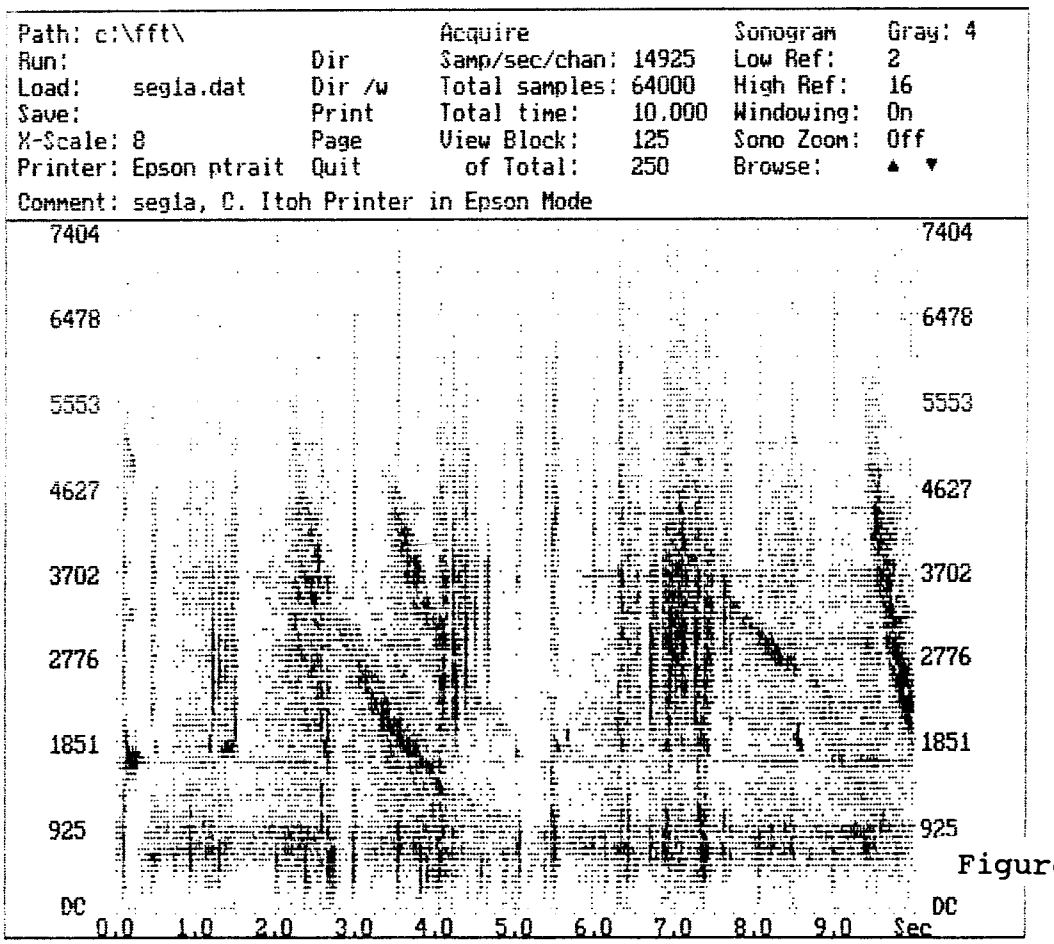


Figure 4b

Figure 4. Sound Blaster output.

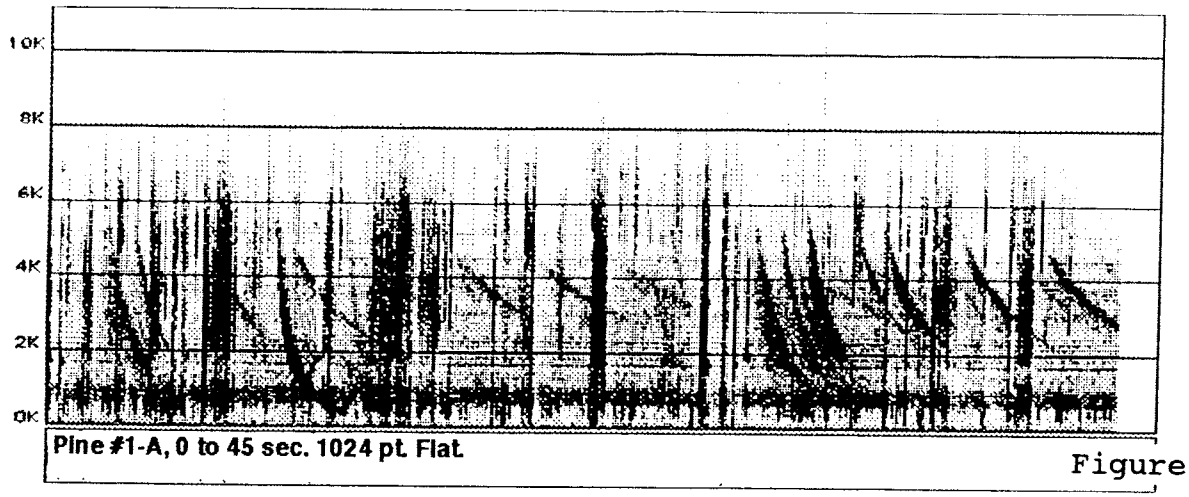


Figure 5a

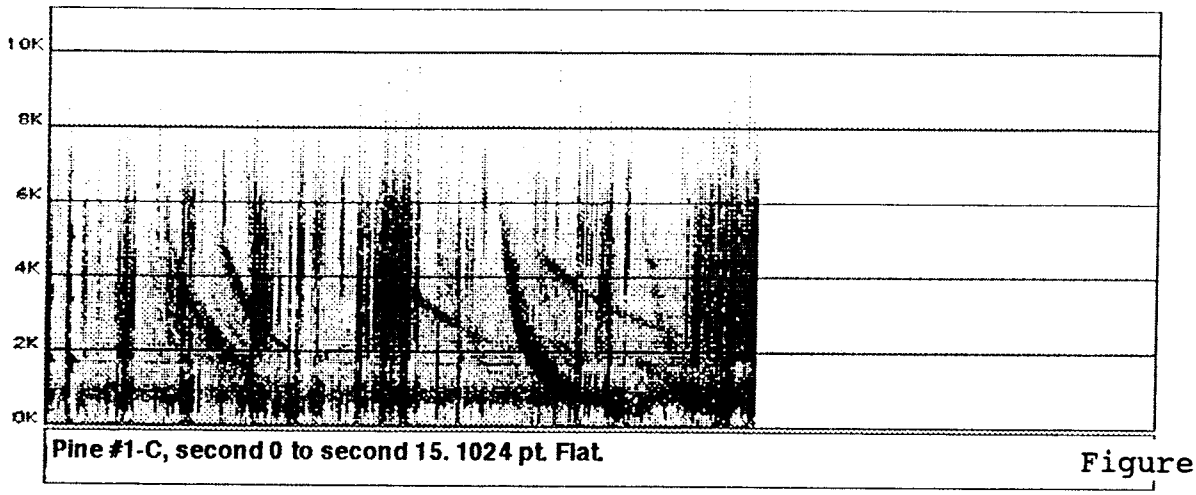


Figure 5b

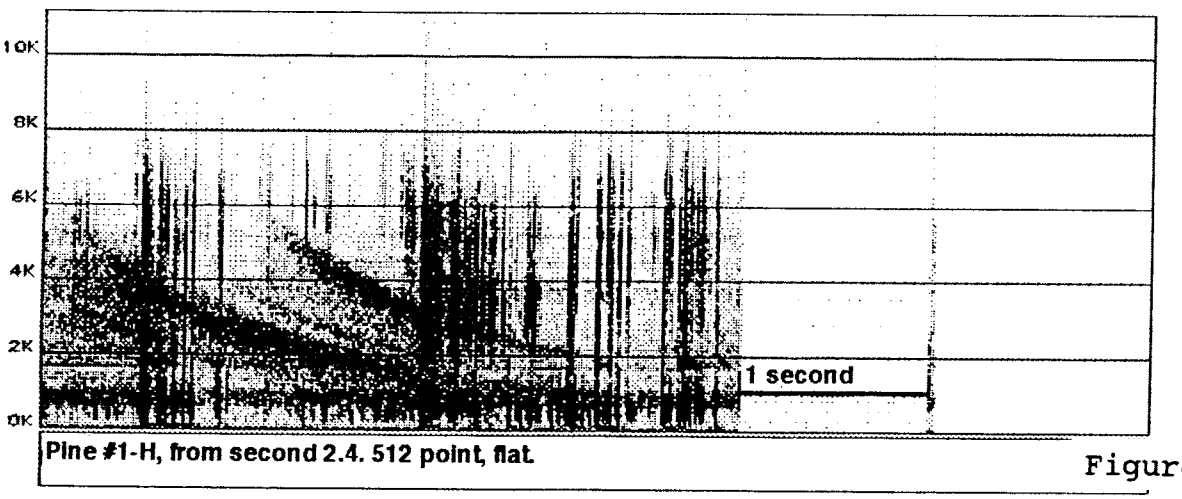


Figure 5c

Figure 5. MacRecorder output.

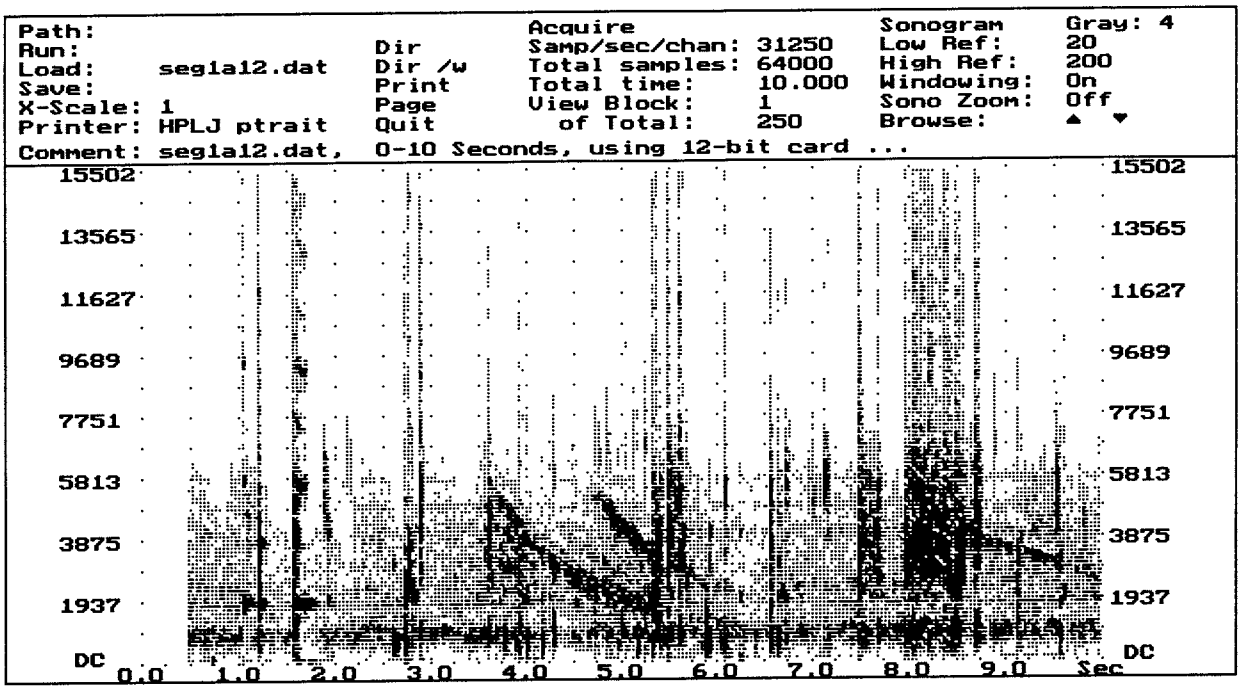


Figure 6a. AD12-X1 output.

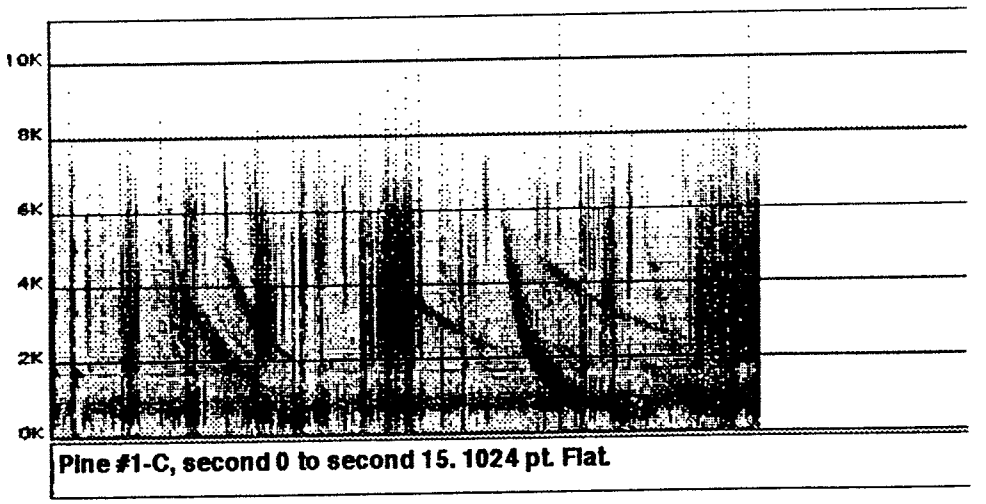
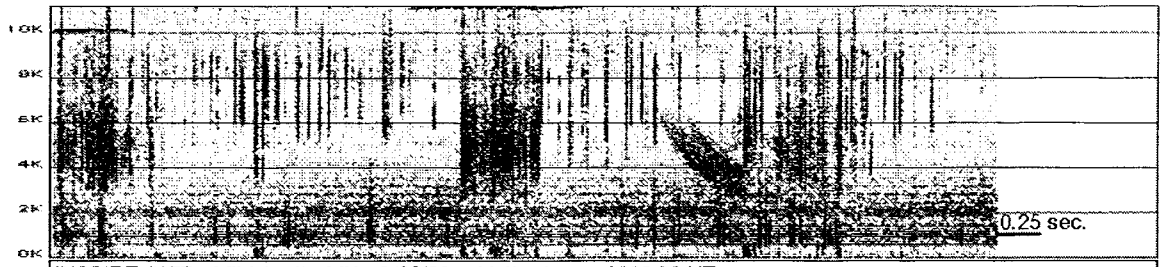
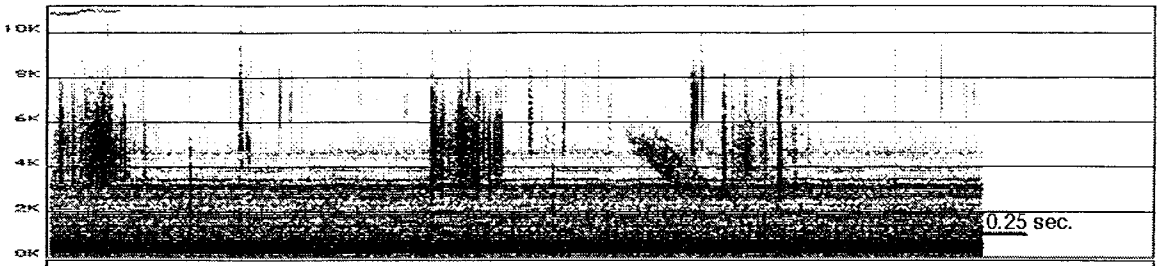


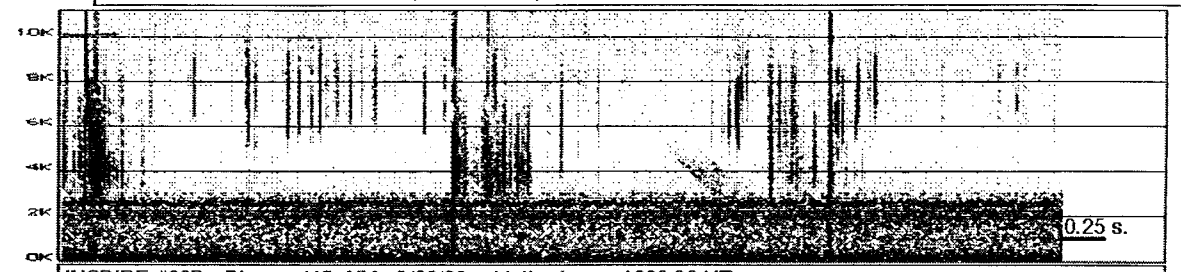
Figure 6b. MacRecorder output.



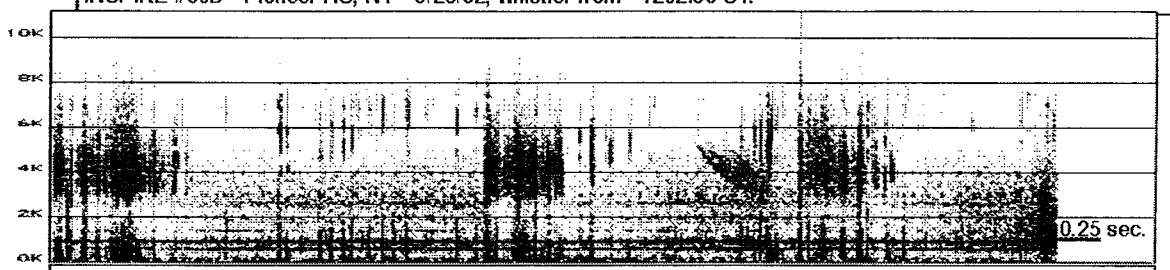
INSPIRE #47F - Mildebrath, MN - 3/28/92, whistler from ~1202:38 UT.



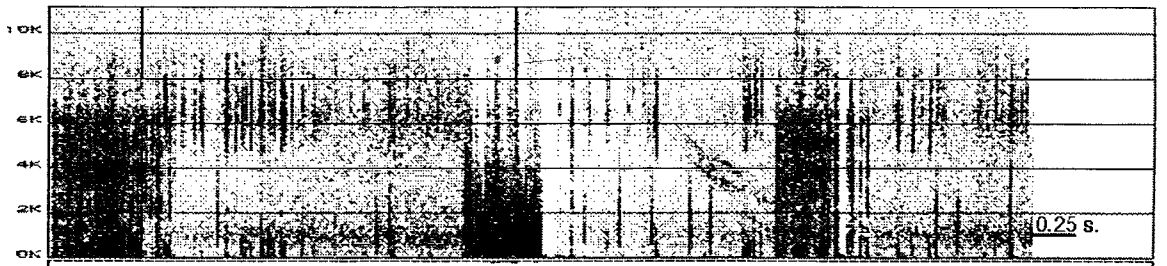
INSPIRE # 67C - Cedar Falls HS, IA - 3/28/92, whistler from ~1202:38 UT.



INSPIRE #80B - Pioneer HS, NY - 3/28/92, whistler from ~1202:38 UT.



INSPIRE #183 C - South Point HS, NC - 3/28/92, whistler from ~ 1202:38 UT.



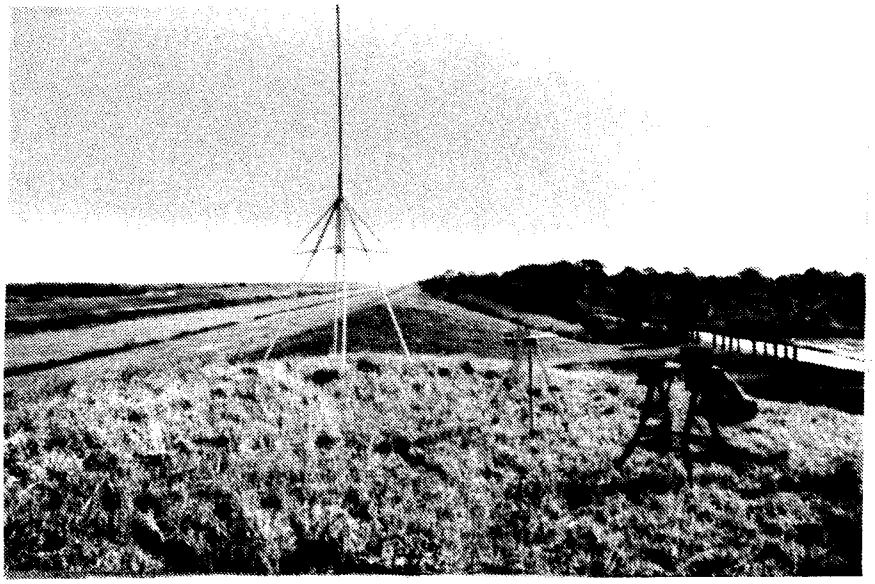
INSPIRE #62C - Girl Scout Troop 117, TX - 3/28/92, whistler from ~1202:38 UT.

Sixteen INSPIRE ground stations in 12 states recorded this whistler, from California to New York and North Carolina. Note matching of the large sferic clusters. Horizontal scale of #67C does not match the others.

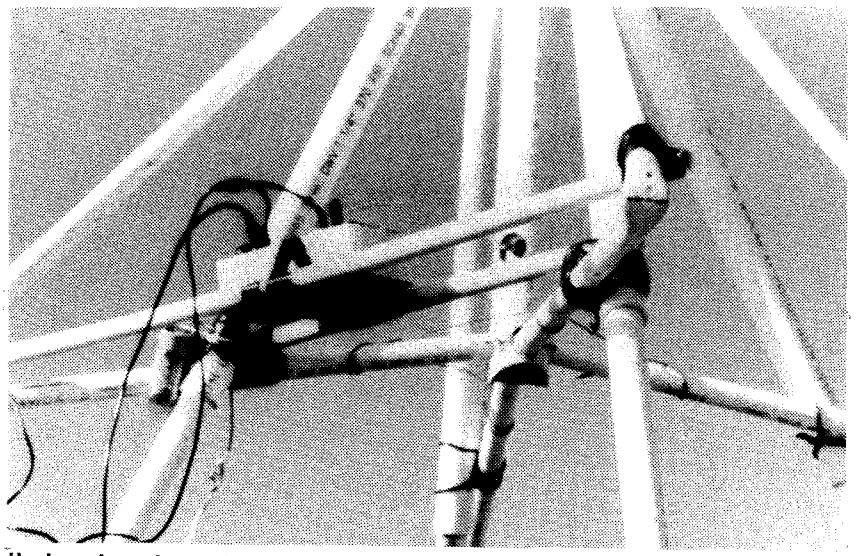
and far enough away from all the little electrical noises of the recording operation to make a real difference.

Assuming the LWCA mounts a VLF monitoring program next Spring, readers of ***Inspire Journal*** are certainly welcome to participate, whether or not they are LWCA members. However, ***The Lowdown*** is the primary communications medium for organizing LWCA projects of this sort, and if you do not subscribe, your best option to find out what's happening is to place a business-size 29 cent SASE on file with me. I will stuff and mail it when organization gets underway for the next round, sometime in October or November.

The Lowdown is $18 per year in the US, $19 in Canada, $26 overseas air mail, from LWCA, 45 Wildflower Road, Levittown, PA 19057.



PVC antenna designed and built by the Palm Bay High school Radio Club. The PVC encased 3 m whip is mounted in the small central pyramid sturcture. The legs fit into the small central pyramid. This is a good example of a listening site that is "in the clear".



Detail showing the middle portion of the Palm Bay antenna. The VLF receiver is mounted on the framework next to the bottom of the 3 m whip. An alternative approach would be to mount an outboard preamplifier unit at this point, as described in the Oct. '92 issue of this journal, pages 18-19.

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THE SEP PROGRAM: HANDS-ON SCIENCE IN A UNIQUE FORM

Students in Alabama are getting a chance to experience hands-on science in a rather unusual way . . . they are serving as the design, integration and post flight analysis teams for experiments launched onboard Class B sounding rockets. The Student Experimental Payload Program is an endeavor brought to life by Greg Warren and Ken Pearce, two long time rocket enthusiasts that wanted to take launching "model rockets" one step further.

The SEP Program is a non-profit organization that allows students the opportunity to submit ideas for payloads (experiments) to be launched up to an altitude of nearly two miles. Once the payload ideas have been reviewed and passed, students must design the experiments to fit within specific parameters. Such limits as weight, size, power requirements, materials and scientific value are pitted against each other in a competition similar to a science fair. The winning entries are then processed and the actual payload construction begins.

"We wanted to show students that science can have specific values in their education while they are in school," comments Greg Warren, Program Director,"rather than simply tell them 'you should pay attention in science class, you may need this someday.' And so far the response has been well received by both teachers and students."

In addition to getting students involved in the payload design and construction process, the program offers support to physics and chemistry classes by performing high power model rocket launches at different schools, static firing demos, and an information kit now available to teachers so that they may conduct similar small scale activities for their own classes.

This program did not come about overnight. During the 1991-92 school year, Warren and Pearce conducted a "pilot program" using students from physics classes at Athens High School and the gifted program students attending the Limestone County Vocational School. During the pilot program, students constructed a total of 11 experiments which were launched using three different SEP rockets. The program went exceptionally well and teachers encouraged continuation of the program, stating that a good science involvement program was hard to come by.

Although the interest and motivation was there, the money wasn't. At the recommendation of several teachers, the team contacted AmSouth Bank and applied for a grant through the Amsouth Fund for Educational Excellence Program. AmSouth Bank reviewed the grant application and consented to a $14,085.00 grant to enable the SEP Program to go state wide. With the money now available, the program has been expanded to include every public school in Alabama.

In addition, the SEP team has also been expanded to include Joe Robertson, a design engineer with Thiokol Corporation; Dan Coon, a research engineer with General Dynamics; Guy McClure, physics teacher at Athens High School and SEP educational coordinator for grades 9-12; Pam Fowler, gifted program teacher at the Limestone County Vocational Center and SEP educational coordinator for grades 5-8; and Karen Warren, elementary teacher at Cowart Elementary school and educational coordinator for grades K-4.

The Student Experimental Payload Program has proven so successful that plans are to expand it nationwide beginning in the 1993-94 school year. Payload modules will be provided to participating students and the completed, self contained experiments will be mailed back to SEP for launch and recovery. When the experiments are returned to the students for post flight analysis, a video tape of the launch and recovery activities will be included. Complete information on designing, building and analyzing a payload experiment for the program is available from SEP.

In an effort to keep students informed on activities and deadlines, SEP now offers a newsletter that covers demos, activities, NASA news and current events in rocketry. Published monthly during the school year (nine issues total), the "Flamethrower" as it has been dubbed is available at a subscription rate of $10.00. Signing up for a subscription will entitle you to all nine issues during the school year, including back issues if you sign up after the school year has started.

A brochure and detailed information sheet about the SEP Program is available at no charge simply by contacting the SEP Operations Center and requesting an information packet. SEPOC may be reached at: P.O. Box 1934, Huntsville, Alabama 35807 or call (205) 230-0353.

END

In both cases, the companies mailed me portions of their grid maps for those portions of their respective service areas that they felt provided the best chance of getting further away from AC power lines. Each map indicated power lines by lines drawn on the map, with dots representing individual customer locations. Names of roads and townships were also indicated on the maps, making it easy to follow them.

The maps provided by one of the two companies went into even greater detail. Their maps were printed by township and were obviously computer-generated and printed on either a printer or more likely some type of plotter. Individual sections within each township were also numbered to correspond to the county's plat book. Their maps even went so far as to print the power lines in color(red, green and blue) with the color indicating the different phases of the power lines!

If you decide to contact your area electric company(ies), whether it be in person, by phone or by letter, be sure to explain to them the nature of your project and why you need this information. Also be sure to provide them with the criteria you have in mind for the site you want, such as:

1- How far away would you LIKE to be from the nearest power lines.

2- How far you are willing to go from your "home base" location(EX: a site within appx. one hour's drive of Abbotsford).

3- Having a site that is preferably located on public land as opposed to private land, requiring receiving permission from the landowner to use it.

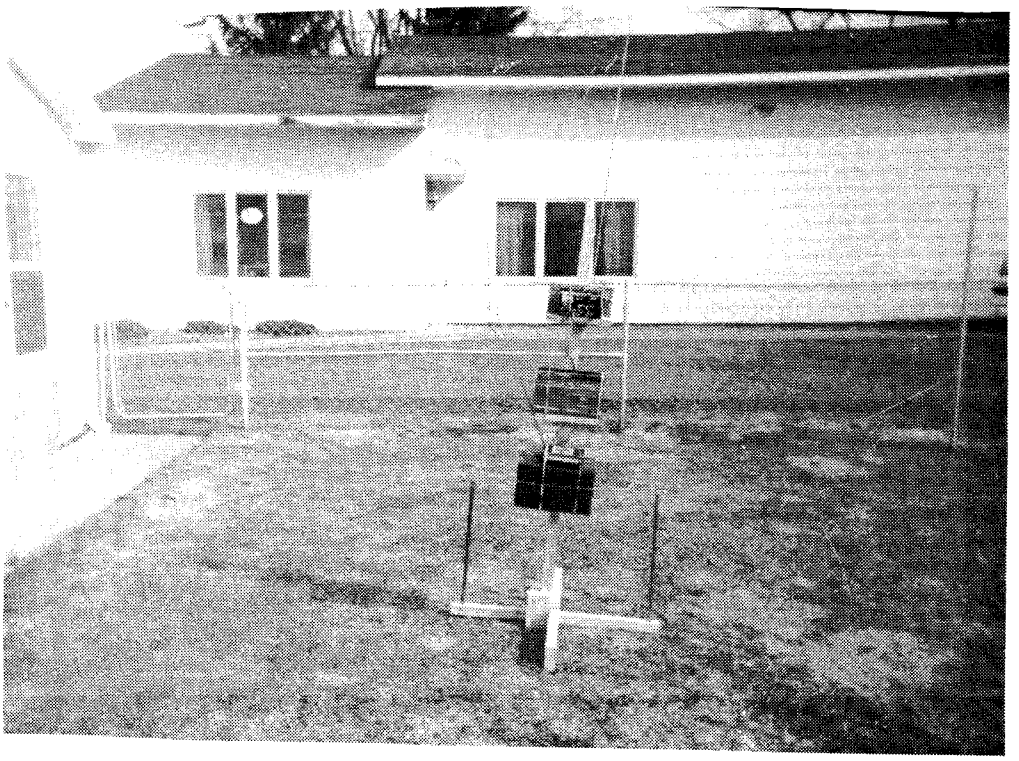
4- A site that is readily accessible by the type of vehicle/transportation you plan to use, for the time of year you plan to be on-site. Obviously, if you plan to be out in late winter or early spring when snow and/or mud are factors, and if you don't have access to a 4-wheel drive, all-terrain vehicle, you may want to avoid going on logging roads or national forest fire lanes!

Also, when looking for a quiet site, don't forget that if you are considering a site on private property, get permission from the landowner first! A county plat book should help you to identify and contact the owner of the land in question.

I have a copy of the 3-page letter I used to send to my area electric companies on file, and anyone who is interested in a copy of it, to use as a guide in writing your own letter, can receive one by sending me a business-size, self-addressed, stamped envelope. Hopefully, if you're presently still looking for a quiet site, or a better site, these suggestions can help you cut down on the time and effort required to find one!

HARDWARE CONFIGURATIONS(continued...)

Looking through the pictures in the October, 1992 issue of "The INSPIRE Journal" I could see there were some very different hardware configurations being used, including at least one card table. I would be interested in seeing information on other INSPIRE teams' setups appear in this publication, particularly if they are unique. By sharing such information we can perhaps all make our work in moving and setting up equipment a little easier.



Who do you want to talk to, to get information about a particular charitable foundation or trust? If dealing with a bank, try one of the bank's officers. If it is a business or company, try one of the executives, such as the director of finance. The information you will need may probably be obtained just as easily from a receptionist or secretary, so that might be a good place to start.

What kind of information should you be looking for? One of the first things you want to find out is what kinds of projects and organizations the foundation will donate to. Schools are usually on the list, but don't take that for granted. There may also be a limit on the geographic area served by the foundation. Probably the most important information you'll need to know is what you need to do in order to be considered as a recipient of a grant(see accompanying copy of a sample charitable foundation contribution policy).

Some foundations and trusts may have an application form that they will ask you to complete and return. Some others may ask you to write and submit a request or proposal, using a format of your own. They will likely ask you to include a detailed description of how the contribution will be used(i.e. project description); the benefits it will provide to the school, community, etc.; total anticipated cost; total amount being requested; etc.

There are a few other things to keep in mind when requesting funds from a charitable foundation or trust. For one thing, they often only meet a few times a year to act upon requests for funding. Be sure to ask about a deadline for submission of your proposal so that it can be acted on at the next meeting of the foundation board.

Be aware that you may not necessarily receive the full amount of your grant request, but rather only a portion of it will be awarded to you. This is not an uncommon practice. Also be aware that you will most likely be in competition with several other groups for a limited amount of funds each funding period, and that your request may be turned down. If that happens, don't give up. Get back in touch with the foundation's contact person and ask that your request be kept active for future consideration. If required, submit a new request/proposal.

Requests or proposals for funding should ideally be written up by a teacher at the school, or, if written up by the INSPIRE team advisor/ham radio operator/etc. should at least be signed by one or more teachers from the school. This will lend a degree of legitimacy to the written proposal, and ensure that the foundation board knows that the funds will go to, and remain within, the school.

EXAMPLE

ABBOTSFORD STORY, INC.

Charitable Foundation
Contribution Policy

CONTRIBUTION OBJECTIVE

It is the objective of the Abbotsford Story, Inc. Charitable Foundation to provide donations that will enrich, create or support existing community projects where the benefit derived from the contribution will aid the greatest number of citizens possible. Contributions should further enhance the standard of living or education of the receiving community.

CONTRIBUTION POLICY

1. Contributions are to be used to provide monies to schools for updating or creation of defined disciplines, individually or cooperatively, which resources were not included in budgetary planning or,

2. To provide resources for defined nonconsuming civic construction or reconstruction that would have unlimited public access.

3. Contributions from the Foundation are limited geographically to an area within a ten mile radius of Abbotsford, Wisconsin.

4. The Grantee submitting a request to the Foundation must demonstrate present or future fiscal responsibility.

5. All charitable requests must be in writing and provide the following information:
   a) Name and address of the organization making the request.
   b) Detailed description of how the contribution will be used.
   c) Total anticipated cost of completed endeavor.
   d) Total amount of request from the Foundation.
   e) Funding term of request from the Foundation.

6. All donation requests will be acted upon semiannually on the second Monday of March and September. All requests must be presented to the Foundation at least thirty days before scheduled meetings.

7. This contribution policy shall be made available to all who shall seek a donation request from the Foundation.

This policy adopted by the Board of Directors of the Abbotsford Story, Inc. on the 27th day of February, 1990.

SHUTTLE ASTRONAUTS MAKE RADIO CONTACTS(continued...)

During each SAREX mission, the astronauts' primary work schedules dictate when they can and cannot operate the radio equipment. As a result, most of the contacts they make are random. If the astronauts are operating their radio however, you can be certain that many hams will be attempting to contact them.

During SAREX missions, a handful of schools are chosen from around the world to make contact with the shuttle. These contacts are prearranged, giving the schools a greater chance at making a successful contact. One or two students at each of the selected schools ask questions of the astronauts during the contact. The nature of these contacts embodies the primary goal of SAREX - to excite students' interest in learning.

Schools wanting to make a SAREX contact with the astronauts are asked to submit proposals to the American Radio Relay League. You may write ARRL Educational Activities Dept. for a SAREX application form, at: ARRL EAD, ATTN: Tracy Simpson, Educational Correspondent, 225 Main St., Newington, CT 06111. Their phone no. is (203) 666-1541, FAX (203) 665-7531.

While only a handful of schools get chosen for an actual contact, all schools can participate by eavesdropping on the shuttle astronauts. SAREX lesson plans are also available to all schools who participate. Imagine listening in on the astronauts from your classroom! In addition, there is always the opportunity for a random, chance contact.

If you are a school teacher, you can easily become a part of this activity in your local school(s). Contact the ARRL EAD to get a list of your local Amateur Radio clubs or individuals. Because the radio equipment being used on the shuttle for SAREX is licensed in the Amateur Radio service, you will need to work with a licensed Amateur Radio operator(s) in order to participate in SAREX. If you are not a licensed "ham" yourself, there may even be another teacher at your school who is.

If you are a parent, grandparent and/or a ham radio operator, contact ARRL EAD and a local school. EAD will send you materials, including ways to convince teachers and school administrators that Amateur Radio is an important discipline the school should take advantage of on a full-time basis. This is a tremendous opportunity for you to showcase SAREX and Amateur Radio to kids of all ages in a big way.

SHUTTLE ASTRONAUTS MAKE RADIO CONTACTS(continued...)

Voice Uplink(Europe): 144.7, 144.75 and 144.8 MHz

Voice Uplink(rest of the world): 144.91, 144.93, 144.95, 144.97 and 144.99 MHz

Most scanner radios should be capable of tuning in these frequencies. An outside antenna will improve your reception greatly.

TELLING TIME WITH OMEGA

By Michael Mideke

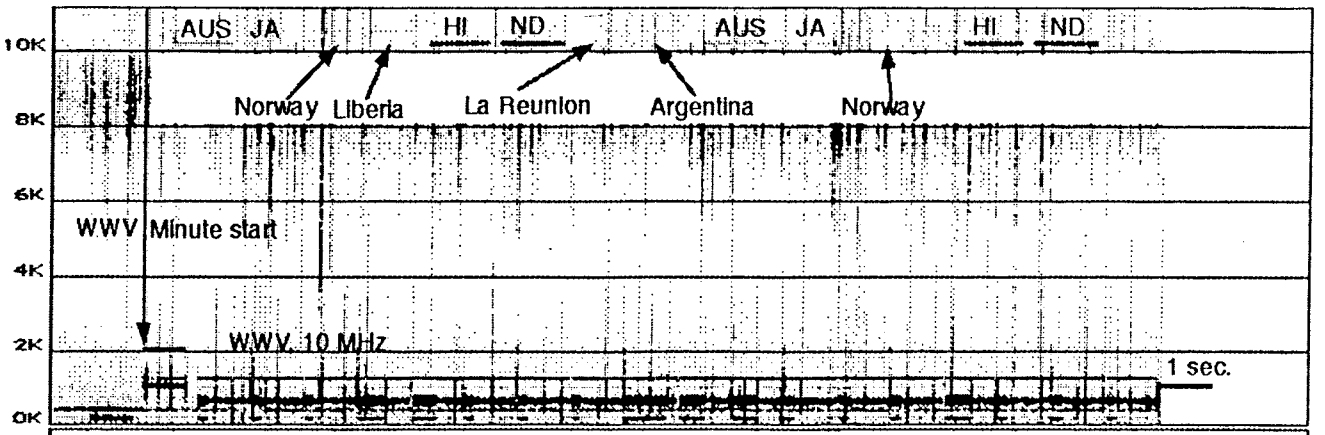
The OMEGA VLF radionavigation system gives us (for free!) a continuous series of atomic clock accurate time markers on 10.2 kHz. This global clock was set in motion at 0000 UT on January 1, 1972 with the phase of each transmitter passing through zero, moving in the positive direction. At that instant, Station A (Norway) commenced a 0.9 second dash on 10.2 kHz. It was followed by Liberia and the other stations shown below. The full sequence of 8 stations, with 0.2 seconds between their transmissions, occupies just 10 seconds, or exactly 6 cycles to the minute.

Each station has three cesium frequency standards to keep it "on time", and the network has been running on time for over 21 years, far more stable than the planet on which it is mounted. As a result, OMEGA time is way out of synch with UTC time, which is corrected by the introduction of leap seconds (usually on Jan. 1 and June 21) to compensate for variations in the earth's rotation. OMEGA is not corrected since every correction would cause users to loose synchronization.

The table below shows the current relationship between UTC and the OMEGA cycle on 10.2 kHz with sufficient accuracy for our purposes. If you can time your subject to within 10 seconds and if you can find an identifiable OMEGA dash, you can readily determine the UT time of events on your spectrograms. If you are in doubt as to which OMEGA stations you are seeing, it can be figured out by measuring the length of the dash and/or the time between the start of a UT minute and the appearance of the first dash. Note that the relationship between stations and dash length as given here only applies to the 10.2 kHz channel. This table is unlikely to apply to past or future data, but its principle can be easily applied to generating new tables as UT wanders. Leap seconds are announced well in advance on WWV.

STN	SEC	LOCATION	TIME (SECONDS) AFTER UT MINUTE					
A	0.9	Norway	3	13	23.0	33.0	43.0	54.0
B	1.0	Liberia	4.1	14.1	24.1	34.1	44.1	54.1
C	1.1	Hawaii	5.3	15.3	25.3	35.3	45.3	55.3
D	1.2	North Dakota	6.6	16.6	26.6	36.6	46.6	56.6
E	1.1	La Reunion	8.4	18.4	28.4	38.4	48.4	58.4
F	0.9	Argentina	9.3	19.3	29.3	39.3	49.3	59.3
G	1.2	Australia	10.4	20.4	30.4	40.4	50.4	00.4
H	1.0	Japan	11.8	21.8	31.8	41.8	51.8	01.8

10.2 kHz Omega referenced to UT minutes for Spring 1993. Note that there is a space of 0.2 seconds between each Omega dash.



WWV and OMEGA - Relationship of UTC to 10.2 kHz OMEGA. 3/93

One individual, who had been fishing from his boat in the area, had even managed to take a photograph of the sighting, which was shown in the segment. This was not the first time I had heard about this particular ghost sighting, as I had read about it in two separate publications, one being a state newspaper article, and the other being a book on ghosts owned by a friend of mine.

The segment that most intrigued me, however, had to do with some mysterious balls of light appearing in the night skies near the community of Marfa, Texas. These balls of light apparently appear randomly, with no set pattern or schedule, and might be seen several nights in a row or not for weeks or more at a time. They apparently seem to glow and change colors, and move about in the sky in random patterns.

The program more or less stated that UFO's were NOT suspected in this particular case but that instead, they are thought to be some sort of natural phenomenon, caused by conditions within the Earth's atmosphere, below the ground, or a combination of both.

It was mentioned that there are some who believe these balls of light are nothing more than the reflection of headlights from cars passing by on a highway in the area, but that did not make sense even to me, since there would have to be something in the sky for the headlights to reflect off of. If there were cloud cover present each time, perhaps that could explain it, but not in every instance, such as on a clear night. In addition, from the information given in the segment, it sounds as though the lights are much higher in the sky than what could be expected for the angle of light coming from the headlights of vehicles at ground level. Also, it does not explain the random, sometimes erratic movement of the lights.

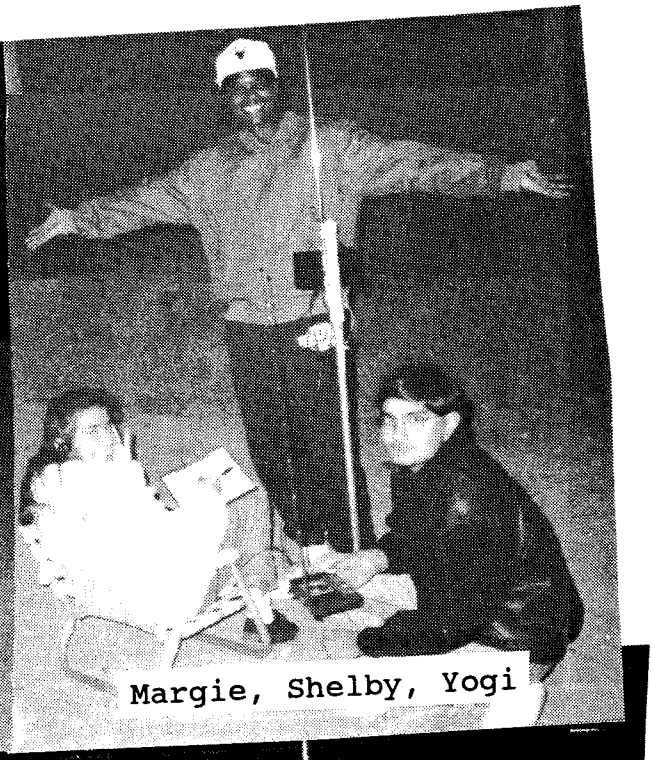
Some videotaped footage was shown, and showed two balls of light that slowly moved towards each other in a horizontal plane, merged, separated again and moved away from each other, then both reversed direction, moving towards each other, merged again and again separated and moved away from each other. The segment went on to tell about an international team of scientists who came to Marfa to investigate the phenomenon, and then several locals who have seen these balls of light were interviewed on the show.

It was at this point in the segment that I became particularly interested. They started interviewing a man who lived in the Marfa area and who had been putting a lot of his time into studying this phenomenon.

INSPIRE Photo Album

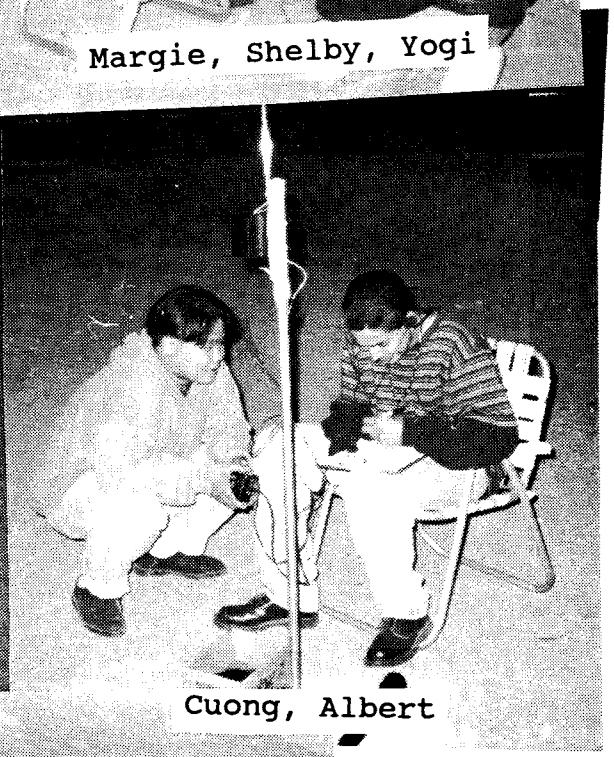
Chaffey students participate in natural radio observations.

Julio, Marco, Anwar, Ramon

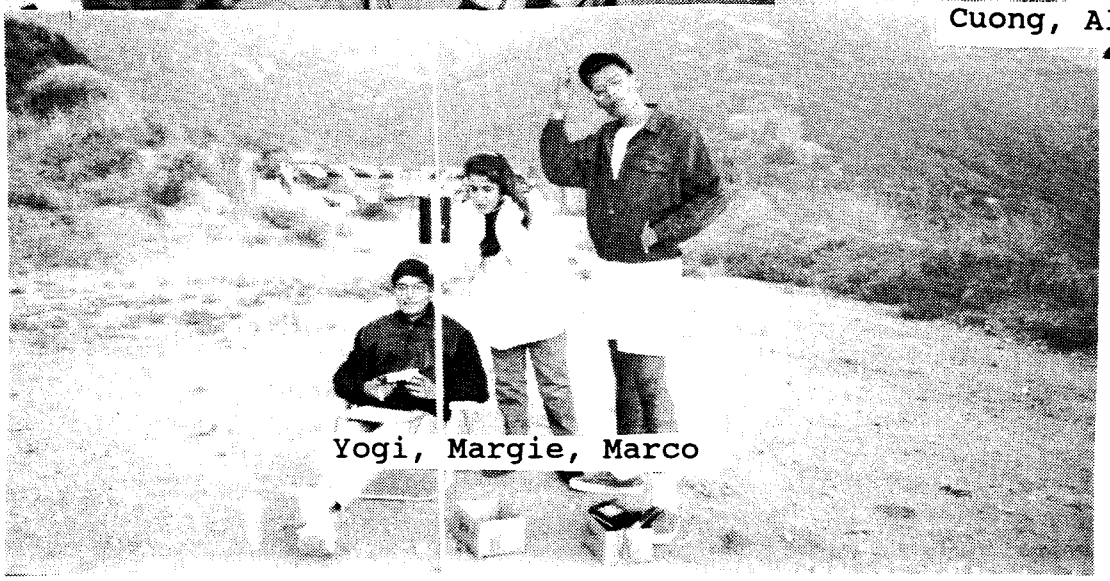


Margie, Shelby, Yogi

Linda, Xuan, Sonia



Cuong, Albert



Yogi, Margie, Marco

The following are descriptions of Chaffey field trips last fall. In addition to natural radio signals, we also observe and log descriptions of OMEGA and WWV signals since the propagation of these signals is also interesting. The three Chaffey receivers are:

- #1 B-field receiver from the ACTIVE Project of 1989-90, using a 1-meter square loop antenna with 80 turns, center ground.
- #2 RS-4 INSPIRE receiver using a 6 foot telescoping whip antenna. This receiver is a prototype from the design phase of the RS-4 development and is nearly indentical to the RS-4 kit.
- #3 RS-4 INSPIRE receiver using a 6 foot telescoping whip antenna. This receiver was assembled by Chaffey students.

Our site is located in the nearby mountains about a half hour drive from school. The site is on an open ridge top at an elevation of almost 6000 feet. The nearest power lines are about 8 kilometers away down in the valley. The southern edge of the ridgetop acts as a screen for even that 60 Hz signal. It is a very quiet site.

Sunset Run 10\14\92

Personnel:

#1 Ramon Contreras
Julio Villafuerte
Anwar Sinaga

#2 Shelby Wynne
Margie Sotelo

#3 Marco Pasillas
Yogi Mistry

Weather: Clear, calm thin fog developing in the valley

WWV: Audible on 5, 10, 15 MHz, clearest on 15

OMEGA: Intermittent and faint

Natural Radio:
Dense static, tweeks, intense bursts of static.

Ramon, Julio, Shelby, Marco, Margie, Yogi, Anwar

Dawn Patrol 10/18/92

Personnel:

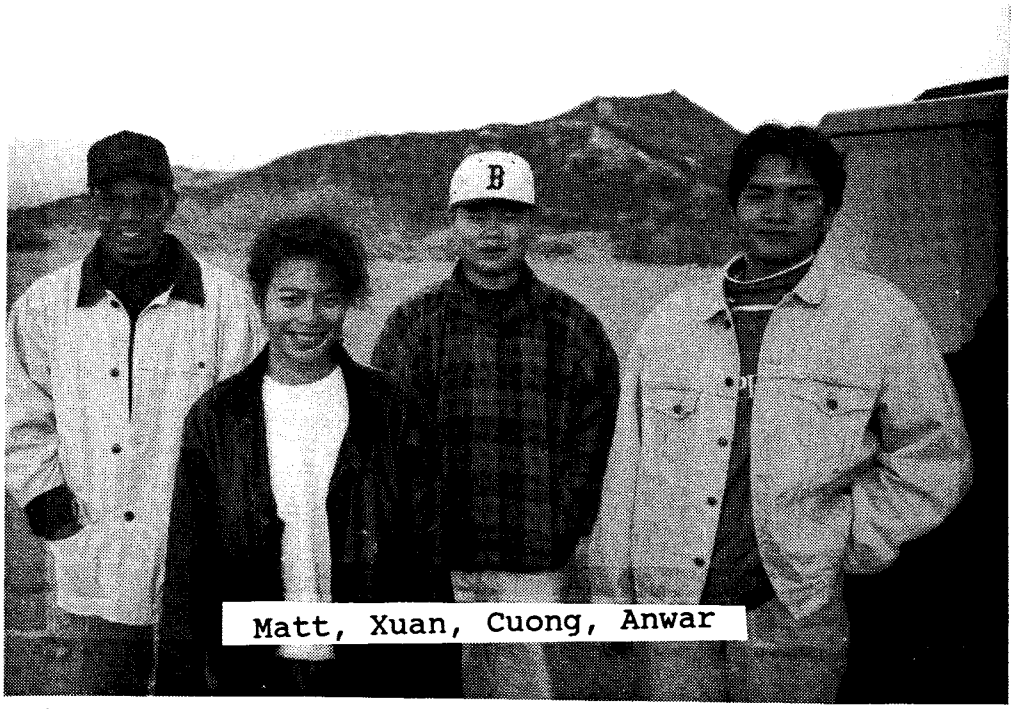
#1 Bill Pine
#2 Xuan Quach
Anwar Sinaga
#3 Matt-Edwin Gapuzan
Cuong Duong

Weather: Clear, calm, mid-50s, fog formed in the valley after 6 AM.

WWV: Clear on 5 MHz, nothing on 10, 15 MHz

OMEGA: Audible on all receivers.

Natural Radio:
Low density static; tweeking falling off to zero; some possible faint whistlers

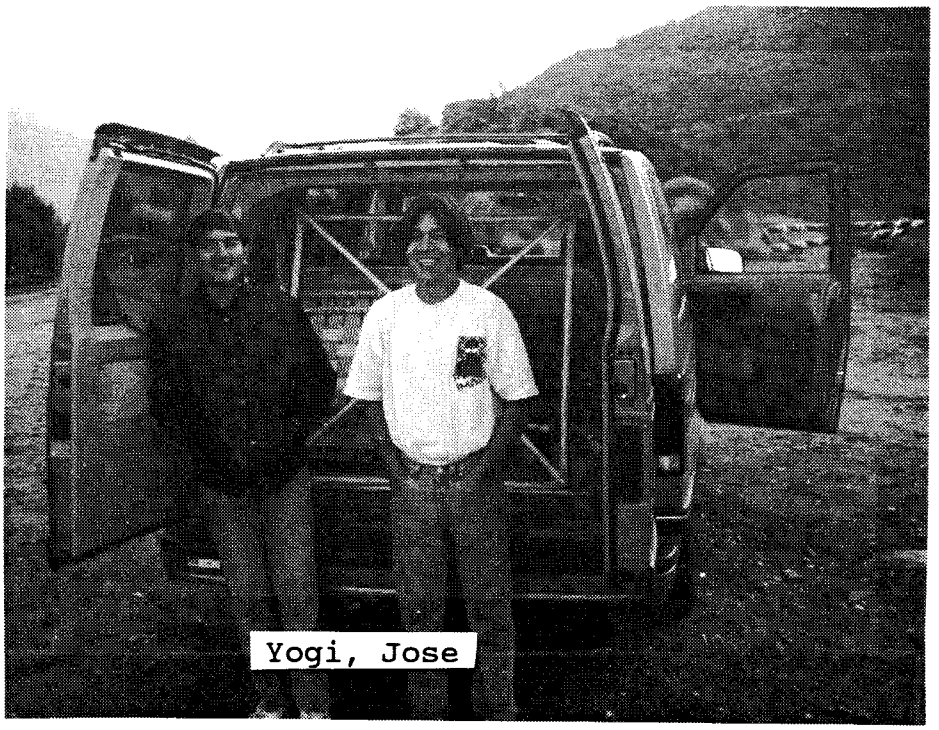


Dawn Patrol 10/25/92

Personnel:
#1 Yogi Mistry
#2 Jose Rodriguez
#3 Bill Pine
Weather: Clear, cool

WWV: 5 MHz only until sunrise, then clear on all frequencies
OMEGA: Audible on all receivers

Natural Radio:
Low density static with some static bursts, intermittent tweeking until dawn then static only.


Yogi, Jose

This last trip was on the last Sunday in October, the day of the time change. Even after going over the time change carefully with the students, only two of the six who signed up were on time. I had told them that they could either (a) change their clocks and we would meet at 4:45 AM, or (b) they could leave their clocks on PDT and we would meet at 5:45 AM. I emphasized that the changing of the clock would have no effect on the sun and that it would rise on its own schedule no matter what our clocks said. Yogi and Jose showed up on time, but the other four were no-shows. Since we could not wait, we left on time. When we returned at 8 AM, the others were waiting for us. They had arrived, of course, one hour late. They knew they had goofed since it was so light at that time! They decided to wait for us to show their good intentions. This is an annual foul-up and I don't know whether to not go on the last Sunday in October or keep trying until I (and the students) get it right.

In any event, our fall observations were a great success. We are planning a similar schedule for this spring in May and everyone is looking forward to more trips in the "whistler-mobile"!

The afternoon of Thursday, March 18th, I loaded up the VLF receiver, recorder and related equipment and headed north. I didn't have too much trouble finding the site I was looking for, except for one wrong turn that put me on a logging road that had about a foot of snow on it with a single set of tire tracks for me to follow. The road twisted and turned and went uphill and downhill and I was going along at about 15 miles an hour. After about a mile or two, I came to an intersection that provided me with the opportunity to correct my mistake! My map was apparently not as accurate as I had thought it was.

Eventually I did arrive at the site I was looking for and I got the equipment set up and made a sample recording. I was very pleased with the results. With the HP filter in the "Out" position there was only a very low level of AC hum present, and with the filter in the "In" position, that was reduced to almost nothing. The only type of interference that could be readily observed were the tones from the Omega navigational system. I also switched to a different antenna, from the 6-ft. telescoping whip antenna used during the Spring, 1992 recordings to a 117-foot longwire antenna.

The high temperatures that day were in the mid 20's and there was still snow on Lake 19 Road. I saw a LOT of tracks, most of which appeared to be deer, but the only wildlife I encountered that day were a lone squirrel, and a woodpecker who greeted me when I first arrived at the site. The Chequamegon is home to many different creatures, among them the black bear and the fox. Only one vehicle passed me while I was on location. An older couple driving a pickup truck slowed down as they approached me, waved, and drove slowly past. They probably were wondering what I was up to with all that equipment and wire strung out!

On the way home I stopped at the U.S. Forest Service ranger station in Medford. There, I picked up a map that was a little more accurate than the one I had been using. It also allowed me to verify that the land we would be on was indeed public land, and not private, as there are some pockets of privately-owned land in the area we would be in.

I also spoke with the personnel at the ranger station and explained to them what our project was all about, what it would involve, and our need to find a location away from any power lines. I gave them the exact location we would be at, and the dates and times that we proposed being there. They gave their approval, and asked only that we not leave our ground rods or antenna up in between recording sessions. They were concerned that wildlife or other people might injure themselves on the equipment if it was left up. I was all too happy to comply with them, as I was concerned, too, about possible vandalism if I left things up all week in between the weekend recording sessions.

We then talked about NASA's SETI(Search for Extra-Terrestrial Intelligence) project, and how they are using giant radio telescopes to both listen for and send radio messages into outer space. We also discussed NASA's SAREX(Shuttle Amateur Radio Experiment) project, and I passed around some QSL cards I received, one from having received Amateur Radio transmissions from the space shuttle Columbia in 1983, and the other from a two-way Amateur Radio contact with the Russian space station MIR.

Day 3: We practiced setting up and operating the VLF monitoring and recording equipment, including recording the voice announcements and WWV time marker and filling out of a preliminary monitoring log sheet. Students were able to hear the affects of 60 Hz AC hum from the VLF receiver. We also discussed the site from which we would be doing our recording and monitoring and made preliminary plans for going out on the weekends.

Days 4 and 5: The students in each class had the opportunity to assemble an electronics project kit which I had purchased. The Physics class put together a 28-tune pre-programmed musical door chime. The 7th hour, 7th grade science class put together a "jungle bird" kit that would make sounds like a parrot or other tropical bird. The 8th hour, 7th grade science class put together a "shimmering light" kit which, when connected to 120 VAC and with a lamp plugged into it, would cause the lamp to "shimmer". The rate(speed) of the shimmering could be adjusted with a variable control.

The students had an opportunity to learn about proper soldering techniques; safety using a soldering iron and electricity; how printed circuit boards are made; and what various types of electronics components, such as resistors, capacitors, diodes and transistors, are used for in an electronic circuit. After the kits were assembled, tested and operating OK, a drawing was held to see which student in each class would get to keep the completed kit.

The teachers offered incentives to the students who actually participated in the monitoring and recording sessions. If they participated they would receive extra credit bonus points. In addition, I promised a free breakfast to anyone that went out.

Our school's participation in recording/monitoring sessions thus far this Spring is as follows:

Sunday, March 21: Mr. Harrison, myself and 3 Physics students(Lori Stuttgen, Jon Resech and Ryan Karsten) loaded up a school van and headed for our site in the Chequamegon for a 6 AM CST recording. Temperatures around that time were in the +20's F. Unfortunately, we were plagued by problems that morning. To start out, the wire connecting our VLF receiver to our ground rods broke off and we were several

As it turned out, the further north we got, the lighter the fog got, and it eventually started getting light out, which improved our travel time. We made it to the site in time for a 6 AM recording. We also drove further north from the spot we had used the day before, and were able to reduce our level of 60 Hz AC hum to almost nothing with the use of the HP filter. We wrapped up the morning's activities with breakfast at Hardee's in Medford.

Saturday, April 3: Mr. Elmhorst, myself, and six 7th grade science students took the school van to our Chequemegon site for a 7 AM recording. Weather and driving conditions were excellent, and we were able to get another good, relatively hum-free recording made. The only noticeable problem with this tape was a swishing noise on the tape that seemed to coincide with movements of the students on the snow-covered roadway. We also seemed to be picking up our own voices, although somewhat distorted. There was a lot of shouting and talking going on during the recording.

We wrapped up that morning's activities with breakfast at McDonald's in Medford. Students participating included Brian Bruesewitz, Josh Luetschwager, Brian Nelson, Eric Beran, Emily Sipiorski, and Alison Kulas.

I did some preliminary "audio" analysis of each of the tape recordings from our previous sessions and found the one from April 3 to contain several whistlers. Some of the other recordings didn't appear to be useable, and the other may or may not have useable data on it, but I will likely be listening to them again to see if I can pick anything out.

So far, I have had students ask me to go out again on Saturday, April 10 and Saturday, April 17, and we will likely make those our last two sessions for this Spring's coordinated monitoring project.