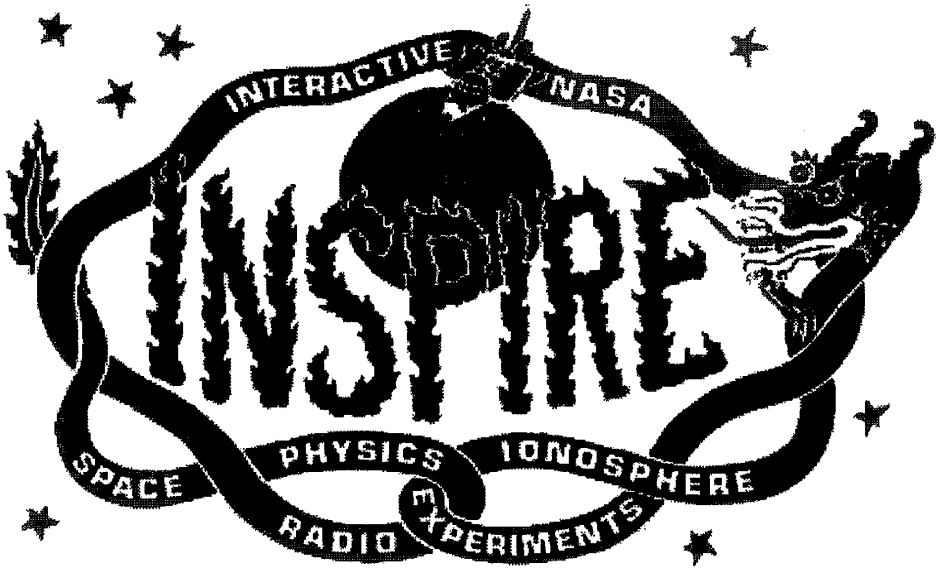


# The INSPIRE Journal

Volume 6 Number 2

April 1998

## INSPIRE Survey Results in Changes!

The INSPIRE survey yielded a wealth of suggestions for improvement of INSPIRE. Careful evaluation of all suggestions will take some time and will be reported on in the next issue of the *Journal*. Some suggestions will be implemented immediately. These include:

1. A method of communication from INSPIRE organizers to participants and among participants will be established. An email network will be established to allow timely distribution of schedule changes and routine communications among everyone. For those without email access, a surface mail option will be available. See the Note on Page 3 for details.
2. The INSPIRE Web page will be updated and kept current. It is possible that the *Journal* will be available electroically in the future. Check the INSPIRE URL for progress:
   http://www.gsfc.nasa.gov/education/inspire/inspire_home.html
3. Coordinated observations of morning and evening VLF conditions will be added to the regularly scheduled INTMINS observations. This will provide an opportunity to observe on a schedule that is not tied to MIR's orbit. See the April/98 Operation Schedule (included with this issue) for details.
4. Receiver repair will now be available for a nominal charge. See the Note on Page 3 for details.

It is hoped that the INSPIRE survey has started a dialogue that will lead to improvements in INSPIRE and greater value and satisfaction for participants. Please feel free to communicate your thoughts and opinions as your input is valued and vital to the success of INSPIRE.

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The INSPIRE Journal
Volume 6 Number 2
April 98

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

Contributions to the *Journal* may be sent to:

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Fax: 909 931 0392

## INSPIRE Goes to the NSTA Convention!

The *Journal* editor (Bill Pine) will be attending the NSTA National Convention in Las Vegas, Nevada, from April 15 to 19. A presentation will be given entitled "Student Participation in the Field Study of Natural Radio". The preliminary schedule indicates that the presentation will be on Friday, April 17, from 9:30-10:30 AM at the Sands Expo Center, Room 107. If you can come to the presentation, it would be great to meet you. There should be local email available at the convention to make it easy to establish contact. Let's get together!

## Email Communication Among Participants to be Established

The problems with the schedule changes for the November operations made it very clear that we need a better and quicker way to communicate than surface mail (snailmail). In addition to that, many survey respondents indicated a desire to communicate and interact with other INSPIRE participants on a routine basis. To meet this need an email list will be established for use in the future. Emergency and routine communications will use this list. To get on the list, just email to:

pine@ndadsb.gsfc.nasa.gov

A test message will be sent to verify the effectiveness and accuracy of the system and it will be used whenever necessary in the future.

## Receiver Repair Now Available

Repair of RS4 and VLF2 receivers will now be offered through INSPIRE. To make use of this opportunity, please send $5 for postage and your receiver to:

Bill Pine
1348 N. Quince Avenue
Upland, CA 91786

My home address is being used for speed and convenience. You are welcome to insure your package (I would not bother doing so), but do NOT send it by a method that requires a signature. There is no one home at that address during typical work hours and the I do not want to go to the post office to retrieve any parcels. Include as complete a description of the problem and any attempted repairs as you can. I will check out the unit and pass it along to a volunteer for repair. Allow at least 8 weeks for repair and return. Thanks in advance for your patience and care in following this procedure.

## Write for the *Journal*

There were many suggestions in the survey for topics to be covered in the *Journal* . In its 6-year history, the *Journal* has published every manuscript submitted. The philosophy here is that if a topic is of enough interest to someone that they will write an article, then it will be of interest to a significant and important part of the readers. There is no guarantee that all submissions will be printed since articles that are way outside the general subject areas of natural radio, magnetospheric physics, ionospheric physics, VLF radio equipment and related computer hardware and software would be best published elsewhere. That being said, submissions are welcome. The publishing dates for the *Journal* are April 1 and November 1 with submission deadlines one month ahead of those dates. If a submission is received too late for inclusion in an issue, it will be part of the next issue. Three articles in this issue were originally submitted as email messages or letters. The format for submissions can be on disk or as email attachments or as hard copy. Mac and PC formats are both acceptable.

# INTMINS-April/98 Operations Schedule

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

The April/98 INTMINS Operations schedule has been determined. Operations will occur on the last two weekends: April 18-19 and April 25-26. Data gathered will be analyzed and reported on in the November 1998 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 73 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 74 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.

## Notes on Time Marks and Logging;

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

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

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

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

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

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

## INTMINS Schedule

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

# A Summer Lived on the Net

By Flavio Gori
Florence, ITALY
INSPIRE European Coordinator

Last summer, especially during our hot August, I was at home lonely since my wife and little daughter Marina were in the country, breathing fresh and clear air for the little girl's health benefit. I was a happy daddy and, at the same time, had many hours to develop some hobbies of mine, usually hard to remember (not just to do). One of them is the study of radio waves, especially the VLF and down. In March 97 I was lucky enough to purchase a brand new Apple PowerBook 3400/180. A portable able to perform fast results on the Net, too, even though some heavy graphics attempt to slow dramatically everybody who even thinks to go in.

After some months in search of VLF sites, as well as many others NASA- and Apple-related, in those summer days I decided to determine which kind of freeware and shareware technical software for Macintosh is actually available, especially in our field of research. First of all I have to say that this kind of software was not common. Many music software programs are present but a real Natural Radio software was not seen up to the last days of January 98, when I wrote this article. Anyway, I have the pleasure to say that I found many kind of technical software, usually really good for Spectrum Analyzer, Digital Oscilloscope, Sonogram makers and Sound monitor. In some cases I wrote to the author and sometimes I had an exchange of letters with them when I needed some more information. Unfortunately some of the authors didn't have time to answer back to me...

I will talk especially about freeware and shareware and just for Mac OS. I'd like to underline that in all the places I'll indicate, you will find so many useful links to find out many more interesting sites, where you can try software that can offer important steps to better use the audio kingdom. All of those products can give something more to our experience and merit to be played. People who produce those items have done a wonderful job and we should give them our gratitude. They offer us good work, let us better understand sound, also graphically, and finally realize that Mac can perform very well the Technical side.

The first one I'd like to report is SoundMaker by an Italian developer, Alberto Ricci (www.riccisoft.com). Alberto has produced a software that is not so different from SoundEdit by MacroMedia, that you well know, being a sort of standard for the INSPIRE sonograms from the recorded tapes. SoundMaker has some more features than SoundEdit, though its limit is located in the site where it records the sound: RAM. So as you can understand, the space available is not so much.

A good Digital Oscilloscope you can download from http://karmac8.ethz.ch/oscilloscope/oscilloscope.htm. It is made by Hansreudi Baer, who is actually experienced the Be operating system.

As a Spectrum Analyzer I encourage you to try a Daffy Software product (I am actually unable to find their web site, if someone can supply it ,please let us know). You can download it at: http://hyperarchive.lcs.mit.edu/HyperArchive/Archive/sci/. This one is a very important Internet address for anyone interested in technical software for the Macintosh operating system. Check it often!

The oldest INSPIRE members will remember a very interesting product, able to track the Space Shuttle along its path. Daniel Adamo's software name is MacSpoc (SPOC = Spacecraft Personal Orbit Computations), a satellite tracking software for Mac OS computers. This program was part of the SEPAC experiment in the spring 1992. You can have a demo and much more information at: http://www.MacMissionControl.com/~MMC/. Try it, it is a very good way to watch the Space Shuttle or any other satellite path off line and Adamo is able to supply updates for the Two Line Elements in order to track the satellite path at its best. In addition to standard geolocation features using world map graphic displays, MacSPOC has some unique functions. If you specify satellite orientation and define an orbiting instrument's boresight to MacSPOC, the instrument's hemispherical field-of-view will be projected onto the world map along with the satellite's horizon. Detailed viewing opportunity predictions are integrated into MacSPOC's digital displays. You can also model complex orbit adjustment maneuvers with MacSPOC.

If you go to http://www.physics.swri.edu/SoundView/SoundView.html, you will experience a very useful way to understand the sound in the freeware domain. There you can discover how a sound can appear as for spectrogram, waterfall, Spectrum Analyzer and the like. Very useful indeed.

Also useful is a software shareware by Tom Erbe called SoundHack. You can ask about it at tre@shoko.calarts.edu, asking for Tom. His software gives again many useful items for people interested in the audio domain.

Also an interesting commercial software product has come to my attention: MacTheScope by ChannelD (www.channld.com/software). It allows using the Mac as a group of technical instruments such as Scope, Spectrum Analyzer, Phase measurement, with 4 averaging methods and log scale. You also can determine a threshold when the signal has to be recorded. All the capability you can see at www.channld.com/software. I see in this product a very good one and I also have to say that I have purchased it. It comes just in just one floppy (finally a software that doesn't need all your hard disk!), with a one meter RCA cable, to be connected to 2 sources and displayed in the Scope. Its capabilities are really high, though I would like a small group of choices that it does not allow. The smaller and probably easy features to put in are related to a clock time as *hh:mm:ss* in the display, to better understand when I have recorded that signal, for future research and comparison. Moreover it should be useful have a system measurement in the XY scale, just outside the display, both for Scope and Spectrum Analyzer. As happens in other technical software, in MacTheScope it should be very useful have a short page to put just down the display, to note any remarks that could be needed for the researcher, in further analysis. I have told this to Channel D and hope to be heard.

Now I'll try to explain the other, the most complex. In the last months I became interested (also) to the natural electric noise. Maybe because I experienced so much of it in these noisy town. Anyway what I am thinking about is a software instrument as a digital scope (just to save hard disk space than a different tool like a Spectrum Analyzer, who likely will let me realize in a better way what is going on, though it burns more bytes) that will let me monitor 24 hours a day but record only when the threshold amplitude noise is passed for "n" time. In this situation the record did start from the very first moment the noise began. If we have a record session, the scope will monitor the condition one time every (for example) hour. If the noise amplitude is still on, the scope will record the situation, writing the hour and minute of the measurement. When it finds a change and the amplitude came back below the threshold, it will write the changing situation, its hour and minute, stopping recording. Of course the same have to do when the amplitude is lower than expected. Since ChannlD corporation says they are not able to produce such an update at this time, I am studying this tool with a good friend of mine, very able to produce radio related hardware, as well as software.

Since he works in the Dos/Windows world, the software will be in these systems. It is in the very first steps, so I'll keep you posted about how it goes on, in the next of mine. Maybe it could be useful for many radio amateurs who believe that by electric noise, they might detect some more electric related phenomena.

In the end of this work I'll talk about one more project, about what I think another software could be for our Natural Radio needs and also I'll talk about a packet software which would meet our needs as radio amateurs operators, Short/Long Wave Listeners and so on, beyond the one said before.

A Digital Oscilloscope and a Spectrum Analyzer (SA), well done and able to monitor the radio frequencies below 500 kHz until 0.1 Hz, should be very useful also to control some kind of electrical work in progress for many hams. The SA should allow saving in automatic just when a signal arrive, or when signal goes over a given threshold, saving memory on the hard disk and work to the observer. Again, the SA should allow to use all the base of the computer display as the software allow us to monitor a large amount of frequency. It will be wonderful monitor a wide frequency range, say 30-50 MHz!

The sonogram capability as the Macromedia SoundEdit or Ricci's SoundMaker would be a must, though a software for us should allow the logarithmic scale, too, and be very well done. Moreover we need to write about 7-10 bars in every sonogram page, for future memory. One more must should be the real time sonogram making, to let us see the sound as it enter in the Mac. In this way we see the signal in the time we can hear it and we are living that time. Wonderful. One more plus: in every sonogram page it is important to have a time scale(as hh:mm:ss, in GMT or in any other time we like set, as the time of our Mac/PC) to better resolve the time of the various signals we see on the sonogram, also to correlate them with other recording from other sides of the world.

The VLF radio range has to fight with the strong 50 (or 60) Hz noise. A hard problem to solve, especially for those who live in the so-called modern town, worldwide. In the last years some people have come to think how get better with this trouble, though is not easy. One way to try, would be to design a solution in two kinds: one hardware, designing an interface notch filter, or maybe two, able to catch the noise and its harmonics, filtering all the way, reducing this strong noise by about 70-80%. The other part of the noise should be cut off by a similar filtering by software, to be enclosed in our packet. In these days we have news of 2 hams are working hard on this difficult problem: Mike Dormann in Seattle, WA and Fabio Courmoz in Aosta, Italia. If someone else is working on it, please let us know. Mike has already made his product. We'd like to use it and report on the INSPIRE Journal.

Another kind of need is related to recording for many hours, the only way to get around high quantity of data. Only a large mass of data would allow us to detect the ones we need to extrapolate anything useful. This will be possible only when we could establish a station receiving at home, and this will be when a noise canceler will work well.

On the other hand many of us would want to record other kinds of signals, manmade or natural, in radio frequencies a little bit higher than VLF, say no more than 100 kHz. Say that in this kind we don't need to record and display in real time all the incoming signals. Say that we might record 24 hours a day but display just a signal/noise ratio average every "n" minutes, in order to create a display for the 24 hours, every day. After 30 days the computer and the software will calculate an average to create the one month situation made by the 30 days averaging. After 12 months we will have the average created for one year. As time passes we could build an important database for what we study, say the radio propagation for ALPHA signal, around 13 kHz. An important and simple plus would be the video capability to split in two parts (up and down) the

recorded files, to let me compare two same date recording of the same frequency, in different years.

One measurement I dream about is differential phase related. Sometime I read about software which assures that they can do it, but when I go deeper or simply ask for it to the producer, I realize isn't so. Effectively is not a minor problem, to evaluate it in the right manner, and also pretend adequate hardware solution. Moreover it would need a standard signal to compare the one (or two) we are monitoring, and this standard needs to be very precise. Likely the same comparing standard should be important in the before described software, too. I' d like that at least two of these software packet instruments should work in the same time, getting a real time comparing with a cross connection, an important way to compare a research.

One fine utility would allow the Mac to start up the recording session at the time we'll choose, and stop after "n" time. Probably it will be important to not shut down the Mac: many switches on and off could do a negative work on the inside parts. In this way a utility like the "Comatose" by Focus Software, would help. I believe that such a software is just a reality: QuicKeys from CE Software. You can reach them at http://www.cesoft.com. You can purchase and get the software directly from that Internet address. I have to say that their post-sales service is not so quick as I'd want. One question: one answer. Second question: no answer. Not so good. A shareware product that helps us to use our machines in a better way is Comatose, an application which will help us prolong the life of our computer and save on the electricity bill while doing so. It allows the users to put their computer to sleep rather than shut down the entire system. It works with all Macintoshes running system 7 or later and only 125K of memory. Comatose would spin down all hard drives (SCSI buses and IDE) and dim the screen to black. The blacking of the screen allows some monitors to also power down internally, thus adding to the savings in electricity. Comatose also has screen saver capability. You can specify how many minutes before the screen is dimmed and how many idle minutes before drives are spun down. Our computer will be able to wake up with an incoming phone call, receive a fax and go back to sleep. Comatose is an ordinary application working transparently in the background. It is not an extension or control panel. It does NOT patch system resources, will not modify your system file. It will NOT slow our system down and will not cause incompatibility with other extensions and system resources. Additionally, you can set Comatose up to run automatically at start up and you can quit it any time you wish to release memory if you are strapped for memory. You cannot quit a control panel or an extension! You can only disable such programs and restart your computer to claim the memory and CPU time they use. There are also mechanical components in our computer which can benefit from this packet. The hard drive in our computer has many surfaces which are in continuous contact with each other. The platters which store your data are spinning at speed of up to 7200 Revolutions Per Minute (RPM), the read/write head is moving on the top and bottom of each platter very close to their surface, and the servo mechanism that positions the heads is also continually moving and positioning the head. All of the corresponding bearings and fittings are used every second the hard drive is working whether or not you are using your computer. These words from Latifi Afshin in Santa Clara, CA, the creator of Comatose, very well introduce the job his software produces. You can reach him at www.focusworks.com. Latifi produces some more interesting programs that you would be glad to meet.

I remember another Santa Clara resident, one good friend of mine and well mastered researcher in the seismic ULF radio waves: Mr. Vince Migliore. Does anyone have any news about him?

This is a rough way to present the packet software, but it is the first time, too. Bill Pine, Bill Taylor and all of you can update this of mine writing and add what you believe could be useful for us and our research. Moreover and very much important, if some INSPIRE Journal readers would be able to produce a software packet (or a part of it) as I before outlined, please feel free to collaborate!

Many features I have described before appear to be not so difficult to add in any software, as Alberto Ricci told me last time we talked. I wonder how it will be possible (and then, what will be the cost) to get together all those items, to produce such a software. Also it will be important to understand if more than one tool could work together with another one, and eventually how many could do it.

Maybe it will be necessary get one external card, to help the Mac monitor faster frequencies. Then it will be useful know who is the producer, the cost, what the cards could do at all, if would be requested write any bars of software related to the job that have to be done, where to buy, especially on the net or in any other site allowing lower prices, especially purchasing through the INSPIRE Educational Project. And please do not forget to let us know if the products work for sure both on desktop Mac and PowerBook, 68xxx and PowerMac.

I hope that this future global hardware and software survey might be extremely useful for the INSPIRE member Mac user and would then give us the hand to begin the same survey for the PC world.

The INSPIRE Journal would do an invaluable service, and not only for our members.

# RS4 Receiver Used in Sprite Research

By Thomas Nelson
Associate Scientist, FMA Research, Inc.

(Note: The following is from a letter to INSPIRE from Tom Nelson as a response to the survey. Tom is webmaster of the FMA Research page: http://www.fma-research.com/ )

I have not been an "active" participant in the INSPIRE projects but, rather, I have used the receivers for research into upper atmosphere electrodynamics - sprites and elves. I was first exposed to the receiver in 1994 when a friend at the Air force Academy loaned his receiver. During our operations, the audio signal was both recorded on one track of our video machines and run through a speaker so we could listen to the signal while also watching the monitors from our intensified cameras looking above thunderstorms. This gave us our first clue that something was different regarding the lightning discharges that seemed to be associated with sprites (elves were not discovered until 1996). I sampled data from the receiver from both close-in lightning discharges (<5 km) and those associated with sprites. My ears also said that there was something different and, by the end of the summer campaign, we could almost tell when a sprite was going to occur. The sound was so distinctive that we continue to use a speaker today to analyze the videotapes.

One project that was particularly exciting was looking at the joint time-frequency domain of the signals from close cloud-to-ground lightning strokes and distant sprite-producing strokes. The differences, even with the response of the INSPIRE unit, was amazing. Common lightning had a 10 kHz cutoff and a sharp rolloff below 1 kHz. A sprite-producing stroke, even though it was some 400 kilometers distant, had considerable energy above 10 kHz and significant energy below 1 kHz (near 200 Hz or so). That sort of response was not expected, but was later verified with data from receivers at Penn State and MIT.

In 1996, I modified the amplifier of the receiver to drive a low-impedance line. This enabled the receiver to be placed away from the computers and monitors so a cleaner signal could be recorded. This made a significant difference in our data collection because the signal now did not have to go through the distribution amplifier and could be sampled directly by the data acquisition card.

This summer the receiver will continue to be used as a monitoring device. We will be adding real-time frequency spectrum software to show us the low-frequency components of the sprites (<200 Hz) and the high frequency components of the elves. There may be other critters up there that we have heard but not seen yet. In addition to the INSPIRE receiver, we have a broadband VLF system from Stanford University and an ELF/VLF system from MIT. However, the consistent favorite and reliability winner is the INSPIRE receiver.

So, I don't fit your science teacher/educator profile that the survey appears to be geared toward. However, the receiver I own and the one my company owns have performed yeoman service since 1994. I expect they will continue to be used for the project as we have found nothing that comes close.

# VLF Observations During the February 1998 Total Solar Eclipse

By Janet Lowry
Houston, TX

(Editor's Note: In the fall of 1997 INSPIRE was contacted by Janet to inquire about natural radio and the INSPIRE Project. She was planning to travel to Curacao to observe the total eclipse on February 26, 1998. Janet purchased an assembled receiver and did some practice sessions to learn how to set up and operate the equipment. After the eclipse she sent two hours of VLF data leading up and including the eclipse. What follows is her account of her trip accompanied by spectrograms made from her data. While the data is an excellent first effort, it was not without problems. The main problem seems to be the setting of levels on the receiver and recorder. For the first part of the data the settings were low, allowing the stronger sferics to be heard but obscuring any low level signal. In the middle of the session either the settings were changed or a contact was made somewhere in the equipment resulting in a much stronger data signal. Unfortunately, after turning the second tape to the last side the levels again subsided. Since Janet had made the (very sensible) decision to make eclipse watching a higher priority than VLF recording, she was unaware of the changes in level. Consistent with the INSPIRE conclusions for Eclipse/94, there is no detectable difference in the natural radio signal during the eclipse. Janet is to be commended for her effort and results.)

While I was packing for the eclipse trip, I gave up on my normal tendency to travel light. [No pun intended.] In addition to the camera and binoculars, I had assembled a substantial pile of odds and ends in order to do my VLF monitoring during the total solar eclipse of 2/26/98. Tripod, 12" galvanized spike [to serve as my moveable ground], wrench, screwdriver, telescoping whip antenna, electrical tape, tape recorder, audio tapes, headphones, spare batteries, etc. And, of course, the receiver. Even though I've read that at latitudes close to the equator there are fewer "interesting" VLF emissions, I didn't want to pass on the opportunity to find out for myself.

I traveled to Curacao [12 degrees north latitude] with about 70 people, shepherded by Paul Maley from the Johnson Space Center. This eclectic group included a couple of astronauts, some folks who work in various facets of the space sciences, many serious amateur astronomers, and a bunch of enthusiastic [if not particularly knowledgeable] fans like me. The authorities on the island of Curacao had set aside an "official" eclipse viewing site on the northwest corner of the island, but we spent the day before the eclipse touring around and checking out visibility and possible alternate sites. The island is 35 miles long and 7 miles at its widest point, and it is ringed with volcanic or coral beaches and crooked shorelines that offered wonderful possibilities.

Although first contact wasn't predicted until 12:40 PM, we arrived at the site early on eclipse morning, anxious to get settled and find out how the equipment would hold up in the ever-present wind. The observing site was a flat and wide expanse of beach, a combination of volcanic rock and sand. Although the wind was howling, the locals assured us that we should be pleased that it wasn't "too strong", and everyone was prepared with plastic coverings and other techniques to protect their equipment from the elements. Clouds were, of course, the other concern. Some people were worried when it drizzled early that morning, but before first contact the sky had cleared and any precipitation had long since evaporated. [In fact, when the tourist board tried to help keep the dust down by sending out trucks to spray water on the beach, dozens of dismayed observers threw themselves between the squirting trucks and their optical equipment, much preferring to battle the sand than the water.]

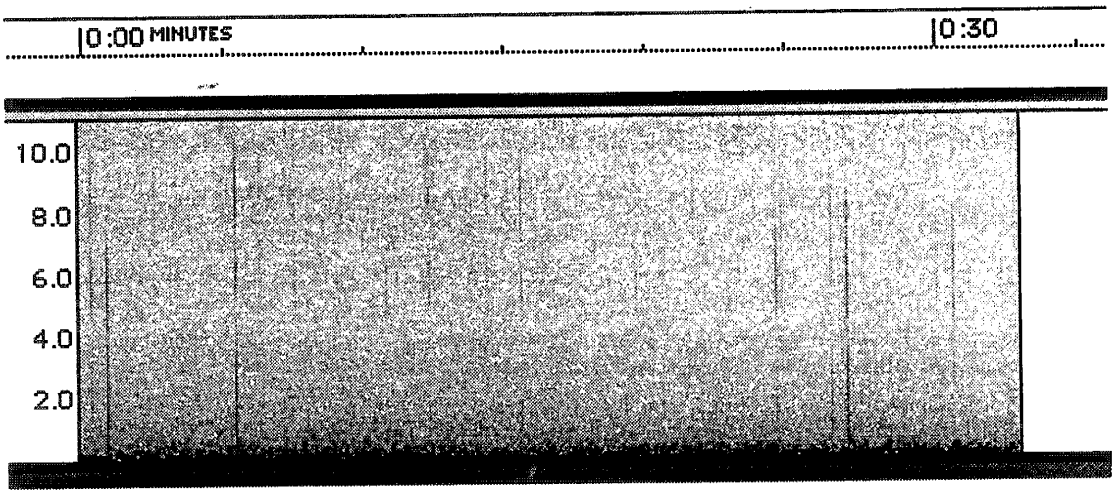
I set up my receiver and its components in the shelter of one of our rented vans, and it immediately attracted attention. People wandered over all day and asked me about this unusual looking thing in the midst of everyone's elaborate telescopes and cameras and I explained as best I could about INSPIRE and what I was doing. I've promised to report to all of them after I hear from you.

This was my first effort at monitoring and recording with the receiver, so I apologize in advance for the lack of precision. I was trying to indulge my interest in the VLF phenomenon without impinging on my first eclipse experience. Since I had 120 minutes of tape, I wanted to start recording before first contact and finish shortly after the end of totality. The predicted times were 12:40 PM-first contact, 2:12 PM-second contact [start of totality], and 3 minutes later [roughly 2:15 PM] would be the end of totality. Here then, was my schedule:

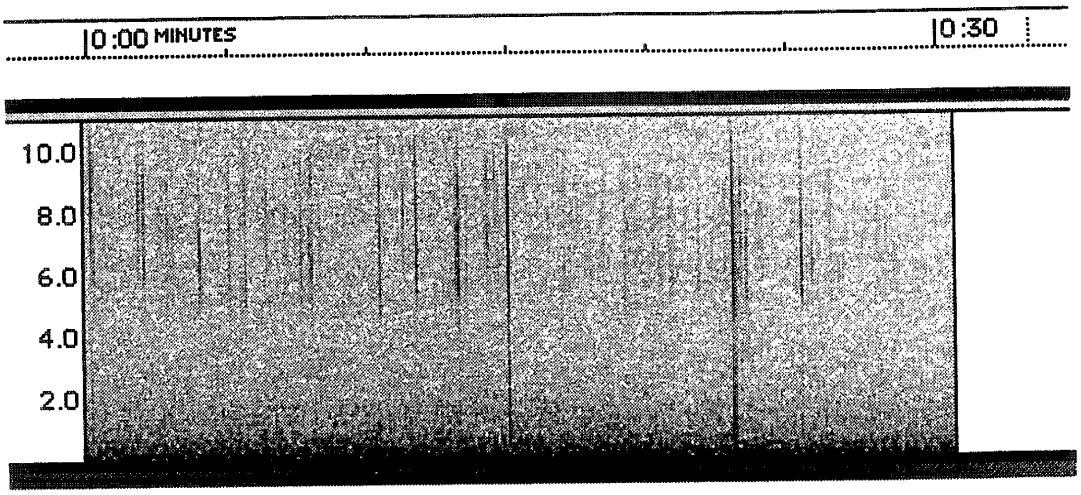
| | |
|---|---|
| 12:20 PM | start first tape |
| 12:50 PM | turn first tape |
| 1:20 PM | start second tape |
| 1:50 PM | turn second tape |

I did a pretty good job of following this schedule. I think that I remembered to put time marks at the start of each side, although in retrospect I should have also put marks at the end of each side as well. By the way, the last side [the one that was recording during totality] just ran out by itself. Part of my plan not to get distracted with the equipment during totality was to walk away down to the water as soon as I started the second side of the second tape.

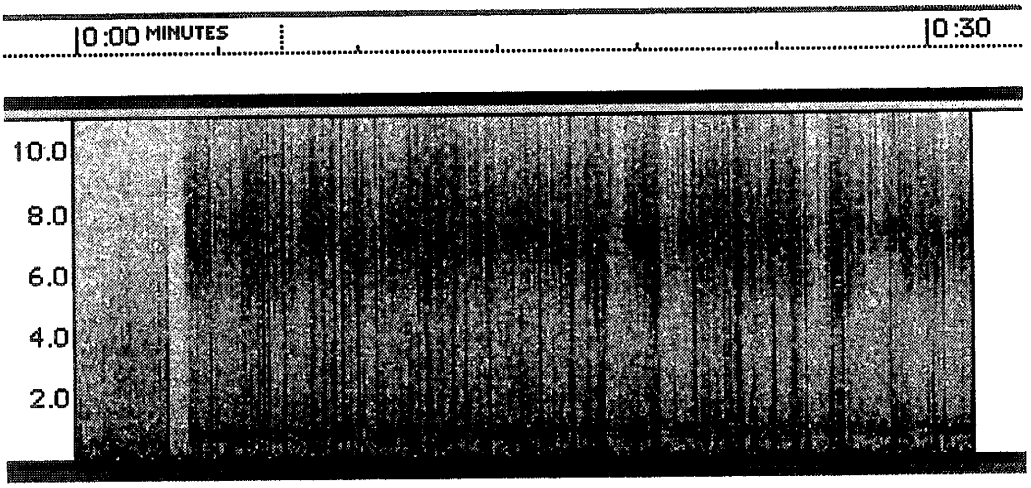
Anyway, it was a neat experience. I've listened to some parts of the tapes and at least I think that everything was hooked up correctly!! Sometimes I think that I can hear the wind howling. By the way, at the last minute we found out that they were doing a radio or TV broadcast just down the beach from our site; I hope that didn't cause any interference on the tape.



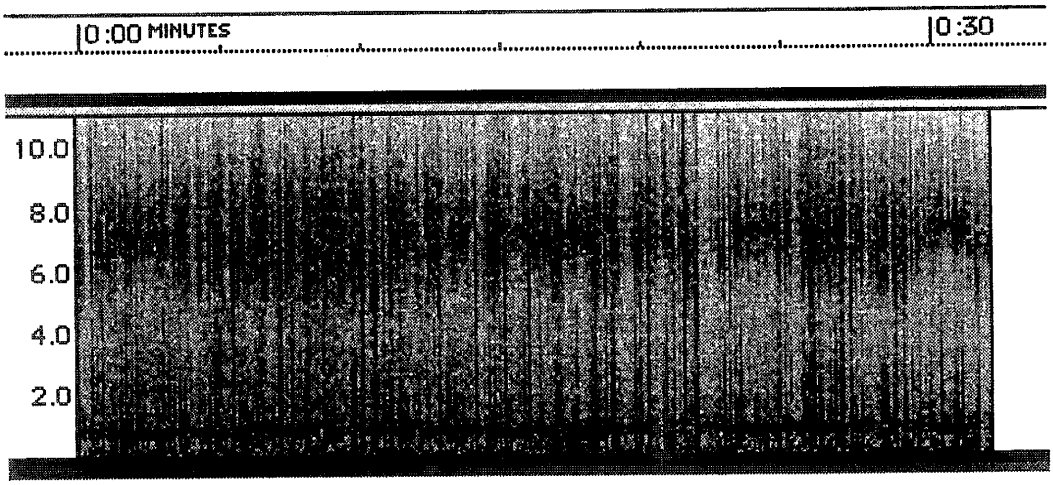

1220 AST Quiet conditions, low density sferics.
Receiver seems to be working well.
Levels on receiver and/or recorder may be set a little low.
(AST is Atlantic Standard Time, which is UT - 4 hours.)



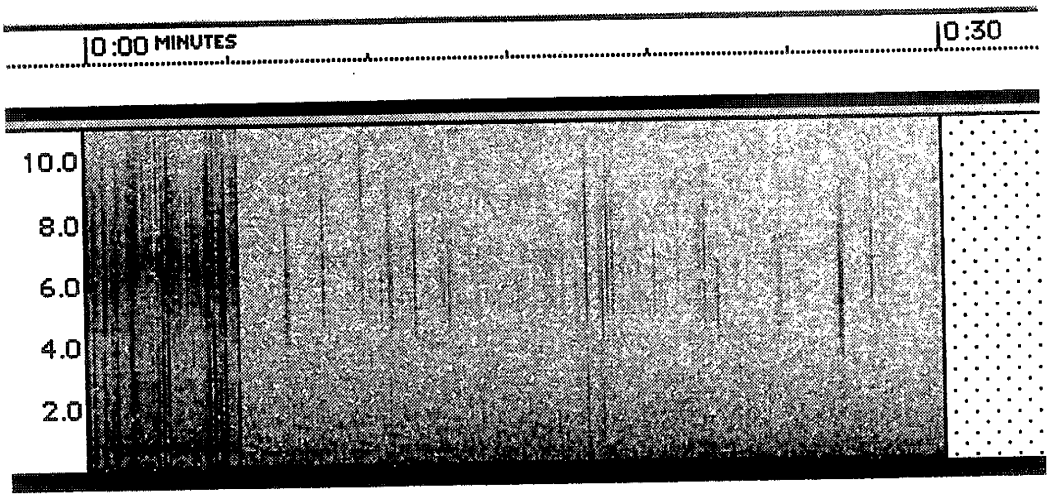

1249 AST Good sferics, low density level.
You are definitely getting what is there to be recorded



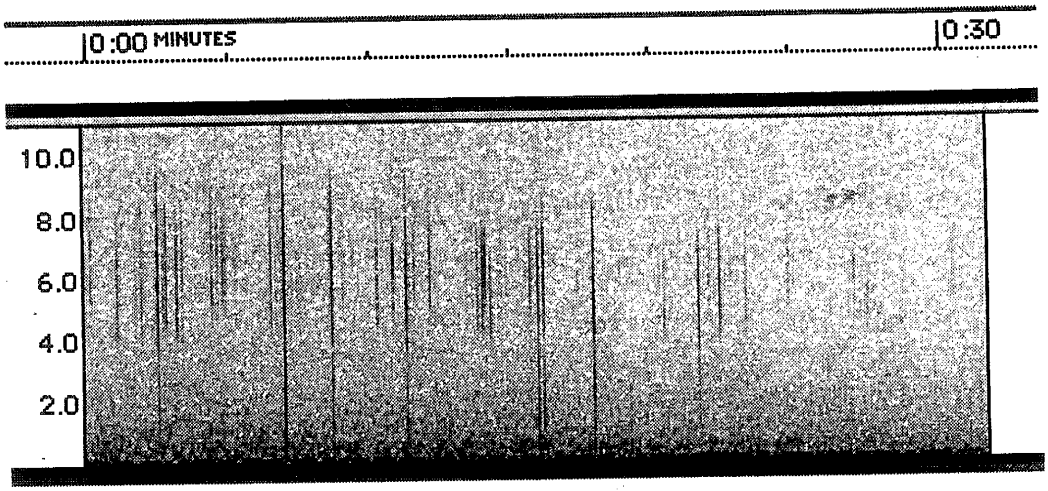

1251 AST First contact. some wind noise and louder sferics.
Looks and sounds like the level on the equipment were increased.



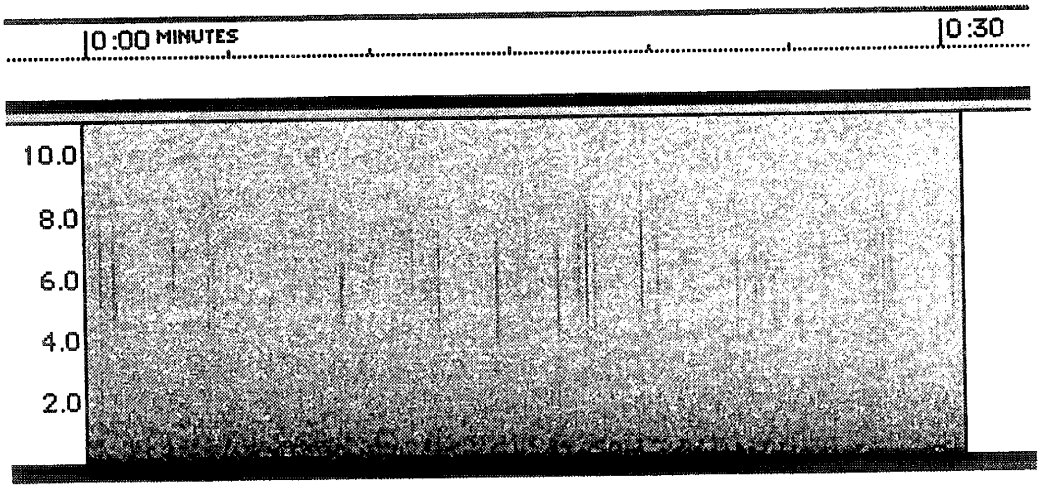

1300 AST Dense sferics and some sort of wind noise on tape




1351 AST Start of Tape 2 Side 4
Looks like the sensitivity was turned down about 5 seconds into this segment.




1412 AST Start of totality



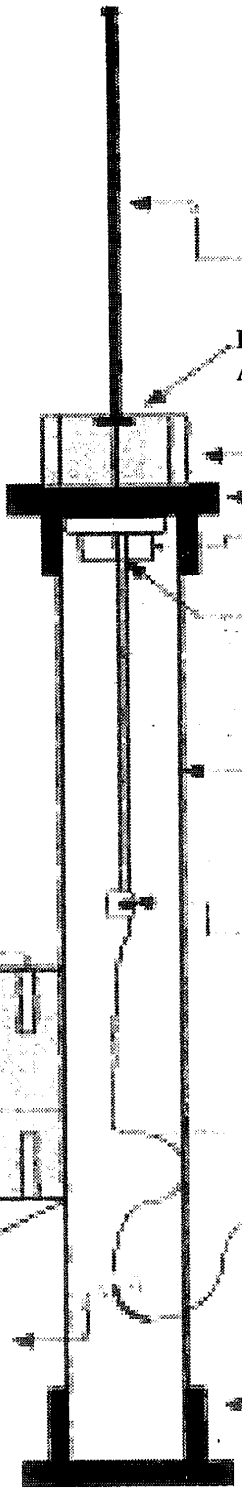

1414 AST Start of last minute of totality.

# An INSPIRE Antenna and Ground Rod

By Carl Chernan
Tarentum. PA

BM List:

1. 1 ea. Radio shack Antenna #270-1408A
2. 1 Section 3/4" - 36" Long PVC Pipe
3. 1 ea. Hubbell Strain Relief Connector
   Aluminum - 3/8" NPT Hub Size
   Grainger PN. 5D712
4. 1 ea. 3/8" Conduit Retaining Nut
5. 2 ea. 3/4" PVC Pipe Caps
6. 1 ea. 3/8" Rubber Grommet
7. 10' #20-22 Flex Stranded Wire
8. 1 ea. Insulated Spade Lug
9. Misc. - Tools, soldering iron, solder, PVC Pipe Cement, Electric Drill, RTV Silicone



Radio Shack Telescoping Antenna
Part # 270-1408A

Insert Antenna Through Rubber Grommet
And Leave 5 3/4" Of Antenna Exposed

Hubbell Strain Relief Connector
Grainger PN 5D712 3/8" NPT Hub Size

3/4" PVC Pipe Cap (Cement this end)

3/8" Conduit Retaining Nut

Fill this area with RTV silicone. Do NOT let antenna touch the inside wall of the strain relief connector.

36" Length of 3/4" PVC Pipe
Schedule 40 (Main Body)

Cut 1/4" x 1" Slot Top and Bottom.
Both sides - front and back

Solder point for the antenna lead wire to the bottom part of the antenna

3/4" x 5" PVC Pipe
Antenna Lead Wire Holder

Half loop the wire and tape in place to prevent the wire from pulling out.

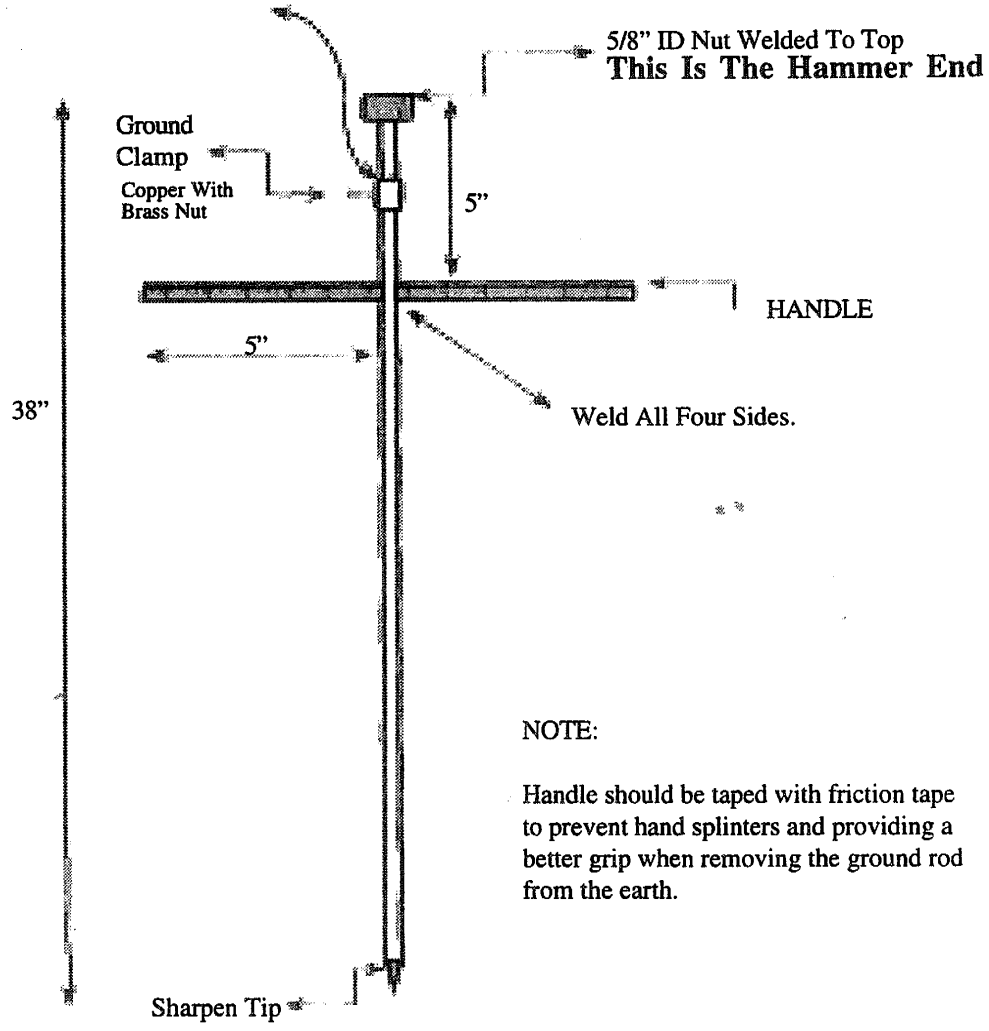
To VLF2 Receiver Antenna + Terminal.
Use approximately 8-10 feet of #20-22 flexible stranded wire. Terminate the end of the wire with an insulated spade lug.

Cement to side of antenna.

3/8" Grommet

3/4" PVC Pipe Cap (Bottom)
Slip fit only (Do NOT cement)

# Ground Rod




NOTE:

Handle should be taped with friction tape to prevent hand splinters and providing a better grip when removing the ground rod from the earth.

# RECORDING SESSION FOR INTMINS 11/97

By Flavio Gori
Florence, ITALY
INSPIRE European Coordinator

November weather is usually not so fine for the INSPIRE members in the Northern Hemisphere, who decide to investigate the very low radio spectrum. Some believe that if you get a negative "star" you might also get very hard rain and cold, even in the middle of the Sahara Desert summer! I do not have the pleasure to investigate this last statement, but for sure I have experienced a very cold and rainy night in the E29-4 MIR operation, 29/11/97. That night we recorded from 20.57 to 21.22 local time under poor weather conditions: cold wind and hard rain put together, one of the worst situation for those who have to record far away from power lines, like me but not only me.

This kind of weather drove to rain on myself too strong and I had to go back home after the E29-4 emission, missing the further two MIR emissions. Sorry. Fabio Courmoz and Sandro Arrighi (north and center Italy) did miss the first one due to working problems, but were lucky enough to record the second and third emissions. Their local weather was not so bad as mine. I was very happy about it, since I would like to understand if a transmission from north of our sites would be useful as the one right in our vertical, if not more useful.

I would like to propose one more session emission for the further MIR operations in April: MIR could do a session far north in respect our geographical position, say they could transmit close the North Pole, or the northern Norweegian latitude. Otherwise we could take advantage by transmitting from a far south latitude, in the southern emisphere. In any case they should play the INTMINS operations over a site on the same magnetic meridian than ours, since it should be interesting to monitor the emissions in a whistler-like propagation system. In the further emission, MIR astronauts could transmit over our head directly: so we'll have the capability to compare two tape recorded between 90 minutes, with few other changes. I believe this item is an important one, not to lose. What do you think, INSPIRE?

This time both Courmoz and Arrighi will ship their tapes to Bill Pine, so he will scan and monitor their jobs through his Mac with SoundEdit 16, looking for something interesting. We'll get a first idea of the hypotesis of mine.

I decided to ship to Bill the tape of mine where Bill will find the E21-1 and E29-4 Mir passages. In the sonogram for E29-4, setting for 16 bits, 44 Khz, no db gain, no Emphasis, Pwr button IN, it seems to me that a signal very close to 1 kHz appears and could be THE signal we are going to look for. Bill will let us know how he thinks. Being so much able to understand the low radio waves and the computer techniques, I have no doubt that he will do the best job we can find.

Unfortunately, a short time after the T-Time, a big hiss hit the recording session and the signal disappeared. I'm gonna ask to Bill to try something to pull out the signal from the hiss.

In these European operations I had the pleasure to work closely again with some friends. INSPIRE operations are still a very good way to stay close to far away people, both in my country and others. Also people who live in the same nation like our INSPIRE community don't have any capability to meet each other, and I have to say that only Fabio Courmoz I have had the pleasure to have met. Other friends are unknow at all by our eyes. Though our telephone calls are an

important way to chat about VLF and INSPIRE, we share important operations together and we all are proud to be part of it.

I still see that ham people are involved in our Project, and this is very important in my opinion. The ham capability to resolve radiowave related problems is, for me, still a magic situation.

A few hours after E21-1 operation, I had the pleasure to get an e-mail from Mike Dormann, a Seattle, WA, INSPIRE member able to design and build a very important tool for Natural Radio Research: a noise canceller. In few words, a noise canceller is an item which tries to cancel as much noise as it can from our very noisy town. We won't be driven from our homes to record VLF, avoiding hard rainy and cold nights.

I believe this is a very important step for us all. Mike developed it for his PhD and this also testifies about how seriously he worked. Bill Taylor has recently reeived one of the noise cancellers for evaluation, and the same will happen to me. We'll keep you updated on a MUST in this worldwide community. In the same time I would like propose a software notch filter to cut away more 50 (or 60) hz. If any Journal reader can do something like this, or knows of a person who could do it, please keep in mind for that work.

I believe that with hardware and software connections, we maybe will be really able to cut away all (or at least, almost) such a strong noise that does not permits us to simply record from home, avoiding cold and rain, yes, but also permitting us to plan a long recording session. Probably the only way to realize how the natural radio emissions really work and the many connections that sometime we read about in so many different fields: from eartquakes to volcanic activity and space craft signs in the atmosphere.

As you can understand a few random recording sessions, are unable to do much. The VLF/ULF propagation system for itself still needs a better way to work from us (if we want really understand something more, for our research and our pleasure). So it is time to be supplied with better instruments. And its also time to monitor a group of instruments that will let us use a logical standardization of our instruments. We can't use different receivers, antennas, magnetic tape, recorder and then think to compare our recordings. Probably serious research does not allows this way to work. I believe that the first steps of INSPIRE are past, everybody has improved his way, his research. Surely most of us have had time to go more in dept with his research and it is logical that most of us would like improve our job for INSPIRE and for ourself.

I believe this is time to choose: Bill Pine, Bill Taylor and some more INSPIRE high members, could help us to choose 3-5 tools for use, as I mentioned earlier in this article. Then our lab test will have to choose after a field test comparison is made. We'll have to test the best receiver/antenna couple, too, and the best couple between the tape and the recorder for our goals, since sometimes the best intrument for, say, recording a music song, is not as good as another for VLF/ULF. So the work is not easy and fast, but I think it has to be done for the best results. Most of us are in INSPIRE for many years. It is right that they want to upgrade their instruments and themselves, but this can be done only studying and working hard on the field. No one other can do that for them.

# The INSPIRE Survey

By Bill Pine
Chaffey High School
Ontario, CA

As a requirement of an INSPIRE grant and to make an effort to improve INSPIRE, a survey was included in the last issue of *The INSPIRE Journal*. In addition to Journal subscribers, surveys were also sent to mailing lists from former INSPIRE projects: ACTIVE from 1989-90 and SEPAC from 1991-92. The following is a summary of the results of the survey. Comments from participants are identified by state or country. Editorial comments and responses are in italics.

## The Number of Surveys Sent

The ACTIVE Project from 1989-1990 involved a total of 112 high schools participating. From that number, there were 77 addresses that were thought to be good (the others had resulted in returned mail at some time in the intervening years). From those 77, two were returned as bad addresses with this mailing.

The SEPAC space shuttle project from 1991-1992 involved a total of 1053 RS4 receiver kits sold. Since some schools ordered more than one kit, there were a total of 911 different school and non-school participants. Of these, 86 are current subscribers to the Journal and 68 were returned as having no longer valid addresses. So a total of 757 surveys went to SEPAC participants.

The current list of Journal subscribers numbered 205 in the fall of 1997. These participants received a survey with their November 1997 issue of the Journal. In addition, in February 1998, a reminder and another survey was sent to each of those subscribers who had not as yet returned a survey (this was 119 surveys).

The total number of surveys sent to addresses that are assumed to be current (because the mail was not returned) was:

| | | |
|---|---|---|
| ACTIVE | 75 | |
| SEPAC | 757 | |
| Subscribers | 205 | |
| **TOTAL:** | **1037** | surveys. |

## The Number of Surveys Returned

The first response on the survey was to indicate when the respondent first became involved with INSPIRE. The total number of surveys returned was 222.

| | |
|---|---|
| 1989-90 ACTIVE | 31 |
| 1991-1992 SEPAC | 159 |
| 1994 Eclipse/94 | 11 |
| 1996 INTMINS | 12 |
| 1997 | 6 |
| Other | 3 |

## In What Ways Have You Been Involved With INSPIRE?

(NOTE: Most survey questions allowed multiple responses. Not all respondents answered all questions. The total number of responses to any questions does not have any particular significance because of the possibilities of Multiple responses and omission.)

| | |
|---|---|
| Subscribed to The INSPIRE Journal | 126 |
| Purchased a kit, assembled it and it worked | 176 |
| Purchased a kit, assembled it and it did not work | 17 |
| Unknown if the kit works | 3 |
| Kit not assembled | 13 |
| Requests for repair information | 21 |

Improvements suggested for receiver kits and/or assembly instructions:

Improvements incorporated in the VLF2 receiver:

| | |
|---|---|
| 4 | Use an ON/OFF switch instead of the plug |
| 4 | Improve the gain and/or sensitivity |
| 3 | Improve filtering |
| 2 | Add audio amp for output to headphones |
| 1 | Add LED to indicate when ON |

Suggestions not incorporated in the VLF2:

| | |
|---|---|
| 4 | Use loop antenna |
| 3 | Include a notch filter for 60 Hz |
| 2 | Easier access to the battery |

Use toggle switches instead of slide switches; Add "D", "G" and "S" to Q1 on the schematic; Built-in antenna; Banana jacks for antenna and ground, RCA jacks for audio.

Suggestions relating to troubleshooting:

Need table of DC voltage values; Need test signal input to test unit; Need local troubleshooting assistance; Need information on antennas and testing

General comments:

Need wider instruction on possible uses; Instructions were vague; Variable frequency ±15 kHz to monitor cleaner frequency; How to lower frequency response; Performance appears marginal; Instructions not appropriate for average high school student.

(NOTE: A number symbol (#) in a table column heading indicates the number of respondents making that response.)

| Participants' History of VLF Observations | | | | | |
|---|---|---|---|---|---|
| Natural VLF | | INSPIRE Projects | | Submitted Data | |
| Number of times | # | Number of times | # | Number of times | # |
| 1-2 | 34 | 1-2 | 72 | 1-2 | 70 |
| 3-4 | 25 | 3-4 | 23 | 3-4 | 10 |
| 5-6 | 28 | 5-6 | 12 | 5-6 | 6 |
| 7-8 | 6 | 7-8 | 4 | 7-8 | 3 |
| 9-10 | 11 | 9-10 | 0 | 9-10 | 0 |
| Many | 62 | Many | 12 | Many | 11 |

| Operations Participated In | |
|---|---|
| ACTIVE | 14 |
| SEPAC | 107 |
| Eclipse/94 | 45 |
| INTMINS | 39 |

Teachers comprised 91 respondents; there were 116 amateur radio operators responding.

| Teacher Involvement | |
|---|---|
| Number of Years | # |
| 1 | 49 |
| 2 | 13 |
| 3 | 10 |
| 4 | 4 |
| 5 | 4 |
| 6 | 6 |
| 7 | 2 |

| Number of Students Involved | |
|---|---|
| Number of Students | Number of Teachers |
| <10 | 26 |
| 11-20 | 26 |
| 21-30 | 13 |
| >30 | 14 |

The total number of students involved with INSPIRE over the years is **2680**.

INSPIRE was used in the classroom in various ways:

| | |
|---|---|
| Enrichment | 24 |
| Extracurricular | 24 |
| Research project | 8 |
| Regular curriculum | 4 |
| Science amateur assisting in class | 11 |

Amateur radio participants worked alone or in small groups.

| Number in Group | * | Total Number Involved | * |
|---|---|---|---|
| 1 | 68 | 1 | 54 |
| 2 | 30 | 2 | 20 |
| 3 | 8 | 3 | 8 |
| 4 | 4 | 4 | 6 |
| >4 | 6 | >4 | 11 |

The total number of amateur radio participants is **148.**

## Current Involvement in INSPIRE

When asked to describe their current involvement in INSPIRE respondents indicated the following.

| | |
|---|---|
| Journal subscriber | 108 |
| Informal VLF observer | 96 |
| Formal INSPIRE observer | 45 |
| Not involved at this time | 96 |

Responses to the question
"If you are not involved, why not? How would you like to be involved?":

49 No time.
32 Unaware that INSPIRE was still going on.
16 No data site.
13 No students interested.
6 No success in detecting signal.
6 Equipment problems.
3 Need more lead time for operations.
3 No information on current projects.
2 No knowledge of VLF.

Single responses included:

Don't know purpose of INSPIRE, Equipment not complete, Don't know how to be involved, Difficult to connect to lessons, Space shuttle was the key, Moved, Difficult, Receiver doesn't work, Used in sprite research, Retired from teaching, Health problems.

## Strengths of INSPIRE

46 Real science, real data.
46 Good for high school students (1 and middle school)
28 National and international scope.
20 Fun, exciting, new.
16 Raise interest in VLF.
11 Hands-on nature of the activity.
11 The Journal.
10 NASA involvement.

9 Receiver.
7 Data analysis and return of tapes.
6 Application of scientific principles.
5 Scientific process.
5 Continuity.
5 INSPIRE is fine as it is.
4 Low cost.
4 Good for amateur science.
3 Organization.

Single responses included:

Number of operations per year, email (this from 1989 when email was new!), Unique, Basic goals, Volunteers, The Chaffey program, Simplicity, Demo tape, Serves a wide variety of interests.

## Weaknesses of INSPIRE

15 Need more success.
13 Communication.
10 Site difficult to find or get to.
10 INSPIRE Web site.
7 SEPAC failure.
7 MIR operations at bad times.
7 Need information on usefulness and purpose of INSPIRE.
7 Inability to analyze own data.
7 Lack of ability to interact and share with others.
6 Low level of participation.
6 None.
5 Inadequate media coverage and publicity.
4 More observations needed in addition to INTMINS.
4 Timing of the Journal - comes too late.
4 Lost contact.
3 Receiver.
2 Difficult.
2 Literature.

Single responses included:

Need new projects, Limited space platform based resources, Need more opportunity for adult participation, Journal, Dependence on MIR, Variety of receivers, Follow-up activities, Links to curriculum, Too difficult for general track students, Need special guided projects, Inexperience with electronics.

## What Can Be Done to Improve INSPIRE?

<u>Suggestions relating to improved communication</u>:

16 Use email.
25 Improve the Website.

*By far the most common suggestion was to improve communications by improving the website and using email. Both of these suggestions will be acted on as stated earlier in this issue.*

**CANADA**: Establish a better communication vehicle with "out of USA" participants. The Internet would be a solution if we were hooked up.

**ENGLAND**: International coordination

**New Jersey**: Being an amateur radio operator, I would like to see distributed a list of other operators to contact and to discuss current projects with.

**Iowa**: Could I get a list of names of persons in my area that are involved in the project?

**Ohio**: Better sharing and discussion among participants (a listserv type of thing).

**ITALY**: Need more contacts among participants. We need to separate the scholastic aspects from the theoretical and practical aspects. Less delay in getting the schedules.

**Suggestions about other operations and activities:**

**Connecticut**: I used to like Mike Mideke's spring weekend - easy to do, short time commitment - not searching for some faint signal no one has yet received.

**BELGIUM**: Maybe several subprojects should exist each with their project reports and articles in the Journal. For example, the physics of propagation, data gathering projects, designing and building receivers.

**Maryland**: Send up more experiments. Provide free trips to the middle of nowhere so we could hear more signals.

**Kentucky**: Tie in more closely with MIR and the proposed new space station.

**Illinois**: Need more projects with a clear focus such as the eclipse where the goal is just get VLF around some event. Students have lost interest in collecting VLF to try to get signals from MIR. When we collect here it is usually early morning and very cold. They are frustrated in standing out in the dark and cold to get what they perceive is nothing. When the goal is just to get VLF (not the MIR signal) they feel good. They got data and can send it in regardless of what it is. Otherwise they feel they have failed at not getting the signal. Regardless of what I may say, this is how they feel.

**California**: It would be great if a similar project could be done in a frequency range that does not require driving to remote locations. Probably not possible!

**California**: Make activities for general physical science classes.

**Washington**: Search for broader applications. Astronomical VLF sources? Earthquake correlation?

**New York**: It would be nice to detect the signal somehow. Try aiming the gun down. More seasonal studies during the solar cycle.

**Texas**: Develop a new and different type of investigation, not just natural VLF signals.

**Missouri**: More projects.

**Michigan**: I wonder if there are some relatively simple circuits (or related projects like antennas) that might be worthwhile for students to work on.

**California**: Entice more people in this and other countries to get involved. Offer a prize to whoever picks up the signal first? It could be an international contest. A problem with this is that MIR does not fly directly over each location.

**Oregon**: How about multiple simultaneous observations of a storm coordinated with a lightning strike location system.

**Washington**: Look inward, pick an individual sferic and do coop observing by close observers. How about interaction with the AAVSO? They have a solar flare program that would seem to be high school friendly. The recording of SID information over a long period of time and the teacher could say "Well, class, how is the magnetic field today? Do you see any flare activity on the strip chart recorder?" Sounds like it could be made into a good educational tool to me.

**ITALY**: We need to standardize the tools we use: receivers, tape, recorders, and so on.

**Colorado**: Need a broader scope to provide other observation incentives.

**New Mexico**: Some thoughts about future INSPIRE activities. Instead of limiting activities to trying to intercept MIR transmissions, we need an experimental aspect. Some areas that might be interesting to experiment with are:

- Trying different types of simple antennas such as active and ferrite loaded systems.
- Different data processing techniques. Try other things in addition to spectrograms. For instance, what about correlation analysis, narrow band energy analysis, etc.
- It might be a good idea to try some of the techniques developed by the radio astronomy people to do SETI work. I believe long base line interferometry techniques to locate sources and pull out interference might work. After all, we already collect time aligned VLF data which is the start point for all of the above techniques.

**California**: Relate noise to sunspot cycles and/or natural phenomena.

**Pennsylvania**: Need to possibly start new projects which would encourage participants to get involved. Examples include sferics and whistler, auroras and solar activity.

**Michigan**: Have not detected signal. Would alter search techniques somehow. Different transmitter? Devise a receiver to filter out AC hum so that it could be used in cities. Increase sample schedules.

**Michigan**: More INTMINS orbital plots so we can observe in October or May (better weather).

**Michigan**: More analysis of observations.

**Wisconsin**: Need a better or stronger transmitter from space.

**Illinois**: Will coordinated sferic recordings be tried again (sunrise, sunset, or ...)?

<u>Suggestions relating to improved publicity</u>:

CANADA: More publicity?

ITALY: Increasing the advertising

**California**: Vast advertising in schools (not just high schools, make college students aware, too).

**California**: How about putting a monthly column in the *Lowdown* ? It would be a welcome addition.

**Pennsylvania**: Need more exposure in Journals, ham radio publications, teacher organizations, etc.

**Missouri**: Get some articles going in the ham magazines (QST, 73, CQ, etc.). More information on antennas.

**Suggestions about improvements in the receiver and technical support:**

**Virginia**: Establish some kind of beacon to indicate operation of the VLF receiver.

South Carolina: Not everyone lives near an area that is a good distance from power lines. Better ways to filter out local noises or automated receivers that could be retrieved at a later time would be nice for those of us that must be at work before the sun comes up.

**Indiana**: Receiver needed some improvement and possible technical contact for help.

**Indiana**: Workshops for construction and training.

**Michigan**: Need greater hardware support in assembly of kit.

**New York**: Make technical support more accessible. Write up a report on what we have learned and where INSPIRE is headed.

**Colorado**: Need sufficient 60 Hz filters so I can operate from my home.

**Washington**; Maybe lower cost receivers. Have slides or video from the participants in foreign countries. Have some way to interface program results on computers.

**Suggestions relating to the World wide Web and the INSPIRE website:**

**New York**: Need a Website with daily information and announcements.

**Pennsylvania**: Need common meeting ground - Internet or ham radio.

**Minnesota**: Use Web access instead of a print Journal.

**Suggestions relating to computer hardware and software:**

**Texas**: Offer software to analyze data on site.

**Texas**: Could a digital signal processor filter out 60 Hz and harmonics to allow monitoring from a school location?

**Arizona**: Computer interfaced receiver model with spectrum analysis software featured utilizing the sound based features and benefits.

**Arizona**: Need a PC format spectrum analysis software program.

**Georgia**: I need a better way to reduce AC fundamental and its harmonic frequencies, since I have been unable to find any quiet location. Maybe keep plasma modulated frequencies away

from AC harmonics and make a computer program available.

**Iowa**: Data gathering is great (one of my favorite subjects), but I think INSPIRE should at least have a little discussion of technical analysis, etc. (not just spectrograms).

**ITALY**: Need more information on how we can do analysis of the tapes. Need more technical information from NASA and RSA on the aims and the outcomes of the operations.
Oregon: Higher time resolution, multipoint observations, automated data reduction to provide a large data base of whistler data for statistical studies correlated with Coronal Mass Ejection events, etc.

**Suggestions related to *The INSPIRE Journal*:**

**California**: Maybe a call for student research papers on the physics of their findings?

**New York**: More frequent Journal issues with more observer participation

**CANADA**: We should analyze more seriously the main reasons why we all fail repetitively to record anything from MIR in order to improve our setup and have better luck.

**Washington**: I'd like a collection of subjects that I could refresh myself on and help introduce others to. It's kind of hard to interest people I'm not absolutely sure what I am talking about.

**ITALY**: It would be better if you let us know with at least 15 days in advance when the satellite passes.

**Georgia**: Better sharing of technical improvements used by some teams - especially antennas, filtration and noise reduction. I need more advance warning of observing opportunities if I am to involve local students. Release a schedule in the summer for the following year. Also, perhaps accept research projects from participants and let us all gather data for them (i.e. Eclipse '94).

**Iowa**: If needed, go to a quarterly Journal.

**Indiana**: The feedback from results are greatly improving. Maybe a little help in improving our results or hints.

**Iowa**: I have plans on paper for an improved antenna system. If it works I will send you a copy.

**Wisconsin**: Need more timely advance notice of INTMINS operations.

**Illinois**: Publish a primer on propagation, antennas, data taking, etc.

**Texas**: Work up what we are doing in layman's terms to use to recruit or retain participants.

**California**: Include recordings, investigation and analysis of natural VLF phenomena likely to occur.

**Washington**: Give some information in the startup kit. Tell us what we're looking for in the charts.

**Suggestions relating to increasing the number of participants:**

**Minnesota**: Hold an INSPIRE conference or somehow get a hands-on demo at an NSTA meeting.

**Washington**: Keep your membership/interest roll up to date.

**Georgia**: Expose more people to it.

**Minnesota**: Simply getting more schools and children involved

**California**: Need more participants. I hope to help you on this one.

**CANADA**: Get amateur radio operators involved. VLF is a good indication of propagation conditions

**Colorado**: There are lots of retired hams who could be recruited to help.

**One suggestion that does not fit any of the categories:**

**Washington**: The attitude expressed in the literature (see Journal, Volume 3, May 1995, second to last paragraph on Page 5, beginning "Underlying this objective ..." This is a statement of philosophy that reflects only one of many ways to evaluate the value and effect of science and technology. One reason many people choose to home school is to avoid the indoctrination of teachers like you who believe their view and value system is the only possibly correct way to think and live. Stick to science and leave philosophy to individuals and families.

## Do You Have Any Questions About INSPIRE?

*Some of these questions have been answered elsewhere in this issue. The answers to the other questions will form the basis for an article in the next issue of the Journal. If you have any other questions, please get them to me and I will include them in the article. -Pine*

| | |
|---|---|
| 4 | Are you on the Internet? |
| 9 | What is the latest with INSPIRE? |
| 4 | What is planned? |
| 2 | How do I subscribe and get reinvolved? |

**Questions about the future of INSPIRE:**

**Maine**: What are the upcoming opportunities to observe VLF?

**New Jersey**: I have a 4 year old. What is coming up in the future?

**North Carolina**: What is the next mission?

**Kentucky**: Are you still working with the shuttles?

**Ohio**: Are there any further plans for SEPAC?

**Arizona**: As a radio amateur I was interested in participating in the experiment on VLF propagation from space. When the experiment was postponed I had no reason to pursue the VLF. I have not been advised of any current program where I could be useful. What are you people doing that I could be useful contributor if I participated?

**Texas**: Maybe get more people involved in analyzing data.

**ITALY**: Is there any information on the receiver VLF3?

**Washington**: How long is the program going to exist?

**Questions about the goals of INSPIRE:**

**Michigan**: Is there somewhere I can get an update on what's happening in the project? What are the current goals?

**Illinois**: What are future goals? How has science of VLF benefited from our research in the "big" picture?

**ITALY**: What contribution has INSPIRE made?

**Miscellaneous questions:**

**CANADA**: Who runs it?

**AUSTRALIA**: How does one subscribe to The INSPIRE Journal?

**Connecticut**: Keep me informed. We will be glad to pay dues.

**Pennsylvania**: Do you have Internet communications - usegroup, etc.?

**Pennsylvania**: Since my original system never worked, what will you do about it?

**Maryland**: What can I listen for now and how?

**Virginia**: Who could I contact for more (current) information?

**Florida**: What is the list of products necessary to participate?

**Ohio**: Would it be possible to get back issues of the Journal?

**Indiana**: Is this doable at our small rural school?

**Arizona**: Are T-shirts still available? Other items?

**New Mexico**: Are kits still available?

**California**: How can I get more involved?

**Oregon**: Is anyone using packet radio to transmit data from remote sites to central data analysis facilities?

**Alabama**: Can you email the orbital elements for home tracking programs during operations?

**Iowa**: It would be helpful if you would list or supply data analysis programs for the Mac platform.

**Texas**: what have we accomplished?

**Colorado**: I would like to get a list of VLF transmitters to use as ionospheric probes.

**California**: Whatever happened to the mythical Michael Mideke? We'd love to see some articles from him.

**California**: Is there any chance to up the transmitter power to give us a better shot at picking up the signal. Two years with no success at the present power level indicates an increase may be welcomed at the receiving end. Or maybe we should go to a radio telescope dish our local university once offered.

**Washington**: Is anyone in Antarctica in the INSPIRE program?

**Illinois**: How can we track the MIR?

**West Virginia**: How to get kids excited about radio astronomy? Web resources?

**Rhode Island**: UT is not defined anywhere in the manual. I assume it is Greenwich Time, but that is not clear.

## General Comments

**BELGIUM**: We wish INSPIRE all success, hope to participate in the future, thanks all the people for their good work.

**CANADA**: Keep up the good work!

**New York**: Involvement with the shuttle program motivated student to participate after school on their own time.

**Florida**: Thanks for your work!

**Michigan**: Thank you for getting in touch with me!

**Montana**: Keep up the good work!

**Illinois**: Thank you for your time and effort. My students really enjoyed their INSPIRE experiences in '92

**Texas**: I spoke with Dr. James Burch who is Vice President of the Space Physics Division at Southwest Research Institute here in San Antonio. The SEPAC unit was built here, but was never designed to be switched on and off at rapid modulation rates used in the artificial antenna experiment. Thus, a fuse in the power module blew during the experiment,. NASA pushed the equipment beyond specs.

**Texas**: I have operated the unit several times at the USAF Academy to show the concept to cadets. This was while I was up there on reserve duty. I have also demonstrated the receiver to my relatives (nieces, etc.).

**New Mexico**: I'd like to become involved again and I hope kits are still available. A fellow saw my kit in action and he subsequently worked the idea into the educational outreach of the "Center for Astrophysical Research in Antarctica", which is out of the University of Chicago. I ended up giving him my kit to add to this resources.

**California**: My students are very interested in WWW. We have easy access at school.

**California**: We solar powered our VLF receiver on a remote mountain top and used a low power 2-meter link to our observation/recording site. The results were great and background noise was almost nonexistent.

**New York**: I am a "recycled" biologist. My background in electronics is zero. I have generally felt unable to deal with technical problems. I read the Journal, but I never get a "big picture" view of what has been learned about VLF, Earth in space, etc., as a result of INSPIRE. It just seems like the same kind of observation year after year.

**Pennsylvania**: Things here are slow. I have only been able to get two schools interested in the project, however I am still trying. The VLF2 kit went together with no problems and the receiver works well. One of the students put it together (took him 3 hours). I also made the assembled unit that I have here portable. I attached a BNC panel mount to the top of the receiver and a steel handle to the side of the plastic case. The new BNC antenna connector is wired via a switch to the antenna terminal.

**Virginia**: Thank you for hanging in there and keeping the concept of the project alive!

**Georgia**: If there is a significant problem with malfunctioning receivers (the official kit), I would be happy to repair some (1 or 2 per month).

**Georgia**: The 1000 Hz signal is close to 1020 Hz which is a common QRM. This project rekindled my interest in radio and caused me to get another degree and change jobs.

**Indiana**: We will put the new receiver together next semester.

**Michigan**: Please keep updating us on new receiver options.

**Michigan**: I limit my participation as I have the "feeling" that the project is primarily for teachers and high school students and does not welcome individual amateur scientists.

**Minnesota**: Thank you for all the good work you have "inspired" in our youth. This nation can only be successful when we have people like you caring for the development of our young people.

**Illinois**: I would like to participate in the INTMINS project, but the times of local passes make it impossible to include my students. In addition, recent housing developments have robbed me of a prime observing site.

**Texas**: You have done an excellent job with INSPIRE. Your hard work and dedication are an inspiration!

**Texas**: for a totally volunteer organization, it looks like it is going very well. Enjoy the Journal.

**ITALY**: Do you remember my last letter about the "OPERA" project? It will arrive at one year of operation in April '98. After that date and the analysis is done, I will send you the graphics material for the Journal.

**California**: I got started with SEPAC as an amateur operator. During that time I recorded numerous whistlers and other noises. This was fascinating to me. As a result of three days alone in the desert (Amboy Crater), I wondered how the whistlers could do what they do. My best guess led me to a new design of a whistler radio. This new design works but I have not been able to find whistlers during the time of testing. On one occasion I heard whistlers but did not have a

tape recorder so could not prove their existence. I am anxiously awaiting good weather to continue the search for non moon bounce whistlers. Guess I found a release for the broadcast engineering background I started with almost 40 years ago. I will be able to prove my theory. I will notify you with recordings and other documentation after completion. Wish me LUCK :)

**Colorado**: You are doing a great job. When I retire in a few years, I hope to be a volunteer in a high school helping students with science projects like INSPIRE. I want to keep subscribed to the Journal.

**Texas**: I hope - and will make a strong effort - to continue my participation in INSPIRE. I am very interested.

**California**: If needed, I could help repairing VLF receivers. I have extensive electronic background.

**Maine**: My son won a science fair project based partly on the INSPIRE VLF project of his design. Many successful recordings in March '96. He also gave a talk on this subject at a grammar school.

**Massachusetts**: I have constructed an antenna using a ground-smooth 1/2" rebar rod 50 centimeters long wound with several thousand turns of #42 copper wire. Will try it out this summer on Cape Cod's Monomy Island or on my sailboat out of range of shore interference. Will let you know if it works.

# INTMINS OBSERVERS

## Roster Update

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

North American observers:

| Team # | Observer | Location | Longitude/Latitude |
|---|---|---|---|
| 1. | John Lamb, Jr. | Belton, TX | 95° 53' 59" / 33° 14' 49" |
| | East Texas State University | | |
| 2. | Stephen G. Davis | Fort Edwards, NY | 73° 29' 30" / 43° 18' 00" |
| 3. | Don Shockey | Oklahoma City, OK | 97° 40' 5" / 35° 43' 30" |
| 4. | Mike Aiello | Ctoton, NY | 73° 46' 45" / 40° |
| 5. | Jean-Claude Toouzin | St. VitalQuebec | 79° 10' / 48° 55' |
| 6. | Bill Pine | Ontario, CA | 117° 41' / 34° 14' |
| | Chaffey High School | | |
| 7 | Dean Knight | Sonoma, CA | 122° 33' / 38° 21' |
| | Sonoma Valley High School | | |
| 8 | Mike Dormann | Seattle, WA | 123.4° / 47.2° |
| 9 | Robert Moloch | Greentown, IN | 85° 58' / 40° 28' |
| | Eastern Elementary School | | |
| 10 | Bill Taylor | Washington, DC | 38° 54' / 77° 2' |
| | INSPIRE | | |
| 11 | Mark Mueller | Brown Deer, WI | 87° 56' / 43° 10' |
| | Brown Deer High School | | |
| 12 | Jon Wallace | Litchfield, CT | 73° 15' / 41° 45' |
| 13 | Bill Combs | Crawfordsville, IN | 86° 59' / 40° 4' |
| 14 | John Barry | West Lebanon, IN | 87° 22' / 40° 18' |
| | Seeger High School | | |
| 15 | Robert Bennett | Las Cruces, NM | 106° 44' / 32° 36' |
| 16 | Leonard Marraccini | Finleyville, PA | 80° 00' / 40° 16' |
| 17 | Kent Gardner | Fullerton, CA | 117° 48' 30" / 34° 12' 13" |
| 18. | David Jones | Columbus, GA | 77° 07' / 35° 00' |
| 19. | Larry Kramer / Clifton Lasky | Fresno, CA | 119° 49' / 37° 01' |
| 20. | Barry S. Riehle | Cincinnati, OH | 84° 15' / 39° 7' |
| | Turpin High School | | |
| 21. | Phil Hartzell | Aurora, NE | 98° 0' / 41° 0' |
| 22. | Rick Campbell | Brighton, MI | 83°50'2.7" / 42°16'43.7" |
| 23. | Jim Ericson | Glacier, WA | 121° 57.91' / 48° 53.57' |
| 24. | Paul DeVoe | Redlands, CA | 116° 52' / 34° 10' |
| | Redlands High School | | |

## European observers:

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

## New Observers (11/97):

25 Norm Anderson — Cedar Falls, IA

| | |
|---|---|
| Longitude: | 92° 15' W |
| Latitude: | 42° 20' N |
| Golf course. | |
| Receiver: | INSPIRE RS4 |
| Recorder: | Radio Shack SCR-51 |
| Antenna: | Long wire |
| WWV: | Radio Shack DX-440 |

# INTMINS - November/97 Data Analysis Report

by Bill Pine
Chaffey High School
Ontario, CA

The November/97 INTMINS observations marked the sixth session in an ongoing series of operations conducted with the cooperation and assistance of the Russian Space Agency (IKI) and ENERGIA, the Russian space engineering organization. INTMINS is an attempt to detect manmade VLF radio waves emitted by instruments on the MIR Space Station.

## INTMINS Status Report

There was a rather large problem with the scheduling of the ISTOCHNIK firing times for the November/97 operations that requires some detailed explanation. The problem was that MIR was so far ahead of the scheduled track that adjusting the firing of ISTOCHNIK the maximum amount of time (13 minutes) would still fail to bring the operation back to the desired geographic track. In other words, when MIR operated it was far to the east of the desired location. We were unable to make an adjustment in the schedule when the discrepancy was discovered, so no change was made in the operation schedule even though that meant there was no chance of detecting the signal. The required explanation is: how could this happen?

The operation schedule is set about four weeks in advance of the scheduled weekends (the last two weekends in November). Orbital elements for MIR are obtained and a satellite tracking program (OrbitTrack for the Mac and STSOrbitPLUS for the PC) is used to project the track ahead to the desired dates and track maps are made. From these maps, operation times are chosen with the power constraints that ISTOCHNIK can only be operated for 2 minutes once per orbit. The problem is that any changes in the orbit or any errors in the determination of the orbital elements will have a large effect on the track after the changes operate for the intervening days until the scheduled operations. It is common for the track to "slip" by several minutes over the period of a week and then to "slip" back to nearly the original track over the next week or so. This represents less orbital maneuvering of MIR than the vagaries of the methods of determining orbital elements. As long as the track does not shift more that about 10 minutes either way, no changes need to be made by observers on the ground. The firing times for ISTOCHNIK are adjusted and the new program is uploaded by our Russian colleagues so that the firing track is held constant. After data is gathered, the appropriate time can be analyzed on the tape even though it is not the originally scheduled "T-time".

If the track undergoes a significant change in the days just before the operations, it may not be possible to make the necessary change in the firing schedule due to time constraints. If the track slips more than about 10 minutes, it becomes necessary to change not only the firing schedule, but also the observation schedule. In November 1997, both of these problems arose. They arose too late to make the changes for the first weekend, but no too late to make the adjustments for the second weekend, so that was done. All time for the operations on November 29 and 30 were moved up 15 minutes to bring the firing back to the original geographic track. All former INTMINS observers were notified by mail and that worked for most observers. Some did not get the word, which is regrettable.

For data analysis purposes, the tapes of the first weekend were analyzed using the original schedule. The tapes of the second weekend were analyzed using the modified schedule. The 1 kilohertz signal from ISTOCHNIK was not detected on any of the tapes submitted. The search goes on!

## Data Analysis Procedure

The data analysis procedure used this time consisted of the following:

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

2. A spectrogram image was made of this file using a frequency range of 0-11.025 kilohertz. The 1 kilohertz region of the spectrogram was examined for the 10 seconds on, 10 seconds off signal from ISTOCHNIK.

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

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

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

## INTMINS-November/97 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 |
|---|---|---|---|
| E21-1 | 2322 | Northern Italy | 4 |
| E22-1 | 0103 | Russia, South of Moscow | 1 |
| E29-4 | 2009 | Northern Italy and East | 3 |
| E29-5 | 2149 | Russia, South of Moscow | 4 |
| E29-6 | 2321 | Southern England | 4 |

North American Passes

| Pass | ISTOCHNIK Start Time | Path during ISTOCHNIK Firing | Number of Observers Recording Data |
|---|---|---|---|
| 22-2 | 0530 | IL, MI | 4 |
| 22-3 | 0700 | Central CA, NV | 3 |
| 22-4 | 0837 | SW WA, Northern ID | 0 |
| 22-5 | 1023 | NY, MA, CT, RI | 0 |
| 22-6 | 1157 | MO, IL, KY, TN GA | 1 |
| 22-7 | 1332 | West TX, South TX | 1 |
| 23-1 | 0434 | West PA, NY West ME | 2 |
| 23-2 | 0602 | South of CA, North AZ | 2 |
| 23-3 | 0739 | SW OR, ID | 2 |
| 23-4 | 0923 | Quebec | 1 |
| 23-5 | 1057 | SE ND, MN, South WI | 1 |
| 29-1 | 0139 | WV, PA, East NY | 0 |
| 29-2 | 0313 | North NE, MN, North WI | 1 |
| 29-3 | 0940 | North OK, North LA | 0 |
| 30-1 | 0041 | SC, NC, SE VA, East of DC | 1 |
| 30-2 | 0211 | South NM, North TX | 2 |
| 30-3 | 0345 | North CA, North NV | 3 |
| 30-4 | 0530 | Quebec | 3 |
| 30-5 | 0843 | West TN, AL, GA, North FL | 2 |

Summary of European Passes Recorded

| Team/Pass | E21-1 | E22-1 | E29-4 | E29-5 | E29-6 |
|---|---|---|---|---|---|
| E1 | x | | x | | |
| E2 | x | | x | x | x |
| E3 | x | | | x | |
| E5 | x | x | x | x | x |
| E7 | | | | x | |

Summary of North American Passes Recorded

| Pass | 11/22 | | | | | | 11/23 | | | | | 11/29 | | | 11/30 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Team | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 |
| 1 | | | | | | x | | | | | | | | | | | x | | |
| 2 | | | | | | | x | | | | | x | | | | | | | |
| 5 | | | | | | | | | | x | | | | | | | | x | |
| 6 | | x | | | | | | | | | | | | | | | x | | |
| 7 | | | x | | | | | x | x | | | | | | | | x | | |
| 8 | | | | | | | | | | | | | | | | | | x | x |
| 11 | | x | | | | | | | | | | | | | | | | | |
| 15 | | x | x | | | | x | x | x | | | | | | x | x | x | x | |
| 18 | | | | | x | | | | | | | | | | | | | | x |
| 21 | x | | | | | | | | | | | | | | | | | | |
| 22 | x | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | x | | | | | | |