The INSPIRE Journal

Volume 5 Number 2

April 1997

Newly Designed Radio Receiver Kits Available!

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

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A Photo Story on the Second Annual DC Area INSPIRE Workshop
An Update of the Roster of INTMINS Observers
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The INSPIRE Journal
Volume 5 Number 2
April 1997

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INSPIRE Is Now on World Wide Web:

URL: http://www.gsfc.nasa.gov/education/inspire/inspire.html

email Address and Fax for INSPIRE

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Fax: 909 931 0392

Chaffey Science has a Web Site!

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

www.chs.chaffey.k12.ca.us

Help Design and Evaluate Curriculum Materials

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

Is the OMEGA System Doomed?

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

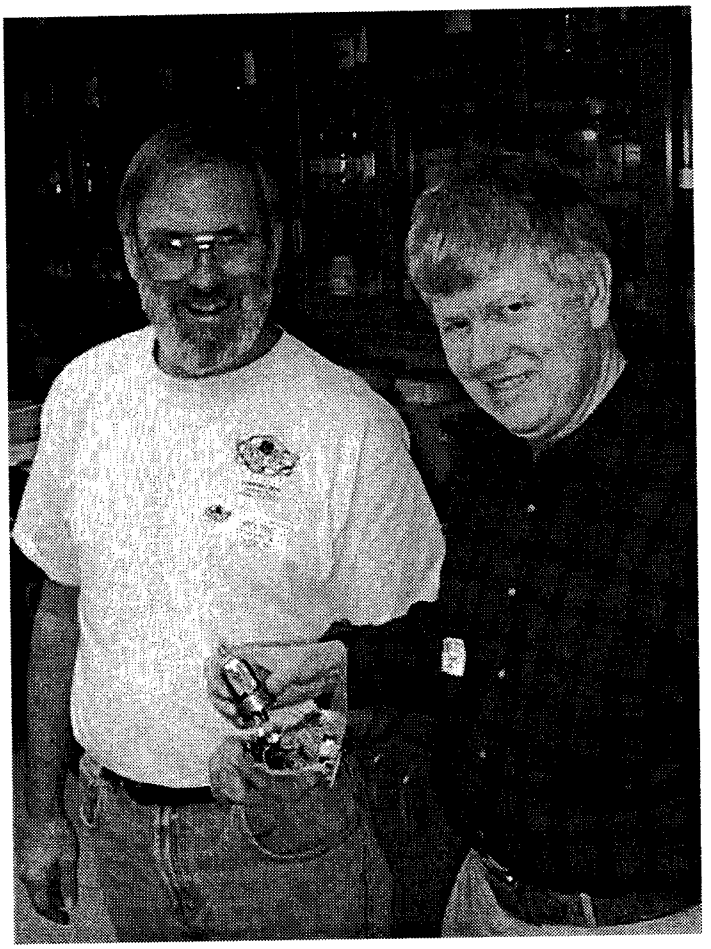
This is not good news for INSPIRE. The presence of the OMEGA signal is a good indicator that the VLF receiver is working well. We use the OMEGA signals as an accurate time mark for

correlating data from several observers. Others will be more inconvenienced by loss of OMEGA than INSPIRE. For example:

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

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

Vacuum Tube Receiver <u>NOT</u> Planned!



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

INTMINS-April/97 Operations Schedule

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

The April 1997 INTMINS Operations schedule has been determined. Operations will occur on the last two weekends: April 19-20 and April 26-27. Data gathered will be analyzed and reported on in the November 1997 issue of *The INSPIRE Journal.*

Gathering Data:

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

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

Step 0: Completely check out all equipment. A good method is to set up everything in your living room. All you will hear is household 60 Hz, but you will know the equipment is working. This is also a good time to fill out the log cover sheet (see the page 61 of the *Journal*).

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

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

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

Step 4: Keep a written log (see page 62 of the *Journal*) of time marks and descriptions of everything you hear.

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

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

Mode of Operation:

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

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

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

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INTMINS Schedule

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

The VLF2 Radio Receiver Kit

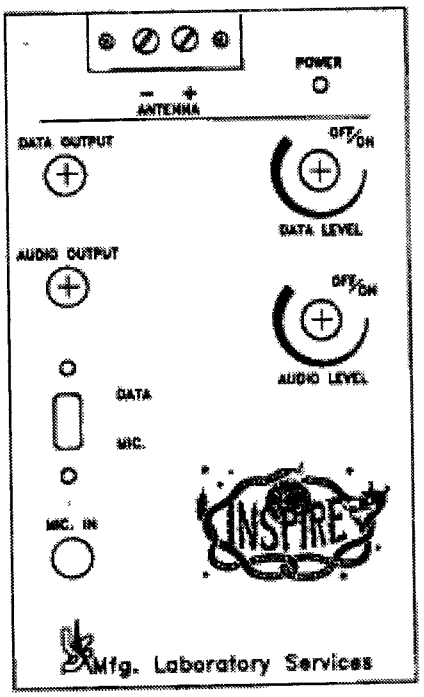
New from INSPIRE: The Next Generation of Natural Radio Receivers

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

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

Features

The Front Control Panel is shown below:



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

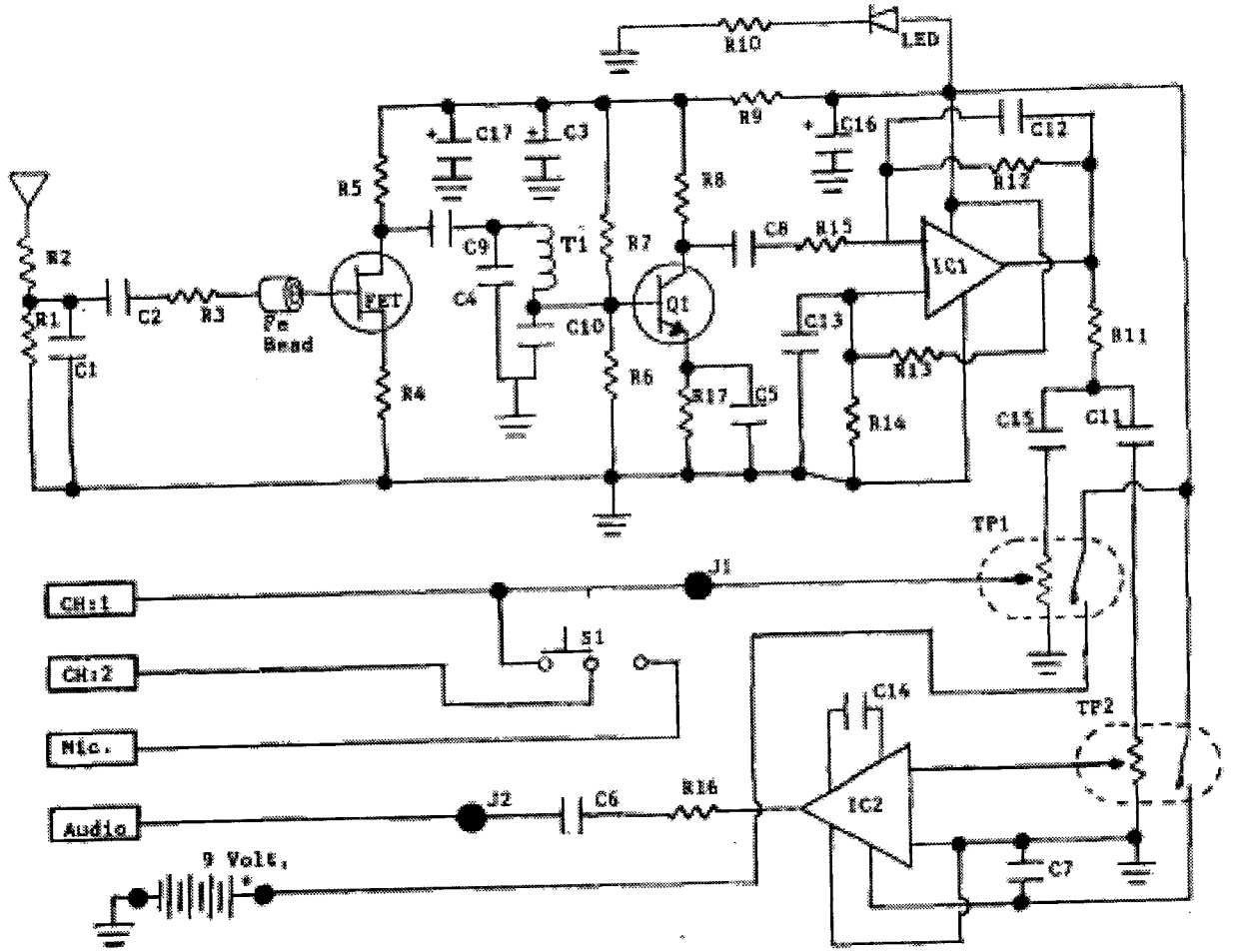
The OFF/ON VOLUME controls are mounted directly onto the printed circuit board, eliminating the need for several of the interconnecting wired used previously.

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

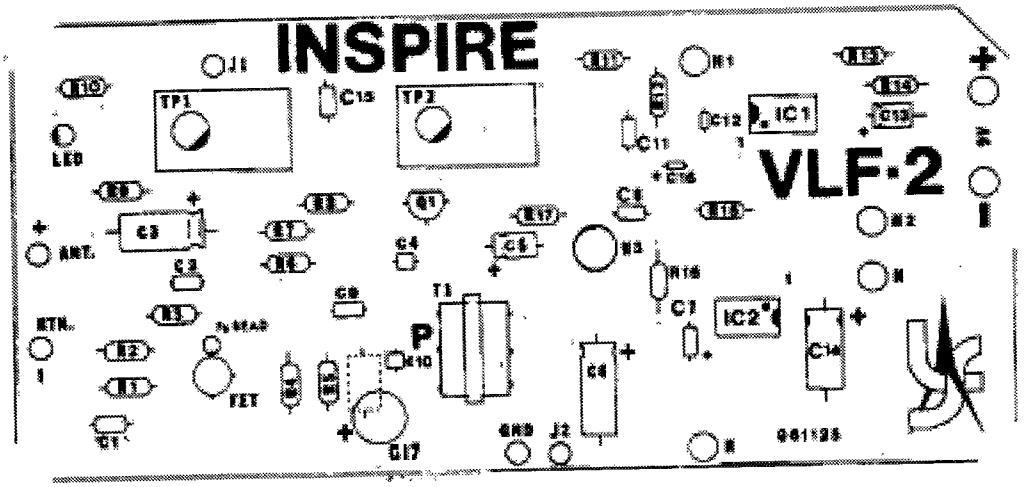
The addition of an LED power light makes it easy to see when power is on.

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

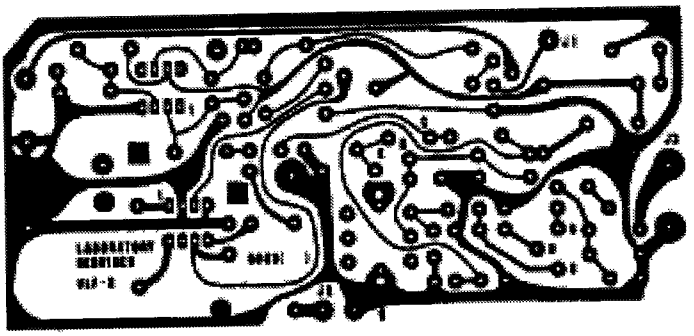
The schematic diagram of the VLF2:



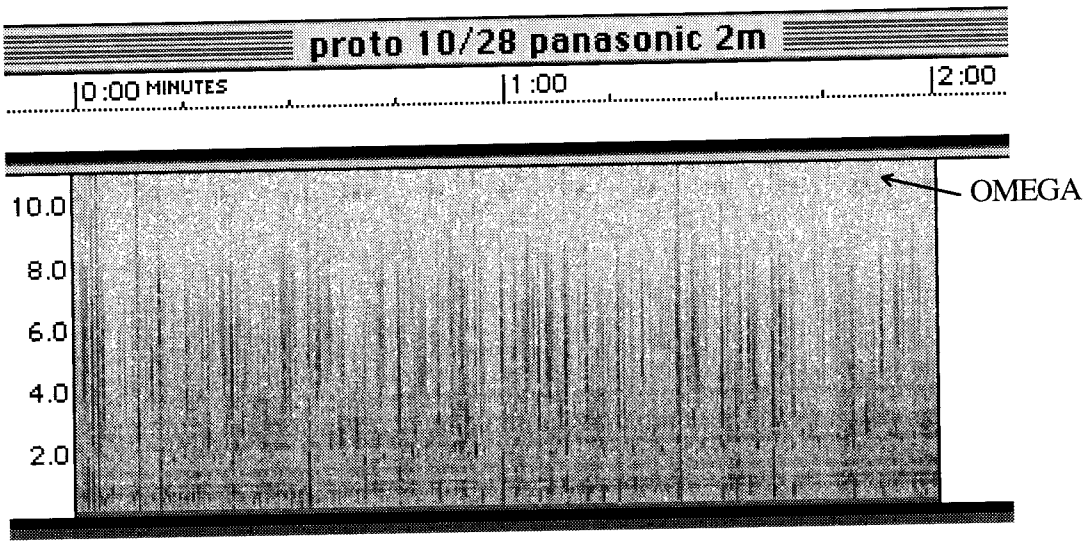
Printed circuit board layout, front side, is shown here.



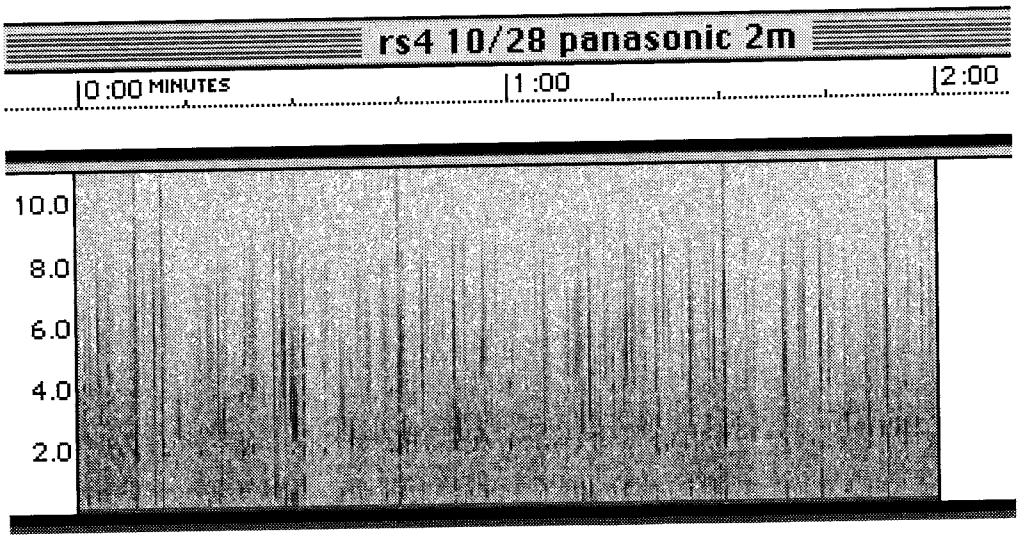
The circuit side of the printed circuit board is shown here.



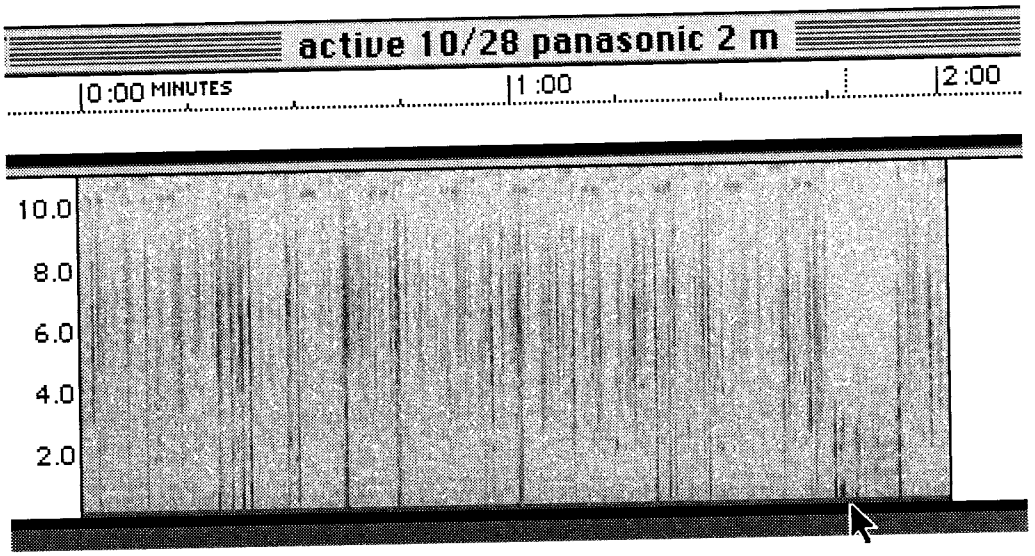
Field Test Results



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



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



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

The differences noted for the prototype VLF2 receiver are:

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

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

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

10 MHz WWV Receiver Kit

by Scott Green
Springbrook High School
Silver Spring, MD

Background

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

Introduction

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

Assembly

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

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

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

Another thing you must look out for is the placement of the three Integrated Circuit (IC) chips. I installed two of the three ICs backwards due to mistakes I made at looking at the diagrams that were given (all the labels on the ICs were shown as being in the same orientation but they actually depended on the pin position). Since IC sockets do not come with the kit and therefore are not

used, the whole IC had to be unsoldered, reoriented, and then of course soldered back into place. Make sure you have extra wire on hand too because, I found that the battery snap wires are not long enough to reach the other side where the switch is located, and still be able to comfortably change the battery. In fact the kit comes with absolutely no additional wire that you can use to connect everything up.

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

Operations

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

Conclusion

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

Ordering Information

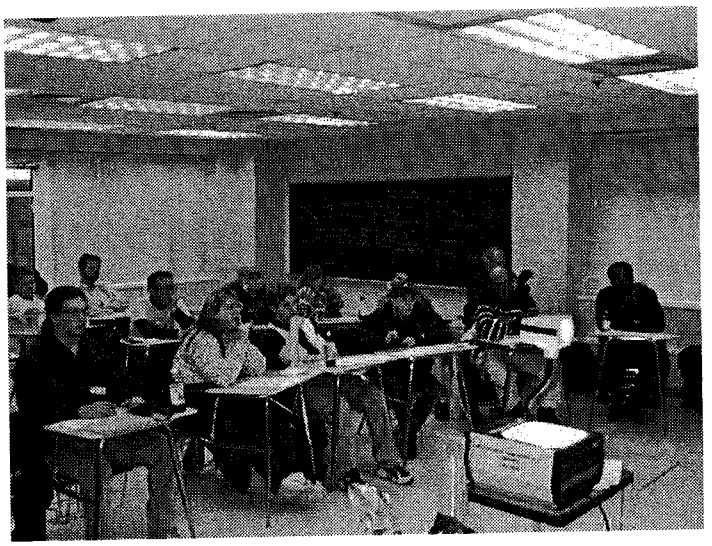
Almost all digital Electronics
1412 Elm St. S.E.
Auburn, WA 98092

Complete kit: $35.95 + $4.00 (shipping)

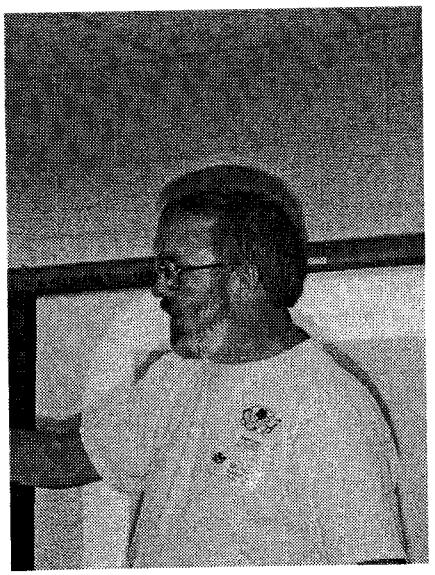
Second Annual DC Area INSPIRE Workshop

The Story in Pictures

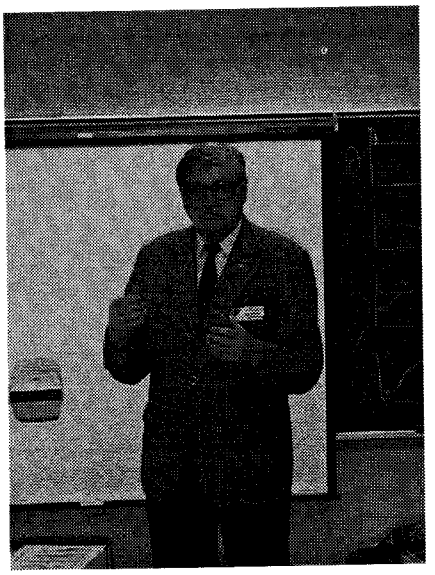
The Second Annual DC Area INSPIRE Workshop was held at Gallaudet University on Saturday February 8, 1997. A total of 7 teachers and 6 students attended. Some who planned to attend were unable to because of the first significant snow storm of the season. Those who did attend joined an INSPIRE staff of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



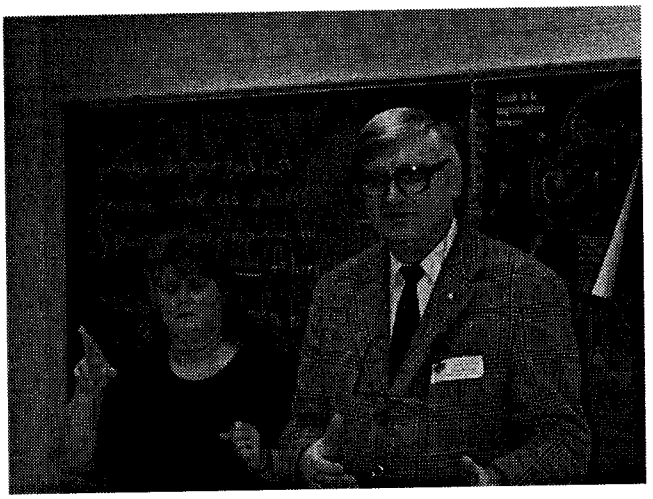
The group gathers for the morning session.



Bill Pine gives a talk on natural radio.

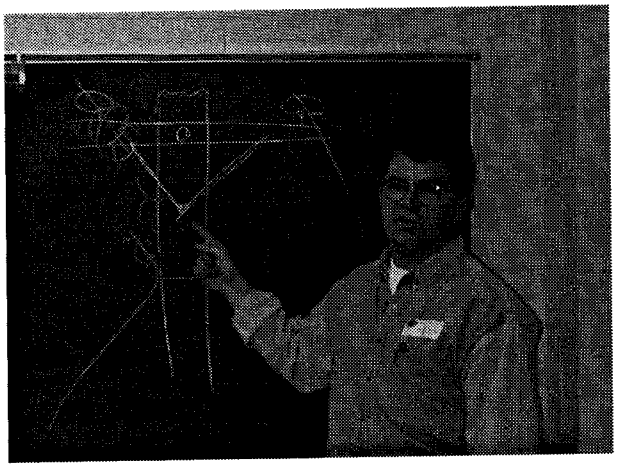


Stas Klimov of the Russian Space Agency described he instruments carried on MIR.



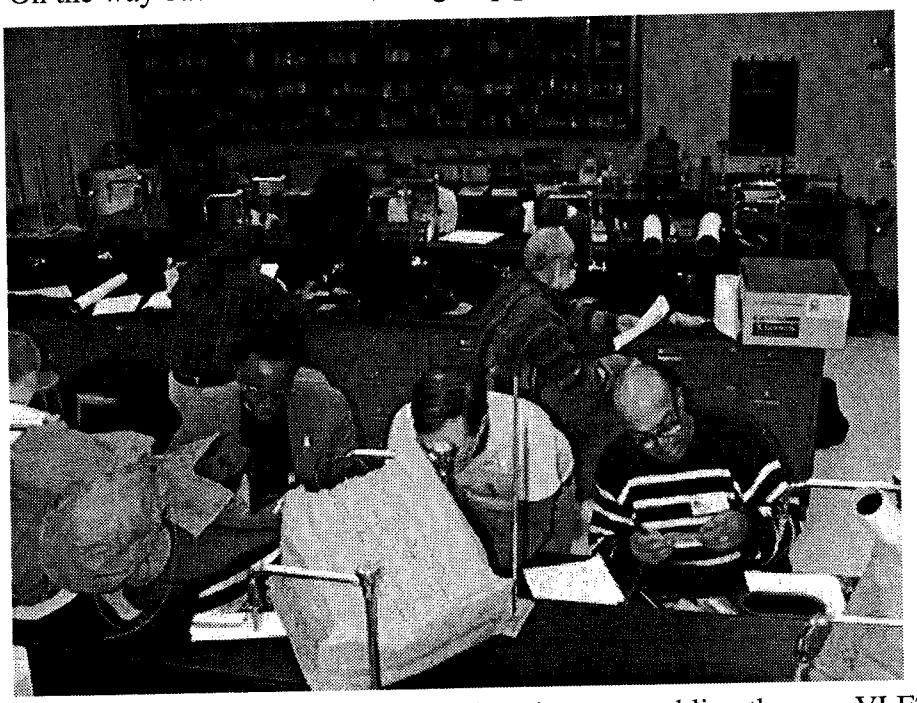
An interpreter signs as Stas talks. Two students from Maryland School for the Deaf attended. Interpreter services were provided by Gallaudet University. Stas was a guest of INSPIRE.

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

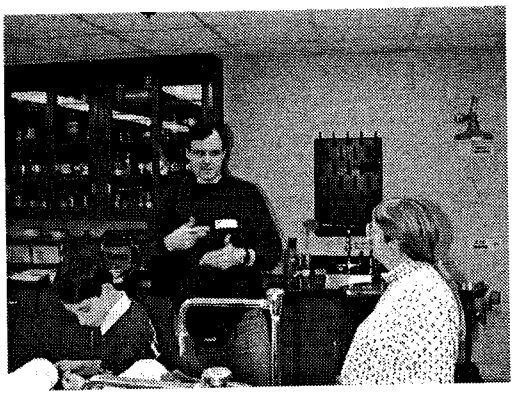


Mike Martin, of Potomac Electric Power Company (PEPCO), gave an interesting talk on radio sources from power lines and malfunctioning appliances. Mike's job with PEPCO is to work with customers to find sources of radio interference in their homes. Mike also spoke last year at the First Workshop.

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

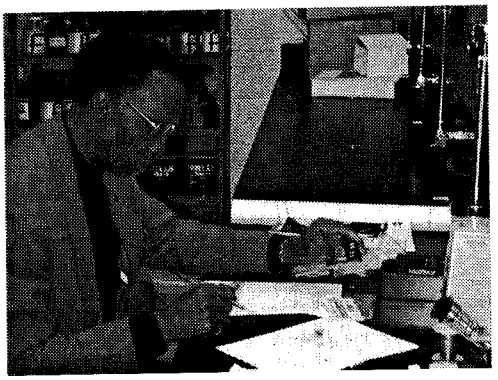


The early afternoon session was devoted to learning about assembling the new VLF2 kit.

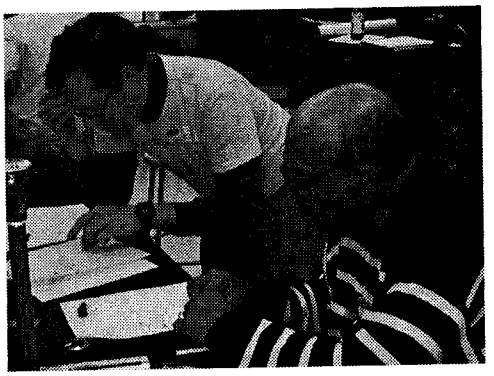


David Snyder of Gallaudet University talks to Becky DeLameter of the Maryland School for the Deaf.

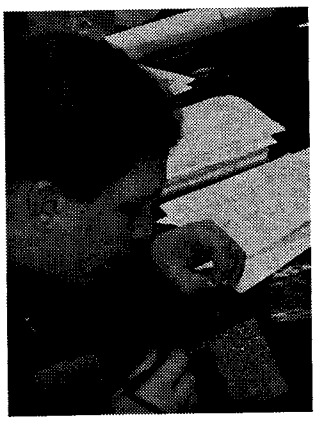
Scott Green instructs his dad, Jim Green of NASA Goddard Space Flight Center, on how to assemble the kit.



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

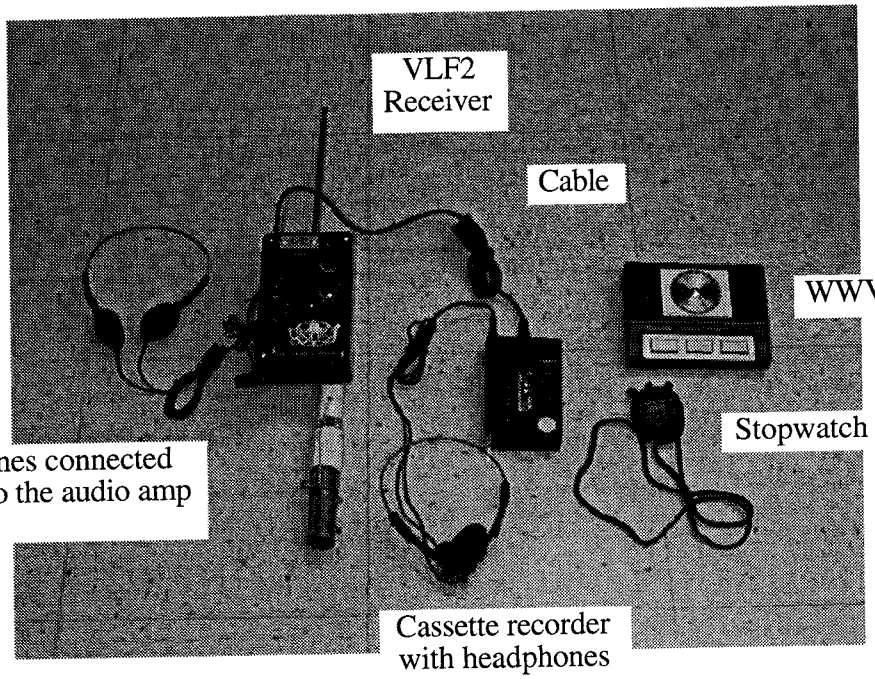


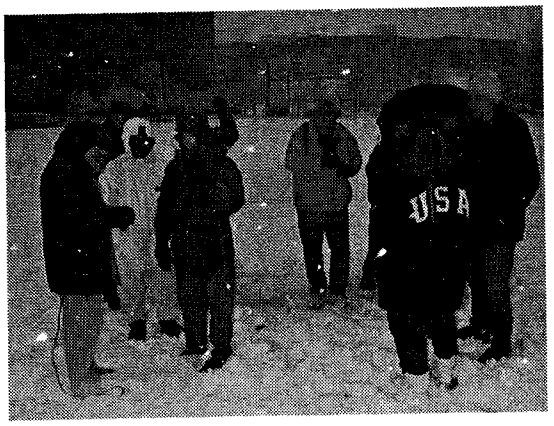
Allen Barwick of Woodrow Wilson High School in Washington DC and Fielding Gentry of Oakhill Milburn High School in Laurel, MD, try a little cooperative learning.



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

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





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

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

INTMINS OBSERVERS

Roster Update

The following is a roster of INTMINS observers including first-time observers. Team number assignments are permanent and will be used to refer to teams in the future.

North American observers:

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

European observers:

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

Additions to the roster of INTMINS Observers:

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

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

North American Teams:

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

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

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

21. Phil Hartzell — Aurora, NE

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

European teams:

E9. Dr. Valery Korepanov — Lviv, UKRAINE

Lviv Center of Institute of Space Research of NASU

Longitude:	24° E
Latitude:	50° N

The south outskirts of Lviv-city, approximately 400 m above sea level

Receiver:	INSPIRE RS4
Recorder:	Karpaty 205-1 mono, N1
Antenna:	1.5 meter whip
WWV:	
File code:	KOREPANOV UKR