The INSPIRE Journal

Volume 3 Number 1

November 1994

INSPIRE/Eclipse-94 Update

INSPIRE has received data from 32 research teams from the United States, Canada and Italy. Analysis of this data continues. With so many teams and literally hours of data received from each team, the analysis has proceeded more slowly than we originally planned. Bill Taylor has completed the preliminary analysis of the data from the first fifteen teams. He has made two or more spectrograms for each team and individual reports have been sent to each team. Preliminary analysis of the data from the remaining teams will be conducted by Bill Pine, but this analysis has not yet begun.

After preliminary analysis of the data from each team is completed, then the final analysis of all of the data can be done. This will consist of examining the data to determine if any identifiable changes in natural VLF radio propagation can be attributed to the eclipse. A report on the results of this final analysis is scheduled for the May 1995 issue of the *Journal*.

Table of Contents

INSPIRE/Eclipse-94 Update 1

Host an INSPIRE Workshop 3
Journal Subscription Status
Receiver Kits Available Now

e-mail Addresses for The INSPIRE Project, Inc., Officers 4
Future INSPIRE Projects
Free Data Analysis Available

Schedule for Special Observations 5
By John Edwards, Nichols Research Corporation, Vienna, VA

INSPIRE 6
By William W. L. Taylor, INSPIRE President, Washington, DC

INSPIRE/Eclipse-94 Data Sites 16

Letter from Data Analyst Bill Taylor to INSPIRE/Eclipse-94 Participants 17

Eclipse Day and Some More Goals 18
By Flavio Gori, INSPIRE European Coordinator, Florence, Italy

GOES Satellite Infrared Image of Cloud Cover on Eclipse Day - May 10. 1994 21

INSPIRE/Eclipse-94 Data Log Summary 22
By Bill Pine, INSPIRE Secretary/Treasurer, Ontario, CA

INSPIRE Order Form 45

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Volume 3 Number 1
November 1994

The INSPIRE Journal is the 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 physics 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. *The Journal* is published two times per year: November and May.

Contribution for the Journal may be sent to the editor at:

Bill Pine - Science
Chaffey High School
1245 N. Euclid Avenue
Ontario, CA 91762

e-mail: pinebill@aol.com

Deadlines: October 1 and April 1

Host an INSPIRE Workshop:

Thanks to a grant from NASA matched by a generous grant from Hughes STX Corporation, INSPIRE will be able to offer INSPIRE VLF radio workshops in your local area. The following describes what is involved in acting as local host for an INSPIRE Workshop.

INSPIRE Workshop Host Responsibilities:

1. Apply to INSPIRE for a Saturday date at least three months in advance.
2. Arrange for Workshop facilities:
   A. Classroom, multipurpose room or auditorium.
   B. Overhead projector and screen.
   C. VCR and monitor(s).
3. Publicize the Workshop to area schools.
   INSPIRE will provide school addresses and addresses of INSPIRE participants in your area.
   INSPIRE will also provide flyers, envelopes and stamps.
   Suggested workshop hours are from 9:00 AM to 5:00 PM with breaks between one hour sessions and a lunch break.
4. OPTIONAL: Provide refreshments on the day of the Workshop.

An INSPIRE Workshop host application have been provided with this issue of the *Journal* to those who requested one. If you would like an application or more information, please contact Bill Pine at the address shown on Page 2.

Journal Subscription Status:

Inserted with your copy of the *Journal* is a memo indicating the status of your subscription. If you have renewed, you will receive the next three issues of the *Journal*. If you have not renewed, this will be your last issue. I certainly hope that you will renew if you have not already. Use the INSPIRE order form on the last page of the Journal. Thanks.

Receiver Kits Available Now:

INSPIRE RS4 receiver kits are now in stock and available for immediate delivery. Please use the INSPIRE order form on the last page of the *Journal.*

e-mail Addresses for The INSPIRE Project, Inc., Officers:

Dr. William Taylor	President	wtaylor@nhqvax.hq.nasa.gov
James Ericson	Vice President	(no address at this time)
Bill Pine	Secretary/Treasurer	pinebill@aol.com

Future INSPIRE Projects:

The latest information on the tethered satellite mission (TSS-1R) from the Space Shuttle is that the payload is scheduled for spring of 1996. The Italian research team which is conducting the experiments has determined that due to funding limitations, only operations listed in the original timeline will be conducted. That means no operations will be scheduled over the United States. Some of the operations will be conducted over Italy and European INSPIRE observers, coordinated by Flavio Gori, will make VLF observations on the ground.

Since no space-based opportunities are available now, INSPIRE has developed an observation program that all INSPIRE participants are invited to join. See the article by John Edwards on Page 5 of the *Journal.*

Free Data Analysis Available:

Chaffey High School is offering free data analysis to all INSPIRE participants. Just send your data tapes and logs to Bill Pine at the address listed on Page 2. Include any notes or comments that will help the analysts provide what you want. A written report complete with spectrograms will be sent. If you want your tapes returned, please include an envelope with the appropriate postage. Estimated turnaround time is 3-4 weeks.

Data may be recorded at any time. If you follow the "Schedule for Special Observations" as described by John Edwards on the next page, your data will be included in a report on the results of the observations.

SCHEDULE FOR SPECIAL OBSERVATIONS

by John Edwards

The lowest frequencies of electromagnetic waves that can propagate in the gap between the earth (which acts like a conducting plane) and the ionosphere (which also acts like a conducting plane) are determined by the density of ions and electrons at the bottom of the ionosphere. This, in turn depends on the rates at which ions are formed--mostly by absorption of ultraviolet sunlight--and at which they recombine with electrons. The recombination processes have to do with the way electrons collide with ions and with neutral molecules, so the rates depend on the atmospheric density and composition at relevant altitudes. The ionization rate is most strongly influenced by the amount of sunlight falling on a given part of the earth. This principle motivated last spring's observations during the annular eclipse of May 10: depriving a region of sunlight must cause the "cutoff frequency"--the frequency of the lowest propagating electromagnetic waves--to be reduced. The data taken during the eclipse clearly show this cutoff lowering effect because we were fortunate enough to have thunderstorms in Texas at the height of the eclipse, and well inside the zone of deprivation. Sferics originating far from the deprived zone would show spectra with lowest frequencies determined by the highest cutoff frequency for regions through which they have propagated, because the lower frequencies would be killed off *en route*. Only signals produced by storms within the deprived zone could demonstrate the lower cutoff.

Despite a continuing effort to identify space missions and natural events with significant consequences and opportunities for audio-frequency observations, not every year is blessed with such events. There are, however, "bread and butter" observations that can prove valuable as the INSPIRE group expands its analysis capabilities. One thing that is clear from the data taken during the eclipse is that simultaneous obvservations from many stations scattered around the country have special value. So we propose scheduling a few particular days--actually, particular hours--for dedicated observing. Because the flux of ultraviolet light hitting the atmosphere is so vital to the propagation channel, it would be interesting to take data close to the winter and summer solstices, when that flux is smallest and largest over the United States. The vernal and autumnal equinoxes are also interesting because they represent "average" lightfall. With all this in mind, we ask participants to organize observations at the following times:

Friday, December 28, 1994	1:00 to 2:00 p.m. EST
Friday, December 28, 1994	5:00 to 6:00 p.m. EST
Saturday, March 18, 1995	2:00 to 3:00 p.m. EDT
Saturday, March 18, 1995	6:00 to 7:00 p.m. EDT
Saturday, June 24, 1995	2:00 to 3:00 p.m. EDT
Saturday, June 24, 1995	8:00 to 9:00 p.m. EDT

The mid-afternoon observations are scheduled so that the sun is at its peak over the central United States. The evening observations are near sunset, which is often a very active time for receiving whistlers.

INSPIRE

by William W. L. Taylor

President, The INSPIRE Project, Inc.

ABSTRACT

INSPIRE (Interactive NASA Space Physics Ionospheric Research Experiment) is a non-profit scientific, educational corporation whose objective is to bring the excitement of observing natural and manmade radio waves in the audio region to high school students. Underlying this objective is the conviction that science and technology are the underpinnings of our modern society, and that only with an understanding of science and technology can people make correct decisions in their lives, public, professional, and private. Stimulating students to learn and understand science and technology is key to them fulfilling their potential in the best interests of our society. INSPIRE also is an innovative, unique opportunity for students to actively gather data that might be used in a basic research project, as is being done with INSPIRE data taken during the recent flight of SEPAC on ATLAS 1. INSPIRE began with a test bed project, ACTIVE/HSGS, which involved 100 high schools, with a centerpiece of making observations of transmissions from the Soviet ACTIVE satellite. The second major project was support to SEPAC in which 1,000 schools participated.

The next major project was focused around the annular solar eclipse on May 10, 1994. Participants (students, teachers, etc.) observed radio waves before, during, and after the eclipse to study the effects of reduced solar UV on the ionosphere and its ability to support propagation of audio frequency radio waves.

Helping teachers and students to make regular observations in another important component. This base effort includes annual fall and spring observing campaigns and publication of a biannual periodical, the *INSPIRE Journal.* State or regional Workshops are also planned.

1. Introduction

INSPIRE is a five year old organization whose objective is to bring the excitement of observing natural and manmade radio waves in the audio region to high school students and give them a new appreciation for science and technology. It also is an innovative, unique opportunity for students to actively gather data that might be used in a basic research project, as is being done with INSPIRE data taken during the recent flight of SEPAC (Space Experiments with Particle Accelerators) on ATLAS 1. INSPIRE began with a test bed project, ACTIVE/HSGS, which involved 100 high schools, with a centerpiece of making observations of radio waves transmitted by the Soviet ACTIVE satellite. While the ACTIVE radio wave transmissions were much weaker than expected because of an antenna failure, HSGS was a huge success, measured by the participation and enthusiasm of the teachers and students involved.

INSPIRE then decided to support the SEPAC investigators on ATLAS 1 with radio wave observations made by 1,000 high schools. SEPAC transmitted audio frequency radio waves with a pulsed electron accelerator that might be observed on the ground. INSPIRE/SEPAC was an even bigger success, again, judged by the dedication, excitement and response of the students and teachers, even though SEPAC was only able to transmit once over the United States.

INSPIRE has proven to be a rewarding project for the students and teachers who have participated and it will continue. A series of regularly scheduled, coordinated observations of natural and manmade radio waves is planned, and the next solar/geophysical event chosen to build excitement in participants is the solar eclipse of May 10, 1994. INSPIRE/ECLIPSE–94 will organize coordinated observations before, during, and after the eclipse to study the effects of the decreased solar UV on the ionosphere and thus on the propagation of natural and manmade signals propagating in the Earth-ionosphere waveguide.

2. History

2.1 HSGS/ACTIVE

In 1988, the Space Research Institute of Moscow requested that NASA participate in its upcoming ACTIVE (not an acronym) project. ACTIVE was a satellite launched in 1989 with a 10.5 kHz transmitter onboard to study wave-particle interactions and the propagation of VLF waves. NASA responded by appointing W. Taylor as the U.S. Coordinator, and authorizing a group of U.S. scientists to make ground observations and theoretical calculations relevant to ACTIVE.

A volunteer organization dubbed HSGS (High School Ground Station) was quickly established by Taylor; W. Pine, a high school physics teacher; and two amateur scientists, M. Mideke and J. Ericson. The objective of HSGS was to recruit high schools to help gather data on 10.5 kHz electromagnetic (radio) waves which might be observed on the ground. A large number of ground receiving sites were needed, both to enhance the probability of receiving the radio waves from ACTIVE, and to determine the propagation paths to the ground.

HSGS was envisioned as a test bed with several objectives. The first was to see whether high school classes could successfully complete a project that included mechanical and electronic construction and a rigorous data-gathering procedure. The second was to see if high school physics teachers could integrate the instructional material into their curriculum. NASA provided moral support and TRW provided financial support to defray the cost of the packages. The packages included an electronic kit and 161 pages of instructional material. The packages were developed and distributed to interested high schools in California, Ohio, Maryland, Virginia, and the District of Columbia.

Many of the schools that received kits successfully operated them, recording the data on cassette tapes for analysis. The transmitting antenna on the ACTIVE satellite failed to deploy properly, however, resulting in a decrease in signal strength of about 30 dB. Even though no waves were observed on the ground, the teachers reported a very high level of enthusiasm in their students. The teachers integrated the HSGS instructional material into their units on waves, electronics, radio, and the atmosphere. The student and teacher enthusiasm proved to HSGS that continuing such a program would be very useful in stimulating interest in science in general and space physics in particular among high school students. This volunteer organization evolved into INSPIRE.

2.2 INSPIRE/SEPAC

Following ACTIVE and the proof of the concept through HSGS, INSPIRE was formally organized and incorporated by W. Taylor, W. Pine, M. Mideke, and J. Ericson. The objective of INSPIRE was to incrementally increase high school participation by a factor of ten and to more or less permanently establish a set of high school physics classes (through teacher participation) around the country to make observations of radio waves in the audio region. SEPAC (Space Experiments using Particle Accelerators), a payload on the ATLAS 1 Spacelab mission, flown in March/April 1992, provided the initial enthusiasm for INSPIRE classes. SEPAC consisted of an electron accelerator and support instrumentation and performed many experiments in the ionosphere, including producing an artificial aurora and investigating the electromagnetic waves produced by a pulsed electron beam (a virtual antenna).

W. Taylor is a SEPAC Co-Investigator and is the leader of the virtual antenna experiments on SEPAC. The ATLAS 1 payload did not include a subsatellite to receive the waves from the SEPAC virtual antenna, so the logical alternative was to establish a set of ground receiving stations to receive the radio waves. INSPIRE provided that service to the SEPAC investigator team, and at the same time, allowed high school students the opportunity to take data that would be used in a published basic research project.

To publicize INSPIRE, the project sent invitation letters to "The Physics Teacher" at the 10,000 largest high schools in the U.S. (of about 20,000 total). In addition, articles publicizing INSPIRE were published in various journals[*Anonymous*, 1991a, b, c, d; *Ericson*, 1991a, b; *Mideke*, 1991; *Pine and Taylor*, 1991; *Reneau*, 1991; *Anonymous*, 1992a, b, c; *Taylor et. al*, 1992; and *White*, 1992]. More than 1,000 schools (10% of those solicited) responded with orders for the package. The package included an electronic kit, 250 pages of background and

instructional material, a[illegible]udio tape of expected phenomena and a promise to analyze any tapes that were sent to INSPIRE after the mission. Only the first 1,000 orders could be filled due to the limited resources available to INSPIRE. Figure 1 shows the geographical distribution of the participating classes.

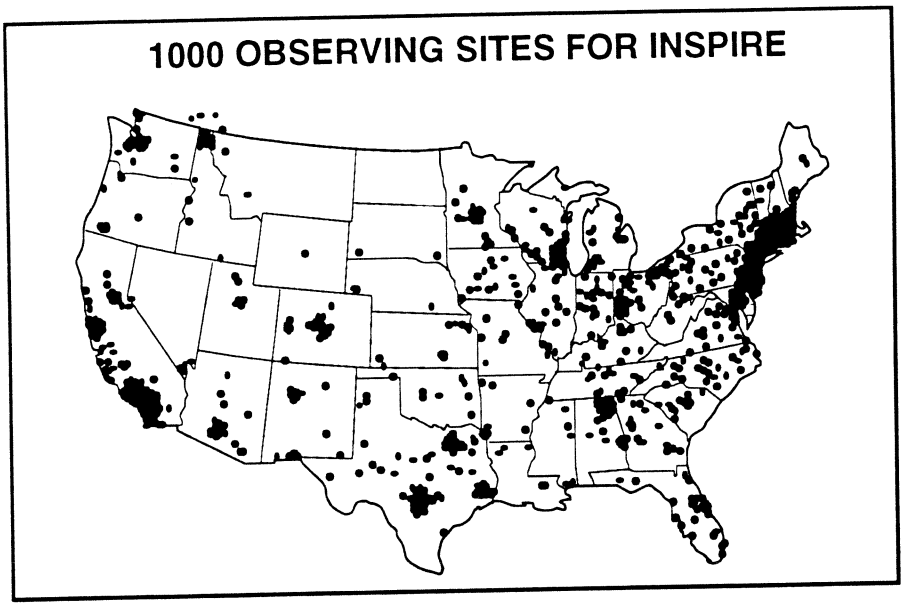

Figure 1. Locations of the 1000 high schools that participated in INSPIRE/SEPAC.

An elaborate information distribution network was established to inform the participants of the experiment schedule, including hourly announcements on WWV (the U.S. time and frequency short-wave radio station), announcements as needed on four electronic bulletin boards, and a toll-free telephone number with a recorded announcement that was changed as new information became available. W. Pine participated in mission simulations and the mission, to act as the INSPIRE focus during the mission at the Payload Operations Control Center. ATLAS 1 flew for about a week and the plan called for ten virtual antenna experiments over the U.S.

The electron accelerator failed on its second virtual antenna operation, but many of the high schools participated in the backup listening schedule to study the changes in sferic (lightning impulse) propagation at sunrise. Approximately 300 cassette tapes were sent to INSPIRE for analysis. Each of the participant classes who sent tapes received in return at least one spectrogram of the data they had collected, a personal letter from M. Mideke, who performed all the analysis, describing what they had observed, and a Certificate of Appreciation for participating. As with ACTIVE, the teachers and students were wildly enthusiastic about INSPIRE. The project gave them a means of relating the physics they learned in class to a real, practical experiment, and one that was being done cooperatively with NASA, using the Space Shuttle. Some classes also performed computer analysis of the signals they received.

The observations of one of the INSPIRE participants, D.Griffin, from Ridgefield, Connecticut, are being carefully analyzed by W. Taylor. The data show evidence that waves from the SEPAC virtual antenna were observed on the ground (see Figure 2). Other INSPIRE/SEPAC data will also be examined. The results were reported at the Kyoto URSI meeting in August 1993 [*Taylor, etal.*, 1993a] and will be presented at the Fall American Geophysical Union(AGU)meeting [*Taylor*, 1993b]. A publication is also in preparation [*Taylor*, 1993c].

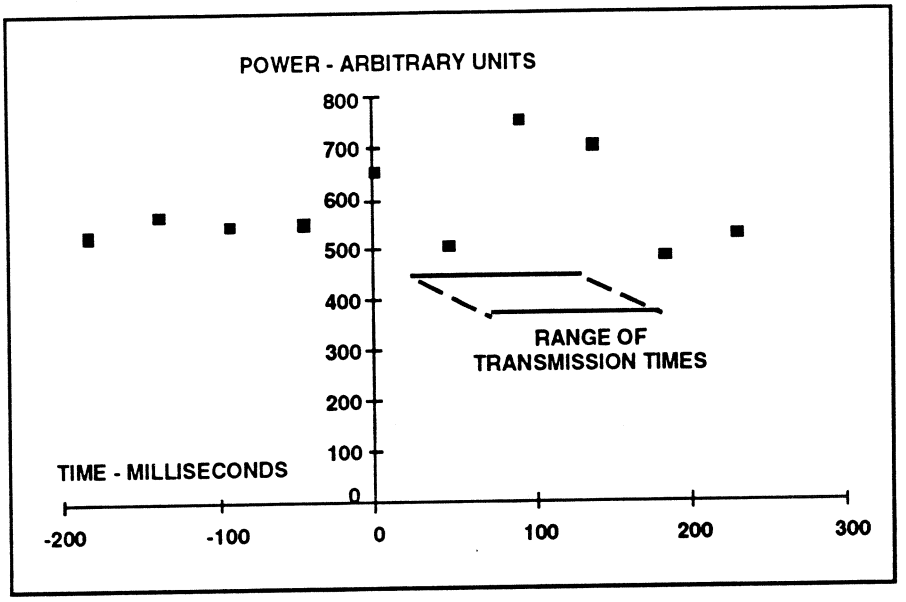

Figure 2. The average power received on the ground during the 140 transmissions during Functional Objective (experiment) 7-2.

After the success of INSPIRE/SEPAC, the officers decided to continue the INSPIRE project. Several activities have been identified. One is the *INSPIRE Journal*, W. Pine, Editor, published biannually, which, for a small subscription fee, describes INSPIRE activities and INSPIRE results. Another is a continuing coordinated observation campaign, in which participants across the U.S. make simultaneous observations to study the propagation of radio signals in the audio range. Examples are manmade signals such as the OMEGA and ALPHA radionavigation stations, and natural radio emissions such as sferics (the broad band electromagnetic impulses from lightning) and whistlers (frequency dispersed impulses from lightning).

INSPIRE has organized and participated in two workshops. One was held at Chaffey High School in Ontario, California in December 1990, to acquaint high school teachers and students with ACTIVE and HSGS. Fifty-four students and teachers from 17 high schools attended. W. Pine organized and ran the Workshop. While designed for schools in Southern California, one teacher attended from Washington, D.C.!

The second Workshop, this time for INSPIRE/SEPAC, was held at the Academy for Science and Foreign Languages, a public magnet middle school in Huntsville, Alabama, in March 1992.

Aimed at middle and high schools in Madison County, 40 teachers and others from northern Alabama attended. It was sponsored by the University of Alabama at Huntsville. W. Pine attended and spoke at the Workshop.

2.3 INSPIRE/ECLIPSE–94

On May 10, 1994, an annular eclipse swept across most of the U.S., with a maximum coverage of the sun of about 88 percent. Since the Earth's ionosphere is primarily created by solar UV, and since radio waves in the audio frequency region propagate in the Earth–ionosphere waveguide, it is natural to assume that the eclipse will have an effect on radio propagation and that the changes may be observable with INSPIRE or ACTIVE receivers. Therefore, the INSPIRE project decided to make INSPIRE/ECLIPSE–94 its next major observational objective. High school classes, through their teachers, were solicited to make observations before, during and after the eclipse. Table 2 shows the schedule for INSPIRE/ECLIPSE-94.

Item	1993	1994
Issue *INSPIRE Journal* Vol. 2, No 1	11/1	
Issue *INSPIRE Journal* Vol. 2, No 2		4/15
Eclipse		5/10
Tapes due to INSPIRE		6/1
Processed data returned to participants		8/1
Issue *INSPIRE Journal* Vol. 3, No 1 with results	11/1	

Table 2. INSPIRE/Eclipse–94 Schedule.

Kits and completed electric field receivers were offered for sale for about $60 (cost) to students, classes, teachers, amateur scientists and others to allow them to participate. Those with HSGS (magnetic field) or INSPIRE/SEPAC (electric field) receivers were able to use them, of course. Publicity for radio wave observations during the eclipse included Mideke [1993a; 1993b] and Taylor[1993d; 1993e]. Figure 3 shows the path of the eclipse in North America [Espenak and Anderson, 1993]. Everywhere in the contiguous 48 states experienced at least a 48 percent coverage of the solar disk as measured by the overlap of lunar and solar diameters.

Data was received from more than 30 observers. It is hoped that analysis of this data will reveal eclipse effects on the propagation of natural VLF radio signals.

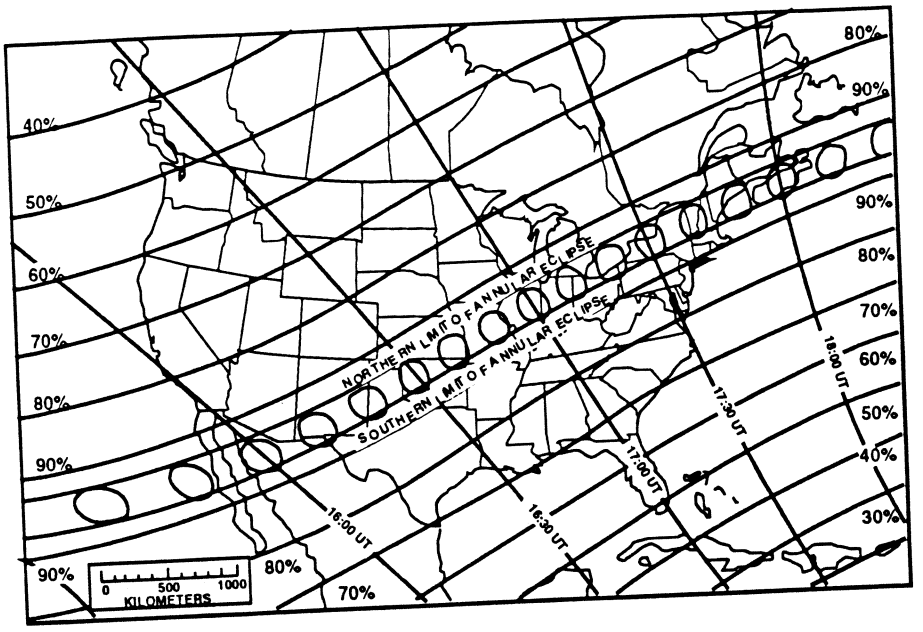

Figure 3. The path of the annular solar eclipse over North America on May 10, 1994. The percentages/maximum on the Figure are the overlap of lunar and solar diameters. From Espanak and Anderson [1993].

3. Plans for the Future

3.1 INSPIRE/Continuing

Through this proposal, the INSPIRE project will continue, rallying around opportunities for observations of special events, but with a base of activity to make U.S.-wide observations of natural and manmade phenomena. The *INSPIRE Journal* will be an important part of these activities. Plans are for it to be issued in November and April of each year with INSPIRE news, activities and results. In addition, more high school physics classes will be recruited to participate in INSPIRE, to learn about space and NASA through the study of the ionosphere, lightning, electronics, mechanical and electrical construction techniques, data gathering procedures, and data analysis. Spring and fall observing campaigns will be organized to observe natural and manmade phenomena. A schedule for INSPIRE for the next three years is given in Table 1.

Item	1994	1995	1996	1997
Spring Observing Campaign	4/1-15			
Issue *INSPIRE Journal,* Vol. 2, No 2	4/15			
Eclipse	5/10			
Fall Campaign		10/15-31		
Issue *INSPIRE Journal,* Vol. 3, No 1		11/1		
Workshops		11/1-3/1		
Spring Campaign		4/1-15		
Issue *INSPIRE Journal,* Vol. 3, No 2		4/15		
Fall Campaign			10/15-31	
Issue INSPIRE Journal, Vol. 4, No 1			11/1	
Workshops			11/1-3/1	
TSS-1R			11/15	
Spring Campaign			4/1-15	
Issue *INSPIRE Journal,* Vol. 4, No 2			4/15	
Fall Campaign				10/15-31
Issue *INSPIRE Journal* , Vol. 5, No 1			11/1	
Receive evaluations from teachers				1/1
Spring Campaign				4/1-15
Issue *INSPIRE Journal,* Vol. 5, No 2				4/15

Table 1. Three Year INSPIRE Schedule

INSPIRE is dedicated to providing opportunities to all interested students, and giving specific encouragement to those who are generally less interested in or less able to participate in scientific or technical fields. Special efforts will be made to encourage participation by disadvantaged schools as well. Several examples of this encouragement are:

(1) Jill Marshall, the San Antonio Coordinator, has and will make a special effort to involve young women's groups in Texas.

(2) The Society of Hispanic Engineers and the National Society of Minority Engineers has and will be encouraged to sponsor INSPIRE schools.

(3) W. Taylor will attend the NSF sponsored National Conference on Diversity in the Scientific and Technological Workforce to be held in Washington, D.C. on October 28-30, 1993, to promote wide participation. He has arranged to have a special meeting room available to recruit participants.

(4) Local Workshop organizers will be encouraged to have diversified role models participate in the Workshops, including, perhaps, the representative from the local power company,

(5) Organizers make a special effort to contact and encourage participation by local organizations, such as the Eastern Branch of the Boys and Girls Clubs of Washington, D.C.

INSPIRE plans to hold Workshops each year. The Workshops will be primarily organized by local teachers and volunteers and will be designed to offer an introduction to INSPIRE, its projects, kit building (sometimes the students and teachers do not have the expertise to build the kits without help), site location and data gathering procedures. A Workshop will usually be held on a Saturday, with INSPIRE participants (teachers and students) attending.

A typical Workshop agenda might include short talks by a national INSPIRE organizer, introducing INSPIRE, describing previous projects and describing the next projects; a talk by the local organizer; a talk about building kits; and a talk by a representative of the local power company. After the formal presentations, the Workshop would typically break up into small groups to discuss particular aspects of INSPIRE, to locate electromagnetically quiet sites, to build kits, to learn more about the phenomena that can be observed with INSPIRE receivers, and to learn about data analysis. A national INSPIRE representative will attend each Workshop as a resource person and to lend continuity to the Workshop.

3.2 Success Evaluation

Evaluating INSPIRE activities is a high priority. We have solicited comments from the HSGS participants and the INSPIRE/SEPAC participants, evaluated the comments and used the relevant ideas in subsequent projects. INSPIRE/ECLIPSE–94 will be no exception, with an evaluation questionnaire already planned to be included with the educational materials sent to all of the schools who participate. The teachers will be asked to return the questionnaire promptly after the eclipse. The results of the returned questionnaires will be tabulated and reported in the *INSPIRE Journal*. Vol. 5, No. 1 of the *INSPIRE Journal* will include an evaluation section, and recipients will be requested to complete and return it within two months. The results of the evaluation survey will be used to improve future INSPIRE activities and reported in the *INSPIRE Journal*.

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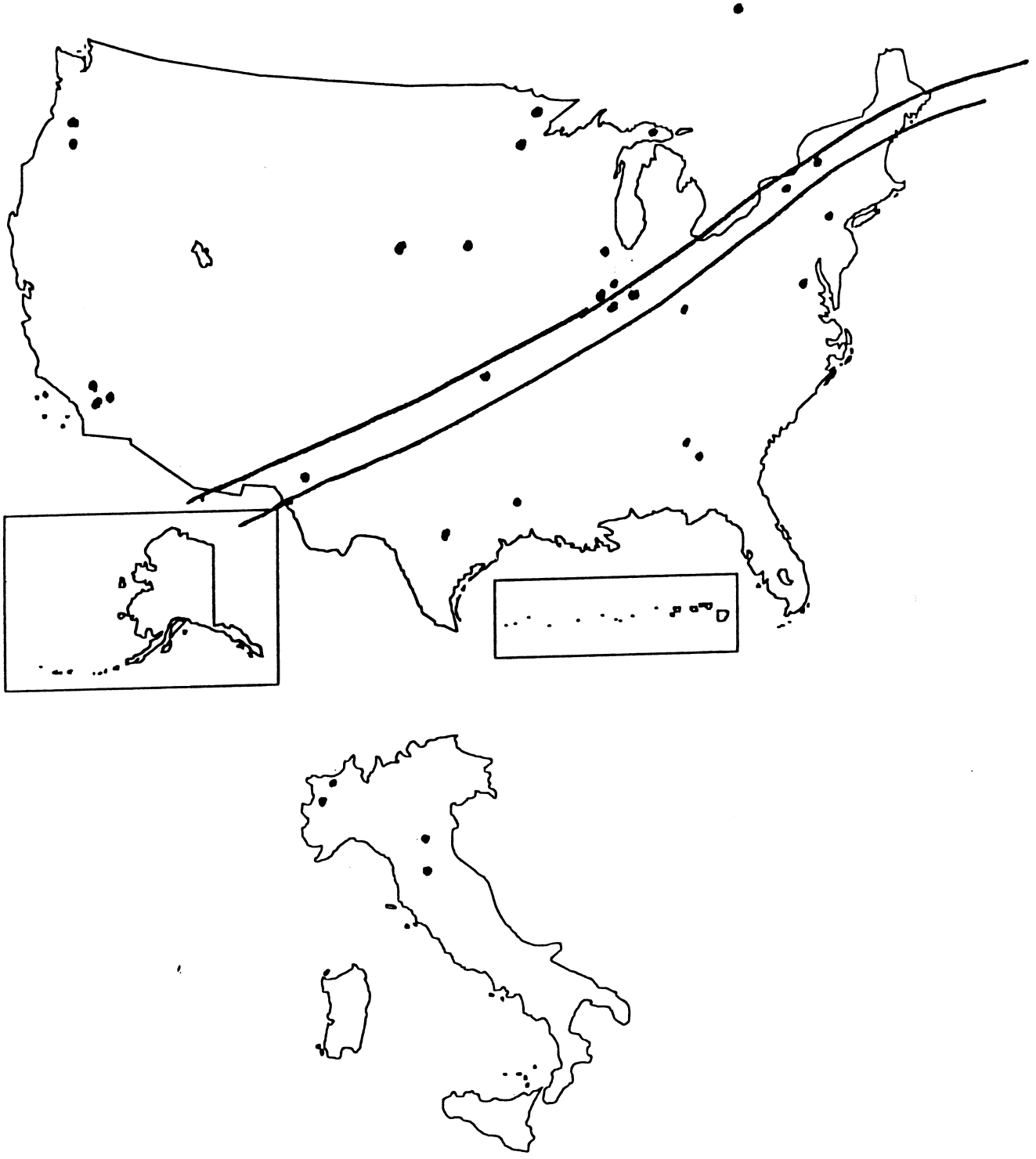
INSPIRE/Eclipse-94 Data Sites



Letter from Data Analyst Bill Taylor to INSPIRE/Eclipse-94 Participants

Dear INSPIRE/Eclipse-94 Participant:

First of all, let me thank you for participating in INSPIRE/Eclipse-94. The eclipse itself was a fascinating experience for all of us. Many were able to view the eclipse - with safe, indirect viewing, of course - in visible light, and many noticed the secondary effects of reduced illumination and decreased temperatures. During my INSPIRE observations on the Potomac River in Washington, DC, the temperature dropped about five degree Celsius and the light level was like looking through weak sunglasses. Perhaps the best part was talking to the fishermen along the banks, who all seemed to know that there was going to be an eclipse, but didn't exactly know what all was going to happen. They were fascinated that I was recording radio waves and a few even listened to my earphones for a while. I told them about eclipses and told them to look under trees for the indirect view of the eclipse in the crescent shaped images of the sun. We were all surprised at the large drop in air temperature during the eclipse.

We don't know how many groups of you participated in INSPIRE/Eclipse-94 observations, but INSPIRE has received about 50 sets of tapes to analyze. There were probably many other groups that took data, but analyzed it themselves. Some groups sent just one tape, most sent several, and a few sent four tapes. So our volunteer data analysis team has been busy this summer, analyzing data. We have just had time to make a first pass at the data, picking out some promising times from the tapes, digitizing them and creating some spectrograms.

Spectrograms are three dimensional plots with the independent variable, time, on the x-axis, frequency on the y-axis and the intensity of the waves at a particular time and frequency indicated by darkness. The time scale is minutes:seconds and the frequency scale is from 0 to 11 kHz. The title of each plot gives your initials, our number for your tapes, the tape type (e=eclipse, b=baseline, and s=supplementary), and the UT date and approximate time the data was recorded.

During the eclipse, there was a storm system over Texas. We believe that many of the sferics that you received were from lightning in this storm. We chose to make spectrograms of your data at times when the sferics from that storm would have to travel through the maximum annularity to reach you. We also chose times to analyze either well before or after maximum annularity for comparison. Copies of the spectrograms are enclosed and some comments on the data you received are given below.

The next step will be to quantitatively analyze the data to see if there were any discernible effects from the eclipse. The most common phenomenon in the radio spectrum over the audio frequency range is sferics, the impulsive radio signal containing all frequencies that is caused by lightning. Sferics sound like pops and are often called static. They travel in the earth's atmosphere, confined by the earth and the ionosphere. On spectrograms, sferics are the vertical lines. There are upper and lower frequency limits for sferics, since some frequencies are able to travel with little decrease in strength and others are absorbed and thus decrease in strength. These upper and lower frequency limits will be one of the measurements that will be examined for eclipse effects. For those of you who sent return envelopes for your tapes, we plan to keep your tapes for a few months for this analysis. If you would prefer to get your tapes back immediately, let me know and I'll send them.

The whole INSPIRE team congratulates you in your participation in INSPIRE/Eclipse-94 and we hope that you enjoyed and learned as much from the experience as we have.

Sincerely yours,

William W. L. Taylor
518 Sixth St., SE
Washington, DC 20003
Volunteer Data Analyst, INSPIRE

Enclosure: INSPIRE/Eclipse-94 spectrograms

Eclipse Day and Some More Goals

By Flavio Gori
European INSPIRE Coordinator
Florence, Italy

After some months spent trying to get together a good VLF group, the Italian INSPIRE people recorded 90 minutes to coordinate with our California colleagues eclipse time, 1515 to 1645 UT. Our purpose was to record control data to see how the eclipse might change something in VLF propagation.

I have to say that we didn't believe that we would be able to see much of the eclipse but after recording for an hour and a half, coming down from my recording site on a hill, I saw some astronomical amateurs watching the sun with cameras and telescopes. I stopped and waited for some minutes and could see a wonderful eclipse with the moon covering the low part of the sun.

The Italian VLF teams chose noise-free (almost) sites for recording. The site chosen by my group was some miles northeast of Florence, in the centre of Italy, about 2000 feet above sea level, with no trees in a range of 300 feet. The electrical lines were about 3500 feet away, but I heard a strong noise. Unfortunately, the same was true for the other friends involved in other parts of the country.

My station was a WR-3 receiver with a whip antenna and a Sony TCM 38 recorder. Marco Ibridi was with us as usual. He recorded with an RS4 receiver, a 20.5 foot wire antenna and a picket ground of about 1 foot. Marco was able to make sonograms on his IBM PC clone with his AE software for DOS. This is very important for Italian members since now it will be possible to get sonograms made in a short time. I believe that more of us will be trying to use this software. The first release of the software stops at 4 kHz and does not use the math coprocessor, but in the next version, I'm sure Marco will improve his product and we will inform you about his results. In another article ("INSPIRE/Eclipse-94 Data Log Summary", ed.) you will see Marco's sonogram showing a "drill" sound looking like an inverse whistler that Marco recorded at 1530 UT during the eclipse. As you can see, this product can show the time.

In my log you can see something about our recording session that, like the other Italian friends, we heard good whistlers (many but weak). Silvio Bernocco was the only one to record

the three days (before, during and after the eclipse day). He reports that only on the eclipse day was the very high whistler activity. It will be interesting to see if computer analysis of the tapes will confirm this.

Fabio Courmoz and Silvio Bernocco, Italian INSPIRE members, used an RS4 receiver to record. For the first time two Italian Technical High Schools were with us. I am very happy to welcome these Institutes since they come to us after some articles of mine in some Italian magazines and daily newspapers. This was one of my goals from the beginning: to try to involve young people in the INSPIRE program, hoping they will become the future (and the present) of the VLF research effort, not only in studying theory but in constructing receivers also.

Also shown is a figure showing the cosmic radiation activity during the eclipse. This data was gathered by Dr. Roberto Pozzo in northwest Italy. Dr. Pozzo has recently joined us and probably in the next session he'll be able to record the VLF, too. Roberto is the Chief of a small (but private) meteo-seimological net, the first and only one in Italy. His net is able to monitor five regions from north to south in Italy.

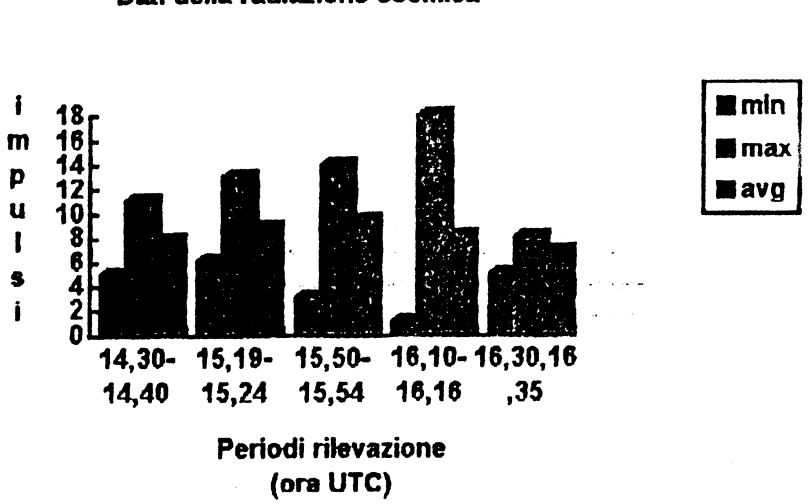


Figure. Cosmic radiation levels during the May 10, 1994 eclipse

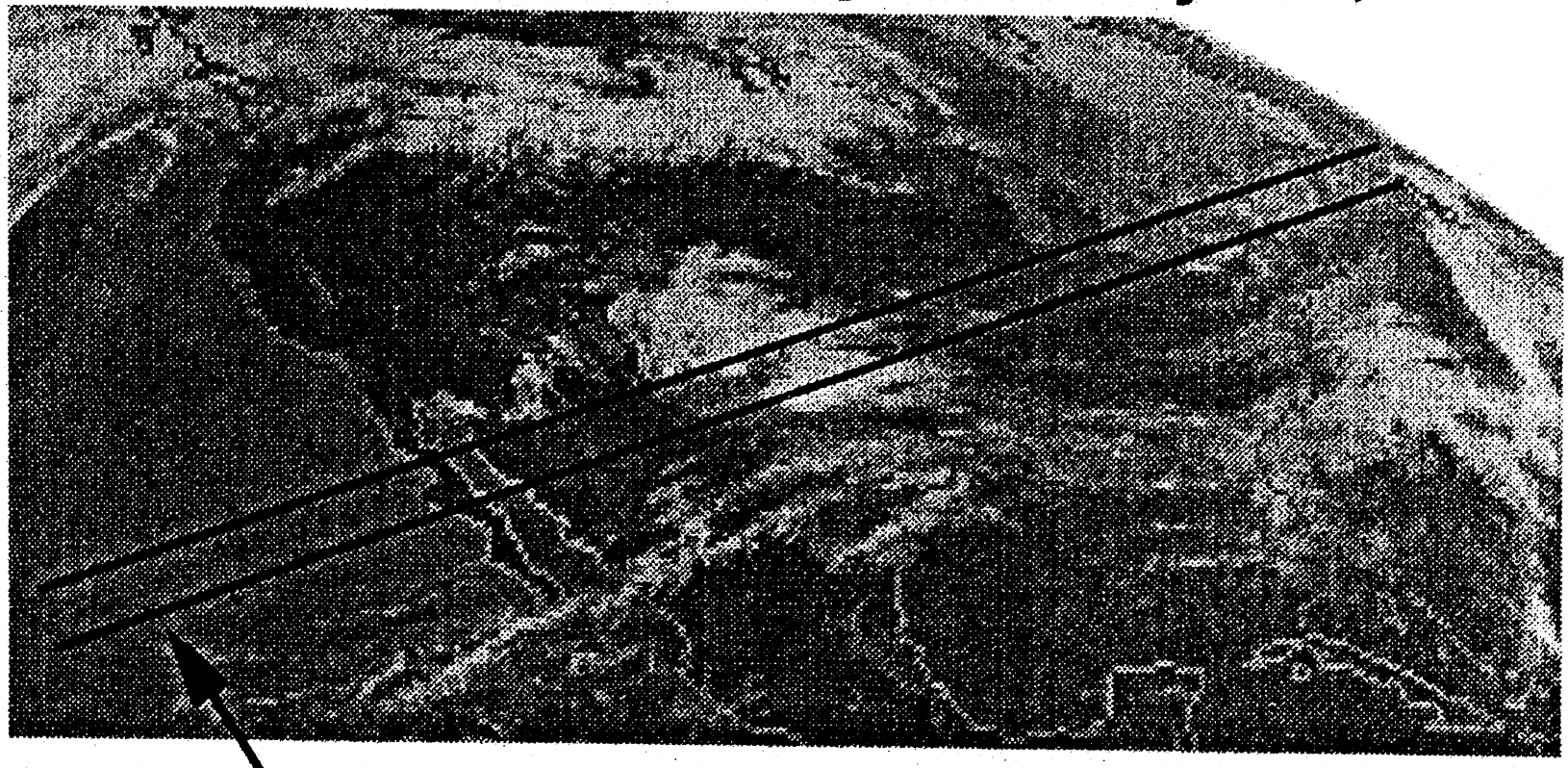
Our next work will be to monitor the "space-bang" in the middle of July when the comet Shoemaker-Levy will hit Jupiter, possibly with an incredible impact. I am expecting a big release of many electromagnetic forces in a large wavelength range from ULF to SHF. We are planning to record VLF from 07/15 to 07/20. Some friends who cannot record in VLF are planning to record some beacons in the HF and VHF/UHF ranges. Of course we'll let you know our results and the latest news about the eclipse.

In the middle of August we'll be looking again for meteor shower influences in VLF. As you know, this is not the first time we have done this. In the previous time we didn't hear anything, but we are still sure to find "something" in this range and so we keep on our research. Anyway, I think that two or three times are not enough to say (as some say) that something is there or is not there. In these sessions Jim Mandaville will be with us in Saudi Arabia and I hope

that also an INSPIRE member from Nigeria, Africa, Mr. Stanley Umoh Etienam-Umoh, will be with us. I did send a letter to him some weeks ago asking him to collaborate with us and I'm sure he will let me know something as soon as possible. Nigeria is a country in central Africa on about the same magnetic meridian as here in Italy. I believe it is very important to check the VLF radio propagation in the VLF range with Italy, Nigeria and Saudi Arabia, too. Let's hope to have this chance.

In the spring of '95 (or '96 as an Italian paper wrote) we'll be ready to follow the tethered satellite mission. I believe that this is a very important mission to monitor for the Italian people since the mission was designed and planned by an Italian. (Editor's note: The tethered satellite space shuttle mission, TSS 1R, is now scheduled for 1996 with operations planned over Italy.) The mission of this flight, to create energy in space, is very important since it will soon be necessary to produce energy in outer space for use there. I hope the Italian INSPIRE group will grow again and again becoming the biggest in the world. This mission will need a big Italian group.

Infrared Image of Clouds by GOES, During Annular Eclipse, May 10, 1994



INSPIRE/Eclipse-94

Data Log Summary

By Bill Pine
Chaffey High School
Ontario, California

As the data logs came in from INSPIRE eclipse observers last spring and summer, I was struck by the interesting variety represented by the submissions. There was variety in the backgrounds of the team leaders; there was variety in the quiet site locations; there was variety in logging techniques. What I have prepared here is a synopsis of the data information submitted by each team. Data has been gathered by 31 participants from 16 states in the Uited States plus four teams from Italy and an observer in Canada. Refer to the map on page 16.

The format used in the synopses is indicated below:

#. Location — Team Leader

E-time % coverage Latitude Longitude

Site: description

Receiver, Recorder, Antenna

Personnel:

Tapes recorded: B(aseline) E(clipse) S(upplemental)

Log notes: Codes:

S	sferics	O	OMEGA
T	tweek	M	time mark
C	chorus		
W	whistler		

(Items in parentheses are provided by the author.)

Comments:

1. Washington, D.C. — Bill Taylor

1726 UT | 85% | 38° 52' N | 77° 1.5' W

Site: Hains Point, Washington, DC; tip of island where Potomac and Anacosta rivers meet.

INSPIRE RS4 and ACTIVE receiver
Sony Digital Audio Tape recorder (one receiver on each stereo channel)
3 m vertical whip and 3 m loop antenna

Tapes recorded: B E S

Log notes: level set background = -9 dB; magnetic (ACTIVE receiver) left (channel); electric (INSPIRE RS4 receiver) right (channel)O; S; 1702 tone of unknown origin; 1711:13 W? (possible whistler); 1716 minimize tone by putting recorder on ground; 1931:40 W; 1944:58 W; 1945:46 W

Comments: Bill has found a quality quiet site in the middle of Washington DC! This site was described in detail in the May 1994 *Journal*.

2. Newton, Iowa — George H. Wilkening

1645 UT | 80+% | 41° N | --° W

Site: Farm field - open except for low hills N and W; power line approximately .25 miles East; mobile telephone relay station approximately .5 miles N.

INSPIRE RS4; Bell and Howell Model 3091; 2 m rod.

Personnel: Physics II class Newton High School; Joe Benesh, Phillip DeMeyer, Arvin Hetley, Brad Hitchler, Jamie Skinner, William Smith, Matthew Young

Tapes recorded: B E S

Log notes: 1127(time not UT?) sferics; sferics are up; tape recorder stopped 2-3 sec @ 1137:15; 1138 whistlers;1139 whistlers gone; 1143 sferics normal, tweeks constant; 1203 intense sferic; 1517 few whistlers; 1518 whistlers still audible every 10-15 sec.; 1520 whistlers in background; 1534:05 whistlers; 1543 large sferics (occasionally), faint whistlers; 1546 cyclic humming; 1611 strange hum; 1615 tweek; 1621 sferics, tweek, hum; 1655 flipped tape; 1712 whistlers in chorus @ 12:25 - 40; 1716:32 whistlers; 1725 loud beep; 1729 strange buzzing; 1730 surging sferics; 1742 squeeking tweek twice; 1745 a waspy sound; 1750 Omega? tweeks, sferics; 1631 whistler possible @ 31:40; 1645 tweeks increasing in number; 1649 tweeks seem to be louder; 1706 intense sferics; popping sferics (individual); 1708 same old, same old

Comments: George and his students made a log entry each minute. This meant that many of the entries were "Same" and "Normal", but the logs were very detailed and it is unlikely that they missed anything significant. Good job, Newton High School!

3. Aurora, Nebraska — Phillip D. Hartzell

1645 UT | 88% | 41° 00' N | 98° 00' W

Site: 2 mi. NE of Aurora, 3500 population town; .25 miles from home; relatively high mound overlooking country, no trees within 1000 ft, small lake below, native grass

INSPIRE RS4, Radio Shack CTR-69, 2 meter 5/8 vertical whip (High pass filter OUT)

Tapes recorded: E

Log notes: 1600 S OMEGA is weak, slight microphonic from wind on antenna; 1603 switch high pass to off, S seem louder; 1604 poss. slight signal from Silver Creek NE? 48 kHz; 1605 S are solid - audio does sound well; 1608 strong S crash; 1611 very strong S crash; 1613 moderate S burst (no tweeks heard yet); 1630 it is getting a little dark - like a hazy day; 1631 recorder pop - bird hit my antenna on car!!; 1634 wind has subsided - microphonic better - quiet; 1635 48 kHz Silver Creek has stayed barely audible; 1641 hiss burst! lasting 1 sec; 1646 side B of tape - E-max now; 1649 more hiss burst - S strong; 1650 levels do resemble sunrise or dusk; 1705 has S drowned out 48 kHz? Seems I can't hear it; 1711 strong 2 or 3 S - OMEGA present; 1720 25% sun coverage, S increasing in number? Intensity has fallen on recorder; 1723 have not heard a solid tweek today!; 1724 hiss burst haven't heard in several minutes.

Comments: Phillip is an Extra Class Amateur operator (KA0KST) with 34 years experience. He reports that he has increased the audio out from his RS4 since Mar-26-1992 (the time of SEPAC) and he has consistently heard whistlers since. (Ed. note: Phillip, how did you soup up your receiver? Did you alter the frequency response range in the process? Let me know and I will pass it on - Thanks!)

4. Commerce, Texas — Dr. Jack Lamb

1630 UT | 87% | 33° 14'49" N | 95° 53'59" W

Site: Farm road between two fields north of Commerce; large open field with no electric lines nearby

INSPIRE RS4, Realistic CTR 70, Whip

Tapes recorded: B E S

Log notes: From Jack: "Enclosed are my log sheets and cover sheet for the event. Some of the time marks are a bit late because I was busy taking pictures and lost track of time. I hope that does not make my tapes unusable." (The tapes are fine. If you are late with a time mark, say so on the tape. For example: 1625 UT Mark 10 seconds late. - Ed.)

"I do not consider myself good enough at distinguishing between the sound of whistlers, tweeks and sferics to mark them on the log when I heard them. Suffice it to say, there seemed to be a lot of radio action during the time I made these recordings. There were crashes, pops, and snaps all over the place. I did not hear any whistlers I could be sure of ..."

Comments: Typed logs! "Crashes, pops and snaps" are perfectly valid terms for logging purposes! Jack also sent some photos of the eclipse. Some hazy clouds rolled in right at eclipse maximum, but even those photos showed the eclipse well. Thanks!

5. Oak Park, Illinois — Jim Stankevitz

1702 UT 94% 40° 58' N 87° 35' W

Site: Open, flat field in conservation area, grasses/small bushes/one tall tree 100' away

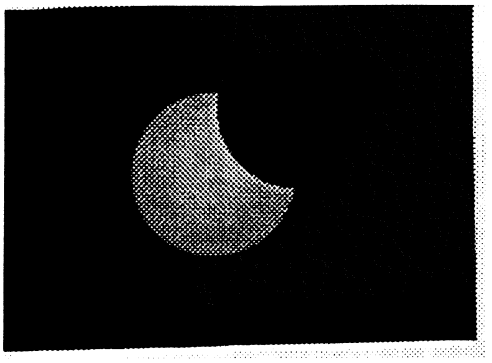
INSPIRE RS4, Aiwa CA-W37, Whip

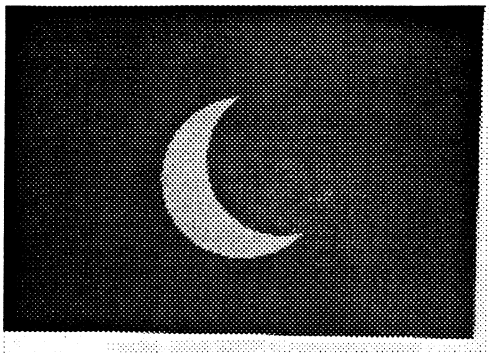
Personnel: Alex Bakunas, Scott Meister, Keith Tyrka, Jason Villalobos, Matt Womack

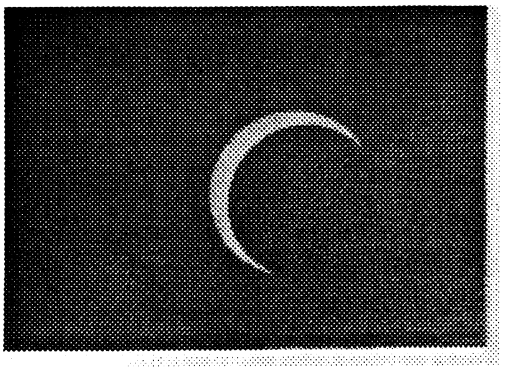
Tapes recorded: E S

Log notes: 1515 M, S: Moderate, C: Distinct, O Moderately strong; 1521 C or faint W??, S:Continuous, O: Distinct; 1533 C: "Like fizzing soda pop", O, S: some intense; 1542 W: Faint, 2-hop?, C: Strong, O, S; 1546 W, C: easily heard, O S; 1553 C: "Upward spiraling fizzing"; W, Bumblebee flyby, O, S; 1554 W, C, O, S; 1555 W, C, O, S; 1600 M, C, O, S, W; 1610 M, W: two bu faint, C, O, S; 1617 Bumblebee flyby, C, O, S; 1619 W: faint; 1620 C: Still distinct, O: Strong and clear; 1625 C: More intermittent, weaker; 1630 M, Feedback -oops, W; 1632 C: Strong again, O, S; 1652 W: Three faint; 1653 W, S: Heavy; 1655 W, S: Lighter, C: Stronger; 1657 W; 1700 Annularity began at 17:00:23; 1705 W, Annularity enede at 17:05:43; 1706 W: Two-hop?, W: One hop, S: less, C: Faint; 1725 C: Easier to hear due to reduced sferics; 1732 C: More swishing than fizzing, S, O; 1734 C: Back to fizzing and strong at times, O, S; 1749 W: Very strong but 'swishy', 2-hop and echo - 4-hop?; 1751 C: Constant, swishy, S: Continuous, O; 1756 WWV receiver 'bleed over' - oops; 1758 C: or swishy W, Hiss: Very strong; 1801 Hiss: Intense, then fades in and out, C; 1813 C: Approaching whistler intensity and length!

Comments: Typed logs! Jim and his students did a good job of describing what they were hearing - even though that sometimes involves making up your own descriptions.







Eclipse photography by Dr. Jack Lamb. (Team 4)

Photo at E-time (at left) is through some hazy clouds that came through at that time.

Sebeka 5th graders (Team 6) look at the eclipse and work on recording VLF radio waves. The radio is taped to a fence post that we planted for the occasion. There are grounds (short pieces of copper pipe) in addition to the post. The wore spool served as a table and the tape recorder sits on it. The antenna was a long wire exten- ding out of the picture to the right.

Photo by Barb Ranson

6. Sebeka, Minnesota — Barb Ranson

1650 UTC | 75% | 46° 36'52" N | 94° 57'56" W

Site: Tree farm, 1 mile S and 7 miles E of Sebeka, MN; about 1 mile to power lines

INSPIRE RS4, GPX Monaural with ALC ($19.95 special), long wire ~ 65'

Personnel: Terra Dallman, Christian Workman, Miles Kuschel, Andrew Martin

Tapes recorded: E

Log notes: 1602 Chorus and lightning static; 1605 some tweeks, mostly chorus and lightning static; 1604 an OMEGA signal - faint; 1620 chorus occasionally and fading out; 1629 noticeably cooler and slight breeze; 1631 closed car door - can hear on tape; 1633 Mark - some wind noise on tape, chorus; 1656 can hear OMEGA - 1 channel - or ALPHA? - about every 10 sec. Frequency is high in audio range; 1713 second OMEGA channel faintly audible briefly, continuing static, chorus, OMEGA; 1718 Tractor running about 1 mile away but can't hear on tape; 1732 Wind noise??, continuing chorus and static.

Comments: From Barb: "This tape has great chorus, especially in first 10 minutes, but no distinctive whistlers. Faint OMEGA after 1654 UT and occasional wind noise after 1732 UT." Barb also sent a photo of her team which is made up of fifth graders! Some of these kids were also involved in SEPAC two years ago!

7. St. Cloud, Minnesota — Eric R. Mildebrath

1656 UT | 80% | 45° 31' N | 94° 16' W

Site: The site is on the access path to a large alfalfa field about .4 miles from the nearest power line.

INSPIRE RS4, Radio Shack CTR-69, Homemade 10 ft. helically wound vertical whip antenna mounted on a pickup truck, Ground is driven stake connected to 50' diameter counterpoise spread under antenna.

Tapes recorded: B E S

Log notes: 1633 WWV time mark. Almost continuous relatively loud chorus, light sferis average about 25 per minute, lots of wind noise, noted cars passing on nearby road generate noise on the recording; 1713:25 Weak, pure note whistler; 1515 Almost continuous chorus. Weak sferics with few pops and clicks throughout; 1525 Switched High Pass filter to IN; 1601:04 End of Side A recording. Turned tape to continue with Side B 'Supplemental' tape; 1602 WWV time mark to establish timing on Side B, chorus continues with same sferics

intensity.; 1610:41 Stopped recording to switch to the 'Eclipse' tape; 1630 weakening chorus; 1700 Very quiet chorus, occuring only randomly. Sferic static continues the same; 1736 Chorus amplitude and frequency of occurrence is increasing; 1745 Started tape again after 'Eclipse' tape, no noticeable chorus, static type sferics continue; 1749:41 Two whistler-type swishes less than one second apart; 1802:47 Chirp - like a wolf whistle; 1804 More frequent chirps, low frequency. Sounds different than chorus. Background noise increased to steady rush of broad frequency spectrum noise. Chirps continue randomly; 1822:12 End of tape; 1633 Wind vibration noise; 1647:48 Very weak, short period chorus; 1713 WWV time mark. Static sferics continue throughout. Very short periods of very weak chorus.

Comments: Typed logs! Eric's logging technique involves breaking the time into five minute intervals and describing what ia happening. Anything remarkable is logged at the exact time it occurs. This seems like a real good system.

8. Croton, New York — Mike Aiello

1736 UT 92% 41° 18' N 73° 46'45" W

Site: Scenic overlook parking area, overlooking the Hudson River just south of the Bear Mountain Bridge

INSPIRE RS4, Marantz PMD 340 stereo recorder, 6 foot whip on 6 foot mast

Tapes recorded: E S

Log notes: 1526:45 Broadcast IM noise first apparent - switch in HP filter; 1533 engine noise; 1616:30 Extended section of engine noise - several cars; 1630 V(oice)T(ime)M(ark) S: medium O: strong IM and engine noise present; 1647:45 W: possible? very weak; 1743-1747 W: counted 4 weak whistlers; 1747:28 W: medium distinct; 1751-1759 W: counted 12 whistlers varying from weak to medium; 1810 VTM S: medium O: medium, some IM noise

Comments: Typed logs and impressive format. Mike made detailed general comments at the beginning of his logs. Sample: "The data is recorded on the left channel only and is characterized by several recurring noise sources. There is persistent recognizable IM source that must be some sort of commercial broadcasting signal because snatches of voice and music can be heard in it. The level of this noise varied considerably over the duration of the recording - it was entirely absent at times and never overshadowed the natural sounds. ... Natural sounds on the tape were mostly a fairly constant level of sferics with occasional heavy bursts. However, for a period of time extending from 17:42 - 18:04 UT, I heard over 20 whistlers ranging from weak to medium strength. Aside from this period, no other unusual sounds occurred."

9. Toledo, Ohio — Mikell Lynne Hedley

1709 UT 94% 41° 52'4" N 83° 27'8" W

Site: LaSalle, Michigan, open field, elevation 600 ft.

INSPIRE RS4, Realistic CTR69, 6 foot whip Radio Shack 270-1408

Personnel: Central Catholic High School students: Matt Teal, Adrienne Yarberry, Angela Rashleigh, Mark Demko, Scott Jagodzinski, Kris Ross, Mike Kristie, Erin Lane, Steve Koralewski, John Schurrer, Joel Denny

Tapes recorded: E S

Log notes: 1539 M S clusters; 1635 S one isolated; 1700 M S: cluster, radio station received; 1705 S: cluster, high pitched hum; 1709 M S: cluster, eclipse full circle; 1739 S: cluster W: one isolated

Comments: Also included with the data logs were plots of temperature as a function of time and light intensity (in candelas) as a function of time. The light readings dipped exactly at the time of maximum eclipse, with another dip about 40 minutes prior to that time due to a passing cloud. Temperature readings showed a dip that lagged a few minutes behind eclipse time.

10. Brown Deer, Wisconsin — Mark Mueller

1658 UT 94% 40° 15' N 88° 05' W

Site: Kickapoo State Park near Kantoul, IL; wooded area surrounded by very flat farm land

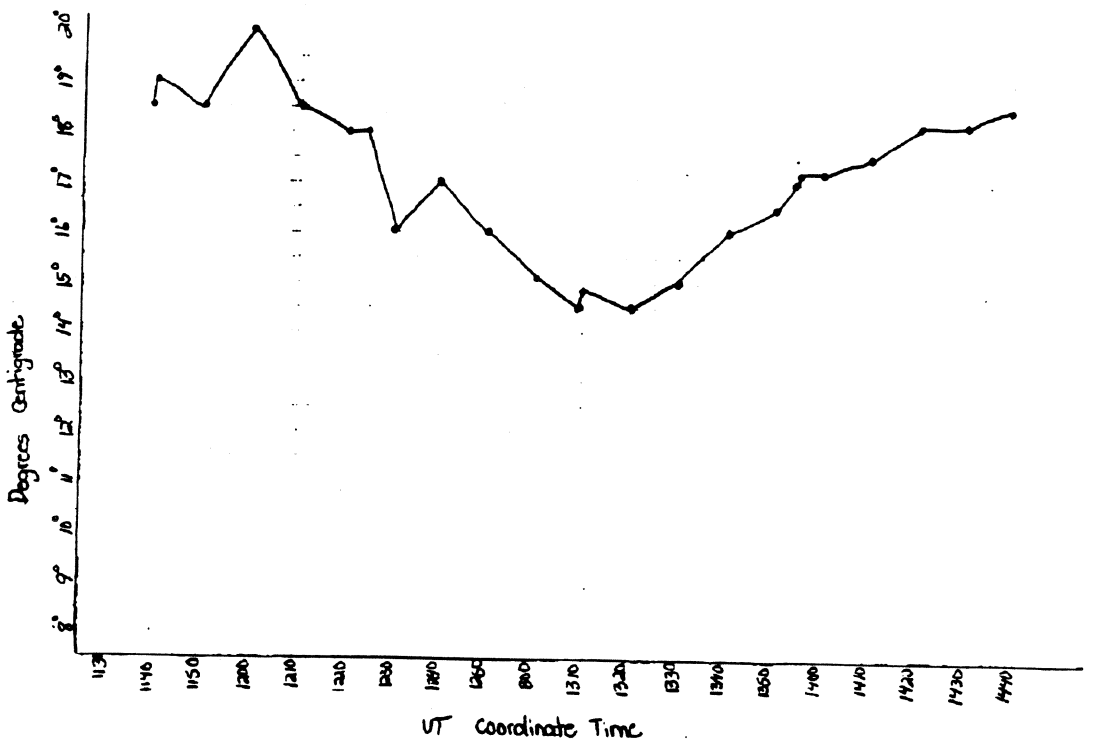
INSPIRE RS4, Realistic CTR-80, 2 meter whip

Personnel: Brown Deer High School team: Mark Mueller, Jason Lohn, Michelle Banot

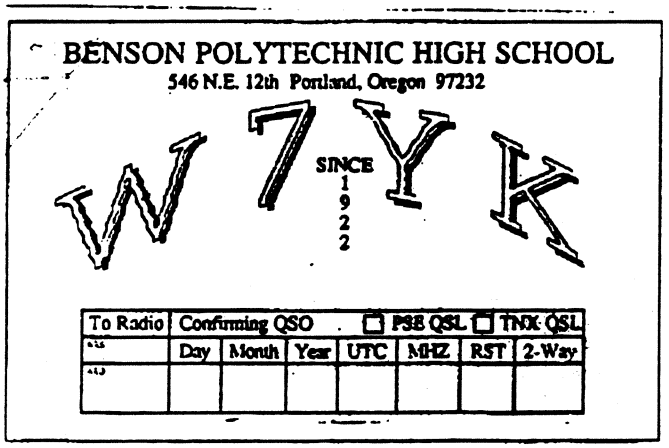
Tapes recorded: E

Log notes: 1620:54 S Time was given as 11:20:54 CDT; 1630 WWV message on the half hour S; 1659 S Annularity 1658-1704; 1750 S Time not audible

Comments: Kickapoo State Park is the only park with camping in Illinois and on the center line; several hundred astronomers were there; high pass filter was used due to buried power lines in the campground.



Temperature graph during the eclipse. Made by the Central Catholic High team of Toledo, OH (Team #9)



Team #16. Amateur Radio Club of Benson High School, Portland OR

Gil Brentley, Advisor

11. Donovan, Illinois — Edward J. Mossman

1705 UT 98% 40° 51' N 87° 39' W

Site: Iroquois County Road 2300N, 2500E; open field, elevation 665'

INSPIRE RS4 (Radio #1), GE 3-50160 Slim Line, 6' whip

Personnel: Donovan High School team: Karen Bush, Lacie Fanning, Mary Sue Laird

Tapes recorded: E S

Log notes: 1515 M WWV Radio - O - Background S heavy - lightning static moderate; 1521 Feedback from amplified speaker; 1540 No change in conditions - although can no longer hear O; 1545 Missed regular M will pick it up at 1546 - open mike; 1608 Possible intermodulation from local radio station; 1701 S becoming quieter again, light to moderate; S light - lightning static light to moderate - possible the start of background hiss; 1740 S becoming heavy - lightning static moderate; 1809 Possible hiss in the background or whistlers - can not tell for sure S too overpowering; 1811 Background hiss or possible whistlers - cannot tell S too overpowering.

Comments: Typed logs! Donovan High School placed two receivers in the field for Eclipse-94; the two receivers were at the same location using slightly different equipment. See Team 12 report.

12. Donovan, Illinois — Edward J. Mossman

1705 UT 98% 40° 51' N 87° 39' W

Site: Iroquois County Road 2300N, 2500E; open field, elevation 665'

Homemade RS4, Panasonic RQ-2102 Slim Line, 6' whip

Personnel: Donovan High School team: Mike Anderson, Nick Larsen, Lucas Martell

Tapes recorded: E S

Log notes: 1515 M WWV radio - S light - Pulsating tape noise on recording; 1524 Possible antenna interference by the wind that has picked up; 1525 M voice - S light - O - possible intermodulation from a local radio station; 1530 Unusual background noise, possible hiss - hard to tell due to S; 1533 Intermodulation from WWV radio; 1537 Possible whistler; 1553 Small burst of static; 1614 Noise possible due to wind moving the antenna - background noise definitely different, again possible due to hiss; 1628 S static less noticeable; 1630 M voice - No

change in conditions; 1748 Possible tweek? - Background noise changing; 1810 M voice - No change in conditions - S light - O - intermodulation from local radio station.

Comments: Typed logs! The logs of the two teams from Donovan HS indicate that the two receivers recorded very nearly the same data. The only exception seems to be the pulsating noise heard by team 2. Good job!

13. Gresham, Oregon — G. L. Parr

1618:59.8 UT 54.2% 45° 31.2 N 122° 39.0' W

Site: Partly open point overlooking a clear cut

RS3, CTR 69, 11' vertical

Tapes recorded: E S

Log notes: 1515 M continuous dawn chorus; 1516 W; 1516:47 W (17 whistlers logged between 1517 and 1533); 1534 M Side A of ECLIPSE tape, still continuous dawn chorus; 1534:30 (45 whistlers between 1534 and 1603); 1604 W - 3; 1605:38 W (29 whistlers logged between 1605 and 1703); 1705:15 W (7 whistlers logged from 1708 - 1724); 1719:37 T; 1722:10 Bug hit antenna.

Comments: Typed logs! "My tapes are recorded with a cheaper recorder but they are hummmmm free. The 'dawn chorus' was especially interesting to me, lasted a long time, and is the first of this intensity that I have recorded."

14. West Lebanon, Indiana — John Barry

1702 UT 89% 40° 17'45" N 87° 21'45" W

Site: Open field, farm, multiple structures, unplanted field with wooded fence rows, closest power lines 3/4 miles

INSPIRE RS4, Panasonic RQ-2309 AV, 102" whip

Personnel: Seeger High School team: Alex Beckett, Cory Thomas, Scott Kenworthy, Jim Taylor

Tapes recorded: E S

Log notes: 1515 M S: several types throughout S: @60/min; 1606 T: ??; 1647:45 T: series; 1648:50 T: Loud; 1705 S: @ 80/min; 1722 T: few? S: series; 1800 M S @ 44/min

Comments: Typed log! Sferic density in "pops" per minute is a helpful log entry item. Good job, Seeger High!

15. Oklahoma City, Oklahoma — Don Shockey

1631 UT 99% 35° 38' N 98° 20' W

Site: 3 miles N/5.25 miles East Greenfield, OK; section line dirt road, 300-400 meters from phone line, relatively open pasture; 1-1.5 meter trees on roadside

WR3, Radio Shack CT 69, whip on tripod

Tapes recorded: E

Log notes: 1616 S - O - T; 1614 S - O - T continuous sferics; 1625 S - O sferics drop; 1634 S - O sferics increase; 1653 S - O - T regular sferics; 1716 S - O moderately heavy sferics; 1724 S - O declining rate sferics.

Comments: Don has been with INSPIRE since the SEPAC days.

16. Portland, Oregon — Gil Brentley

1515 UT 55% 45.8° N

Site: Ridgecrest, WA; hay field, farm; quietest zone

RS4 ?, Sanyo Portable System (1984), 30' wire and 30" whip

Personnel: Benson Polytechnic High School team: Katie Leonard, Robyn Brentley, Chris Schaefer, David E. Brown, James M. Fenton

Tapes recorded: E

Log notes: 1520 S: general everywhere; 1527 W: top to bottom; 1529 W; 1543 W; 1557 T: bottom to top; 1559 W; 1608 W; 1610 S: general everywhere; 1612 W; 1615 S: increase in general spherics; 1617 W; 1621 W: bottom to top very faint 6 sec; 1622 W; 1630 W:3; 1640 Noise level up spherics down; 1659 Squeaks; 1700 closed down.

Comments: Gill (N7DCS-extra) reports that the team experienced the eclipse in several ways: "A) through the 2 VLF receivers ... B) they viewed the coverage through a view box made

by one of the students and C) they felt the change in temperature at our site (it was up to 7-8° cooler) and everyone donned a jacket or sweater for awhile until the ambient air temperature came back up."

17. Chillicothe, Ohio — Tim Curtis

1706 UT | 94% | 39° N | 85° W

Site: Rural - open field

INSPIRE RS4, Realistic, Long wire

Personnel: Huntington High School team: Josh Barlage, James Greening, Kevin Thompson

Tapes recorded: E S

Log notes: 1515 Light to very light sferics, Medium W, Medium S series; 1535 Heavy W sometimes, T occur in series, short bursts; 1605 Light whistlers; 1615 Medium tweek; 1630 Light S, Broad W, Light W, series of heavy S; 1640 Light S, Dense S at times, O at center of 10 min; 1700 Light W, Light to dense S; 1709 Heavy sferic; 1710 Light to moderate S; 1740 Moderate to dense S, Light W, Light S towards end; 1800 End.

Comments: The Huntington HS team used a logging technique of an entry every 10 minutes with special notation made of distinctive events. Good job!

18. Naubinway, Michigan — Robert E. Aldrich

1712:30 UT | 83% | 46° 30' N | 86° 19' W

Site: Approx. 13 miles NNW of Seney, MI; T47N,215W,Sec35 1/2; young mixed pine plantation and semi-open plains.

INSPIRE RS4, Realistic CTR-68, 500-ft. longwire

Tapes recorded: B E S

Log notes: 1650 WWV time mark - poor, but the beep can be heard, Tape opens with light-to-moderate static and a background of chorus. The chorus rises and falls slightly; 1650:35 The hiss begins to rise and fall noticeably; 1653:20 Brief intense static followed by a sharp increase in chorus; 1657 Chorus drops briefly. Background hiss - sounds like the roar of a jet - continues; 1658:50 Perhaps a whistler. There have been a few other times that I thought I may have heard one, but all the noises mixed together make it very difficult for me to be sure; 1702 Hiss and chorus continue at moderate-to-high levels; 1709 Hiss has become the predominate

element, sounding like frying eggs. It virtually covers everything else up.; 1710:35 Sharp static crash and whistler (Two-hop?); 1723:54 Sharp static crash and what sounds like a weak whistler a couple of seconds later; 1734 No significant change, except that somewhere along the line the chorus became more "musical". This VLF stuff must be tough on the ears and mind!; 1515 WWV time mark. Moderate sferics, moderate hiss, and weak chorus; 1523 Since the tape began, there have been several whistles above the chorus. Some have been clear notes, but others have sounded fuzzy or diffuse. However, I don't think that they are actually whistlers; 1542:50 A whistle sounding more like a "real" whistler. The number of these seems to have increased considerably; 1551:09 Good diffuse whistler and several weaker ones; 1553:40 A diffuse whistler. These are quite common now; 1620:53 Diffuse whistler - haven't heard many lately; 1625:50 A lone diffuse whistler;
1627:30 Oral time mark. Some chorus. Light-to-moderate static. 1628 Some short, high-pitched whistles - whistlers?; 1645 Hiss building and becoming a frying sound. It levels off after a few seconds; 1655 Quiet again. Almost no chorus, weak hiss, and moderate static; 1729:20 Chorus plainly heard. An odd sounding series of whistles for the next few seconds; 1820:30 A couple of whistlers in a row -- I think! Still quite noisy; 1821:50 Four whistlers in about a 10 second period; 1822:20 A couple more whistlers; 1822:45 A few more whistlers.

Comments: Typed logs - and very detailed. Bob says: "Sorry the logs are so verbose and full of subjective phrases. However, that's how I am and I'm not good at editing my own material, either!" Bill Pine replies: "Don't change your logging style! Reading your logs is like being there. The subjective descriptions are necessary since the study of natural radio has not developed standardized terminology, so we are free to describe things any way we like." Bob works as a wildlife technician for the Michigan Department of Natural Resources. In the busy six weeks after the eclipse Bob made surveys of waterfowl, cormorants, deer (a "zillion" surveys!), ruffed grouse, sharp-tailed grouse and woodcocks. A bear bait-station survey was next. I like my job ... but I like Bob's job, too.

19. Auburn University, Alabama — J-M Wersinger

1656 UT | 77% | 32° 36' N | 85° 09' W

Site: Open field at state park, meadow, away from power lines

INSPIRE RS4, Sharp stereo radio cassette recorder NQ-T222, van

Personnel: Auburn University grad student Garett Yoder

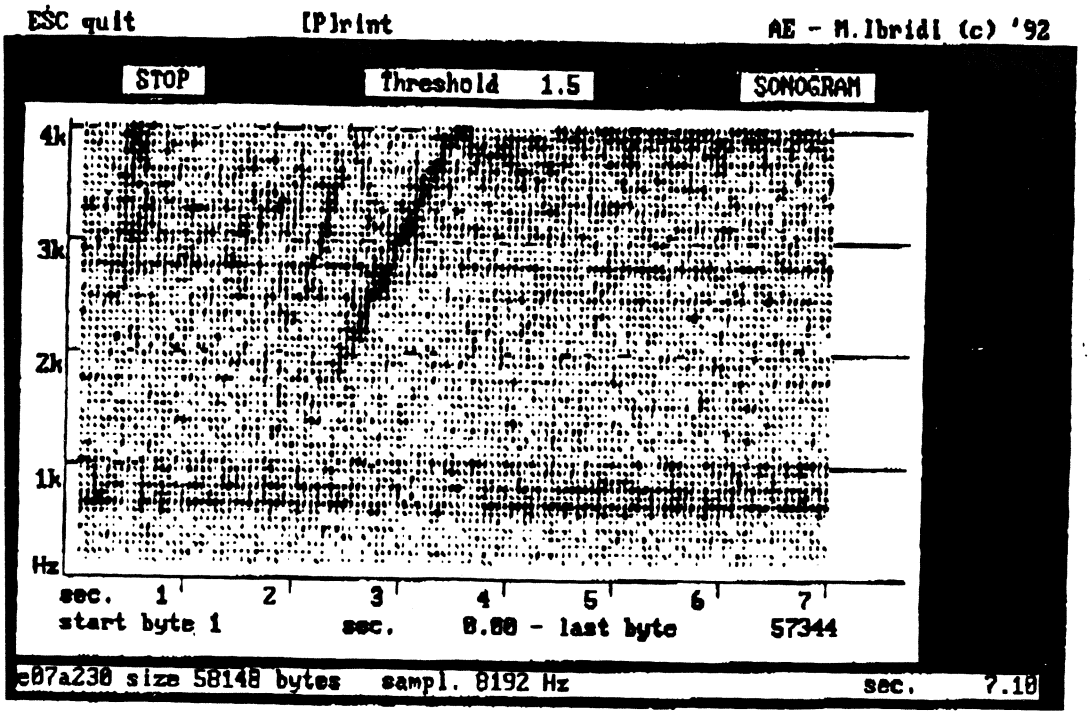
Tapes recorded: B E S

Log notes: There is still a very significant 60 Hz hum at our site. It is not clear whether this hum drowned out all tweeks and whistlers or simply none occurred during our data taking, but none of these were observed. There were constant bursts of sferics - static - and careful listening detected what we believe are OMEGA signals that occur almost all the time; Sferics way down from previous data. No tweeks or whistlers observed; Much the same as

Pelham High School Team (Team #20)

Left to right: Bobby Sawyer, Chris Shell, Thomas Brady, Preston Hite, Brian Rabon, Victor Gatto

Photo at left shows an image of the eclipse projected through a telescope onto a card.



Sonogram made by Marco Ibridi of Italy. The rising tone shown is called "drill" by Marco. Sonogram sent in by Flavio Gori, European INSPIRE coordinator.

previous control. Continuous static bursts and, we think, quite a bit of OMEGA signals. No tweeks or whistlers were detected.

Comments: Most of the reported whistlers seem to come from north and west of Alabama. If you hear sferics, you stand a good chance to hear tweeks and whistlers if they are there. The 60 Hz hum may be a problem when it comes to detecting the fainter natural signals.

20. Hoover, Alabama — Charles Hanke

1654 UT 77% 33° 22'25" N 86° 41'38" W

Site: Oak Mountain State Park, parking lot at edge of lake, elevation 600 feet

INSPIRE RS4, Panasonic RQ A70, Radio Shack 270-148A 6' whip

Personnel: Pelham High School team: Bobby Sawyer, Brian Rabon, Chris Shell, Preston Hite, Victor Gatto, Thomas Brady

Tapes recorded: E S

Log notes: 1515 Start tape, WWV time mark, Several intense bursts S, O; 1524 O?, T?, a new static interference - a plane?; 1530 M, O, continuous bursts of S followed by breaks in S, 60 Hz hum; 1551 O, S stops then continues, rain drizzle; 1555 O, S, team walks back; 1607 Short pops, O, S; 1620 O, S less, time mark at 1620:05 5 seconds late; 1629 O, S cont. and bursts, car drives by and stops; 1633 O, S, - bug flies around antenna; 1644 O, S cont. bursts. People annoying me clanging chairs. Brian walks away; 1654 Peak eclipse time, S, O; 1708 Car drives by, O, S burst, hum still present; 1758 O, S cont., possible very faint T; 1800 M, O, S cont., splash in water near by; 1810 M, O, S - wind blows, heard wind; 1823 S, O, bursts S, car drives by, a clanging noise heard, tape ends.

Comments: The Pelham HS team made a log entry every minute and did a very thorough job. Charles Hanke reports that the weather varied from overcast to light rain to bright sun at eclipse maximum to windy and cloudy. He did not mention a temperature change, but that sequence of weather could certainly have masked any eclipse related temperature changes. Good job, Pelham High!

21. Rockton, Illinois — John Carleton

1704 UT | 85% | 42° 25' N | 89° 8' W

Site: Hill on farm, 300 m away from rural residential power lines

INSPIRE RS4, Sharp PD-767AV, 3m. whip

Personnel: Hononegah High School team: Jennifer Ling, Missy Schoon, Marisol Carmona, Tim Huber, Eric Skinner, Todd Griffith

Tapes recorded: B E S

Log notes: 1637 sferics and O, steady O; 1642 strange hum, wind rise; 1700 OMEGA - lots of wind!; 1720 whistler; 1545 M, supplemental, May 10, O, S, chirps; 1620 O, S, frog, chorus - strong; 1717 W; 1718 W - 3; 1719 W, W, W.

Comments: From John Carleton: "Once again the project was a real success in terms of student learning and, except for a little more 60 Hz hum than we expected, we were pleased with our data as well. Students were surprised at the constant chorus and called out in excitement each time a whistler was heard." The data logs show more than one entry per minute with very careful attention to detail. Way to go, Hononegah High team!

22. Bologna, Italy — Francesco Stumpo

1600 UT* | "a little bit visible" | 44° 30' N | 11° 20' E

* Italian observers, under the coordination of Flavio Gori, used the E-time of Ontario, CA.

Site: Hill on Appennino next to Bologna with no trees or electrical sources of noise

LOWE HF 150 portable receiver (0.03-30 Mhz, made in UK), Sony portable audio recorder with homemade automatic device for the recording of voice mark every 5 minutes, homemade antenna loop with preamplifier for Low Frequency (30-170 KHz)

Tapes recorded: E S

Log notes: During the detection no particular whistler, fading or spherical waves were received; Supplemental tape side A from 1430 to 1515 UT; Eclipse tape from 1515 to 1645 UT; Supplmental tape side B from 1645 to 1730 UT

Comments: "Time signals received from station MSF on 60 kHz from Teddington, England. It is sure that the signal received is not from Fort Collins, Colorado, USA, at the same frequency because the direction of the antenna loop was consistent with the geographical position of the British station. In addition, no decreasing of power during each hour was detected as would be normal for the American station." Thanks, Francesco!

23. Torino, Italy — Silvio Bernocco

1600 UT * ---% 44° 54' N 7° 12' E

Site: Alps mountains : "Accera" mountain pass, open ridge top, elev. 1500 m

INSPIRE RS4, AIWA TP37 mono, 9May long wire: 100m plus 100 m ground laid on ground, 10May Whip 5 m on fiberglass fish pole with 7 m wound wire and ground stick

Tapes recorded: B E S

Log notes: May 9 1715 Voice M, Static; 1719 Static/T/W low; May 10 1515-1525 Voice M static and very low or low level 40 W total; between 1525 and 1645 Silvio counted and logged over 200 whistlers including several double and triple whistlers (2-hop and 4-hop?); May 11 1515 voice M; 1516:30 W; 1517:45 W third on tape - static; between 1518 and 1555 about 30 W

Comments: Silvio covered both baseline schedules and the supplemental tape in addition to the eclipse tape. With him and the other Italian investigators we will have some valuable geographic baseline data.

24. St. Vital, Quebec, Canada — J.C. Touzin

1730 UT 80% 48° 55' N 79° 10' W

Site: Wooded area

BB-2 "Homemade" modified for loop input, MTC MCR-2 modified for listening while recording, Square loop, 8.5' sides, 10 turns (340 feet)

Tapes recorded: E

Log notes: 1645 Omega throughout every 10 sec. Few weak sferics throughout. Weak chorus throughout. Time marks every 10 minutes.

Comments: Much of Canada was pretty far north from the eclipse track, but the exception was Quebec. J.C. has provided some good data.

25. Florence, Italy — Flavio Gori

1600 UT 0% 43° 50'18" N 11° 50'18" E

Site: Elev. 2000 ft., no trees in 300 ft., about 1 km from power lines but a noisier site now (2 years ago it was better)

WR-3, Sony TCH 38, whip

Personnel: Nader Javaheri, Wigi Cobisi, Massimo Mastrosimone, Vanni Guarneri

Tapes recorded: E

Log notes: No OMEGA signals heard. During all the recording time we had very high whistler activity (weak, but many W). Whistlers usually occurred in this sequence: W.W...W: the first two in one to one and a half seconds, the third after 5 seconds. In the 90 minutes we can say an average of 10-12 whistlers in each minute. Many tweeks usually heard mixed with sferics and sometimes with whistlers.

Comments: Flavio has taken on the job of European coordinator of amateur natural radio observations. Look for his article on European operations elsewhere in this edition of the *Journal*.

26. Fort Edward, New York — Stephen G. Davis

1737 UT 94% 43° 18'00" N 73° 29'30" W

Site: 0.15 mi. south of intersection of Hinds Rd. and Town Line Rd. in town of Argyle, N.Y.; open field, 0.3 mi. from 7600 V power line

INSPIRE RS4, Realistic CTR-68, 6' telescopic whip (Archer 270-1408A)

Tapes recorded: E

Log notes: 1706:35 B(urst - intense loud sferics); 1708:35 housefly; 1715 M; 1734:17 B + T; 1740:20 B + walking in grass + wind; 1740:50 B - intense; 1751 M - faint S + wind + walking in grass; 1832 M + song bird

Comments: From Stephen: "The wind generated noise at the antenna throughout the session, and there is operator generated noise from several bumps and walking in the grass. The

operator was having more fun observing and photographing the eclipse than recording!" I think we can all identify with that after observing the eclipse.

27. San Antonio, Texas — Bill Minton

1618 UT 80% 29.31° N 98.48° W

Site: Near San Geronimo, TX, on TX Highway 211 right-of-way (wide shoulder), approx. 19 mi. west of center of San Antonio, TX., 4.4 miles south of TX Hwy 16 and 3 miles from nearest 60 Hz power line, shielded by a hill from that line

INSPIRE RS4, Panasonic Model RQ-A60 (stereo), 12' whip - made of 3/4" aluminum tubing ground mounted on wood stake

Tapes recorded: B E S

Log notes: 9May 1552 M WWV-19MHz; 1552 S and T much static, almost continuous; 1556 S long crash - 2 sec; 1618 S extra strong burst. - This will be E-time 5/10; 10May 1515 M S bursts, nearly continuous with a few T mixed in; 1540 M S nearly continuous due to very unstable weather across south Texas; 1621 M S T; 1640 M S seems more intense and continuing; 1804 Rain squall moving in; 11May 1552 S nearly continuous, some T mixed in; 1604 Light rain; 1611.8 W weak, up scale - maybe T?; 1613 W; 1621 W; 1623 W - up scale, weak; 1625 much S, with T and H(iss); 1631 W weak - maybe T; 1634 T, S, H continuous.

Comments: From Bill: "... I made a presentation at the San Antonio Radio Club meeting... the talk was well received by the 40-odd who attended. I made a pitch for anyone attending to join me in the Eclipse data-taking. The SARC president ... is an avid biker and had biked many times along a fairly new highway, TX Hwy 211. ... I checked it out the next day and found it nearly ideal. ... Unfortunately, no one could join me for the tapings since it was a work day, so I did my stint alone." Sounds like you have found a fine site!

28. St. Victor, Aosta, Italy — Fabio Courmoz

1820 UT 5% 45.8° N 7.7° E

Site: Chalex (Aosta Valley - Italy), open valley on the ridge, Elev: 1817 m

Personnel: Elio Plano, Ezio Borghese

Tapes recorded: E S

Log notes: 1406 S: 40 x 60'; 1515 S: 24 x 60'; 1655 S: 20 x 60'; 1855 S: 28/20 x 60' not so strong and clear as before

Comments: Fabio reports that he heard OMEGA, tweeks and whistlers on the earphones, but cannot hear them on the tape. He wonders what the problem might be. Any suggestions?

29. McGraw, New York — Jim Weiss

1730 UT 90% 42° 37'12" N 76° 4'13" W

Site: Open field, almost highest elevation within 1/2 mile, approx 1650 ft. elev.

INSPIRE RS4, Sony "boom box", short wire

Personnel: McGraw High School team: Sasha Hafner, Claire Hefner, Tasha Van Sickle, Sarah Karl, Danack Peck, Paige Opera, Ben Tongue

Tapes recorded: E S

Log notes: 1430 arrival; 1542 moving antenna; 1602 very windy; 1627 Sarah stepped on antenna; 1634:50 Tasha hit antenna; 1658 getting darker; 1731 total eclipse; 1750 priority 1 tape, side 2 - time mark

Comments: From Jim: "We had an unexpected tape recorder malfunction and had to use another one which seems to have a high background noise level. In addition, at the time of the taping a strong squall blew our lean-to down with consequent added noise due to people trying to stabilize a very chaotic situation. ... All in all, ... the students had a significant learning experience." Now I feel guilty knowing we sat in the warm sun in Southern California while some had to really suffer for science! The Mcgraw team is to be congratulated for a job well done under adverse conditions!

30. Ontario, California — Bill Pine

1600 UT | 80% | 34° 14' N | 117° 41' W

Site: Glendora Ridge Road, 4 miles west of Baldy Village, open ridge top, elevation : 5500' nearest power lines about 5 km to south and oscured by south rim of ridge

RCVR 1: ACTIVE B-field receiver, Realistic CTR-69, 1 m square loop, 90 turns
RCVR 2: RS4 prototype, Panasonic RQ A60, 6' whip
RCVR 3: INSPIRE RS4, Toshiba KT-4058, 6' whip

Personnel: Chaffey High School team: John Caldera, Kathy Franco, Monica Guzman, Farida Kiggundu, Juan Lozano, Violeta Martinez, David Maust, Esmeralda Moreno, David Poole, Susie Rivera, Mollie Standon, Marcos Vargas, Bindhu Varughese

Tapes recorded: E S

Log notes:

RCVR 1	RCVR 2	RCVR 3
1515 M S med-heavy O strong	1515 M O: low S: low	1515 M S high pitch
1516:42 W medium	1517 W medium level	1516:42 W
1536:37 W medium	1536:42 Another good whistler	1536:42 long W
1552:30 W loud	1552:30 W high	1552:31 W medium
1554:11 W loud	1554:11 Strong W	1554:11 W medium
1600:22 W loud	1600:21 High whistles	1600:21 W medium
TOTAL NUMBER OF INDIVIDUAL WHISTLERS LOGGED DURING DATA TAKING:		
74	36	54
All stations logged periods of multiple whistlers like "5 W per minute"		
		1620 O: med level S: high level
1610 M Birds - funny sound (C)	1613:10 static quiet not much other noise besides OMEGA	1632 birds singing
1622 Camera noise	1700 M S: medium O: continuous	1647:40 strange noise high chirp?
1622:39 W O: medium S: high	1745:20 Mr. Pine's footsteps when returning camera	1757 footsteps
1642:44 car motor	1811:51 very wierd noise - like wind blowing	1801 S: lower now
1650 M O-loud S: medium	1813:46 car went by	1810 M O: med S: low
1727 Esmeralda sneezed		1813 van going by
1756:03 interferencs - very high car went by		

Comments: Our best luck in whistler hunting has always come within an hour after dawn. After that time the predominate signal seems to be sferics - often so dense that you could not near anything else if it were there. I did not have high hopes for whistlers on eclipse day. What we experienced was the best day ever for Chaffey whistler hunting. We had two groups of

7 students - one group for the eclipse tape and the other for the supplemental tape. I set up a fourth receiver with a speaker-amplifier so that those who were not on headphones could hear what was going on. What a day! Everyone heard many, many whistlers. There was much excitement when a "good" one came in. This day made the careful preparation worthwhile and everyone rated the day excellent. Oh yeah - the eclipse was neat, too!

31. El Paso, Texas — Chaffey Science Staff

1610 UT 94% 31° 48' N 105° 45' W

Site: Waco Tanks campground, 20 miles east of El Paso on US Hwy 62

RS3 prototype, Realistic CTR-69, 6' whip

Personnel: Chaffey science staff members: Gary Alten, biology/biotechniques; Ted Reeves, biology/natural environment; Andy Webber, biology/aeroscience; Dennis Wilbourn, biology/physiology

Tapes recorded: E

Log notes: 1525 M S: med-high, bursts, some 60 Hz hum, modulation problems for first two minutes (bad ground); 1532:57 W faint; 1547 rising tone - camera motor?; 1555 no change; 1615 M S: heavy, quiet gaps, 60 Hz; 1655 nl change

Comments: With no field experience with VLF radio, these four agreed to take a receiver with them when they went to El Paso to view the eclipse. They found a good site with no power lines that they could see as they entered. When they set up the receiver they heard the hum and then found the wires coming in to the campground from the opposite direction. The 60 Hz hum was constant but at a low enough level that the sferics and other emissions were much more prominent.