The INSPIRE Journal

Volume 12 Number 1

November 2003

Coordinated Observations End; Field Observations Begin

In an effort to increase the level of participation in natural radio observations, the Coordinated Observation Program is being concluded. While it may seem contradictory to cancel an existing observation program, it is hoped that by de-emphasizing observations on just two weekends each year, more INSPIRE participants will take the opportunity to make Field Observations and submit data tapes for analysis. Of course, those who wish can still observe on the Coordinated Observation schedule (third weekend of November and fourth weekend of April).

See the "Report on Field Observations" on Page 21 for information on procedures to follow for recording and submitting data. Data log forms can be found on Pages 48 and 49.

Happy Observing!

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The INSPIRE Journal
Volume 12 Number 1
November 2003

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

Contributions to the *Journal* may be sent to:

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Field Observations are THE Way to Participate!

Everyone is invited to participate in Field Observations. Field Observations offer an opportunity to record natural radio and have the results published in the *INSPIRE Journal*. Field observations may be made any time. All reports received by next March 1 will be included in the next *Journal*.

See the "Report on Field Observations" on Page 21 for a description of observation procedures.

Coordinated Observation Program Ends!

In an effort to increase participation in natural radio observations, the Coordinated Observation program has concluded. In the past, some who might have made observations did not because the weekend chosen for Coordinated Observations did not work for them. All INSPIRE participants are invited to make observations whenever it is convenient and submit the data to be included in a report on the *INSPIRE Journal*. Those who would still like to follow the Coordinated Observation schedule may do so and submit their data for analysis as in the past. Coordinated Observations have been held on the third weekend of November and the last weekend of April (unless there is a conflict with Easter).

Subscription Information Included on the Address Label

You can determine the status of your subscription to *The INSPIRE Journal* by looking at the address label. In the upper right corner of the label is a 2-digit number that indicates the year your subscription will expire. All subscriptions expire with the November issue. If your label shows "03", then this issue will be the last under this subscription. If your label shows "04", then your subscription is good through the November 2004 issue. If you have any questions or if you feel that the information shown is incorrect, please contact the editor.

Write for *The INSPIRE Journal*

The procedure for contributing articles for *The INSPIRE Journal* could not be simpler! Just send it in! Any format is acceptable. Electronic format is easier to work with. A Word file on disk for either the PC or Mac platform is preferred. An email message will work, too. If that does not work for you, a paper copy will do. Any diagrams or figures can be scanned in.

What about topics? Anything that interests you will probably interest most INSPIRE participants. As long as the topic is related to natural radio or the equipment used, it will get printed. The deadlines for submissions are March 1 for the spring edition and October 1 for the fall edition. Don't worry about the deadlines, though. If you miss a deadline, you will just be very early for the next edition!

We at INSPIRE are looking forward to hearing from you.

LORAN TRANSMITTER SITE TOUR

by
Robert Bennett
Las Cruces, NM

In May 2002, our local amateur radio club was invited to tour the Las Cruces Loran transmitter site. The radio club was fortunate in that a member of the club was a USCG serviceman stationed at the facility. The site is open to the public one morning a week and can provide tours with prior arrangement. However, the club received a total tour of the site and was allowed to view up close several items that normal visitors are prevented from seeing due to safety concerns. This article consists of a fact sheet and Loran coverage map provided by the USCG plus many photographs taken by the author.

LORAN Fact Sheet
(Courtesy of USCG)

On April 13, 1991, the United States Coast Guard commissioned the last of four new Loran-C transmitting stations at a location near Las Cruces, NM. Loran-C coverage, once available only in U.S. coastal and Great Lakes areas, now includes the entire continental U.S. Loran-C coverage also currently exists throughout the North Atlantic region, Mediterranean Sea area, and much of the Far East.

Loran, an acronym for Long Range Navigation, was developed by the United States during World War II. The current version of Loran, Loran-C, has been around since the late 1950's. The U.S. Coast Guard has operated Loran systems since their development in order to meet United States national interests both nautically and internationally.

Although Loran-C is more commonly associated with maritime users, it has also been used by aircraft for many years. Technological advances are allowing for Loran-C to be used in many more applications than before. Significant growth in the size of the terrestrial, and civil aviation user communities are expected in the very near future. There are estimated to be over a half million Loran-C users worldwide. This includes about 80,000 Loran-C receivers already being used in aircraft. In response to civil aviation users needs, the Federal Aviation Administration (FAA), with Coast Guard assistance is incorporating Loran-C into the National Airspace System for supplemental enroute and non-precision approach purposes. Loran-C will allow the aviator to fly directly from one point to another and should permit easier location of small airports during poor weather conditions. Benefits of Loran-C use by the aviator include improved safety, time savings, and reduction of fuel costs.

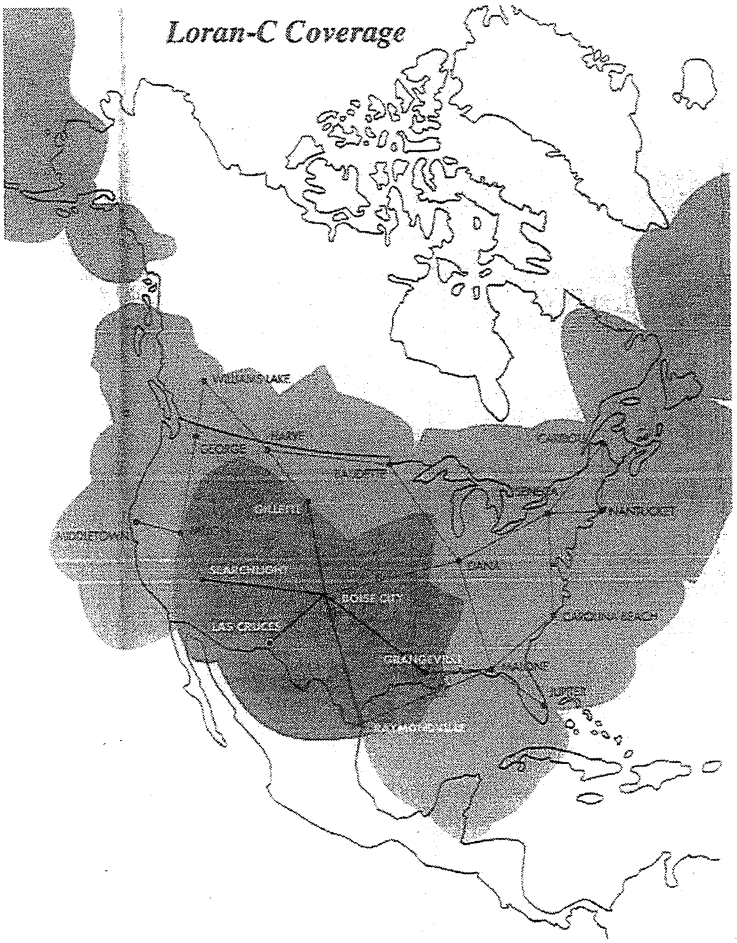
In consonance with this FAA goal, the Mid-Continent Loran-C Expansion Project was established. The service provided under the project completes Loran-C coverage over the

continental U.S., and provides radio navigation service to several thousand small airports that previously had none. It also improves coverage to the west of the Great Lakes, and provides improved maritime coverage to a part of the Gulf of Mexico. The project includes the formation of two new Loran-C chains, the North Central U.S. (NOCUS) Chain with a repetition interval of 82,900, and the South Central U.S. (SOCUS) Chain with a repetition interval of 96,100 microseconds, and the addition of one baseline to the Great Lakes Chain, repetition interval 89,700 microseconds. To form the new chains, four new Loran-C transmitting stations were constructed. They are located at Harve MI, Gillette WY, Boise City OK, and Las Cruces NM. It was also necessary to modify five existing stations to permit operating on the new rates as well as their present rates. These stations were Searchlight NV, Baudette MN, Grangeville LA, Raymondville TX and Williams Lake, British Columbia, Canada

It was also necessary to construct five new monitor sites in the service area. The installation of additional equipment to two control sites at Middletown, CA, and Malone, FL, will allow these existing stations to control the two new chains.

Service from the SOCUS chain, less the Las Cruces, NM station started Christmas Day 1990. The Las Cruces station was added in April 1991 to complete the SOCUS chain. The NOCUS chain became operational in April 1991, along with the provision of additional coverage to the Great Lakes chain by the new Dana, IN, Boise City, OK baseline.

Completion of the Loran-C Mid-Continent Expansion Project is a major step to realizing the implementation of Loran-C into the National Air Space. This joint FAA/Coast Guard Project is an excellent example of the government at work to satisfy the needs of the user, promote commerce, and help ensure air safety in the National Air Space. The cooperative spirit displayed by both the FAA and the Coast Guard during this very major project has resulted in a needed service that was provided on time, and within budget. Civil aviation users now will be able to use Loran-C throughout the entire continental U.S. and a major part of Alaska.

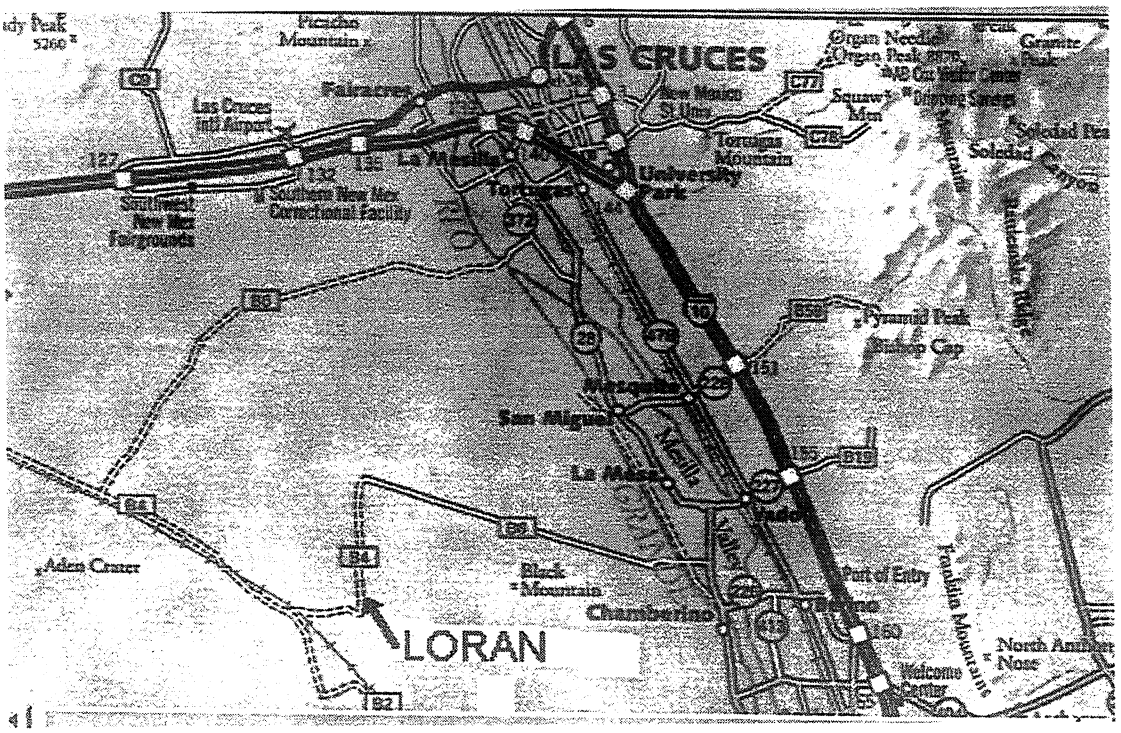


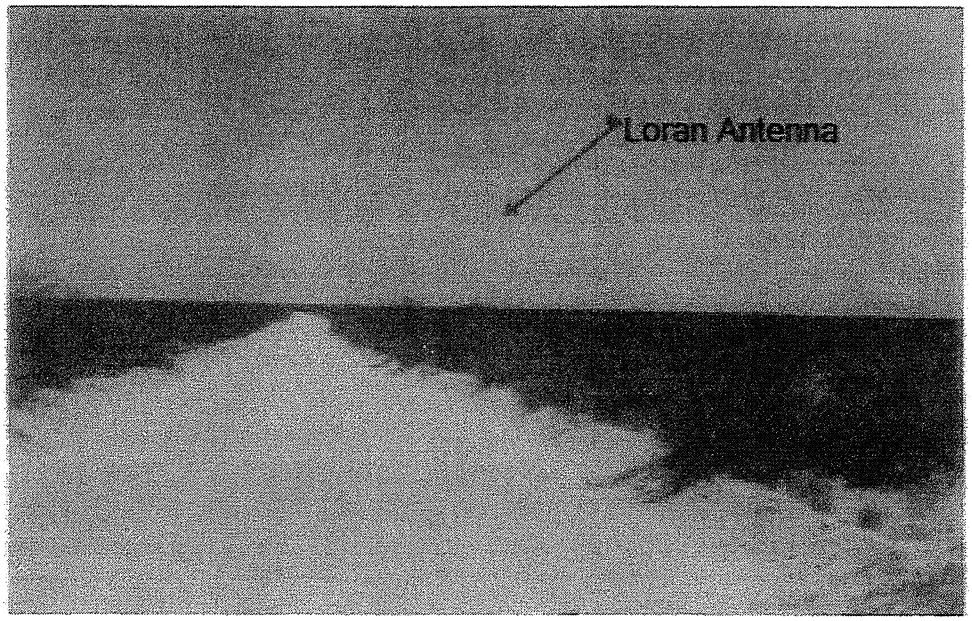
LEFT:

Map showing the coverage of the various Loran-C chains.

BELOW:

Map showing the location of the Las Cruces Loran Station. The author's natural radio receiving site is off the top of the map to the Northeast. The road distance from central Las Cruces to the Loran site is 31 Miles.





This photo shows the Loran site from the access road. The site is about 3 miles from the point the picture was taken.

View of the Loran site from the front gate. The building is about 0.5 miles from the gate.

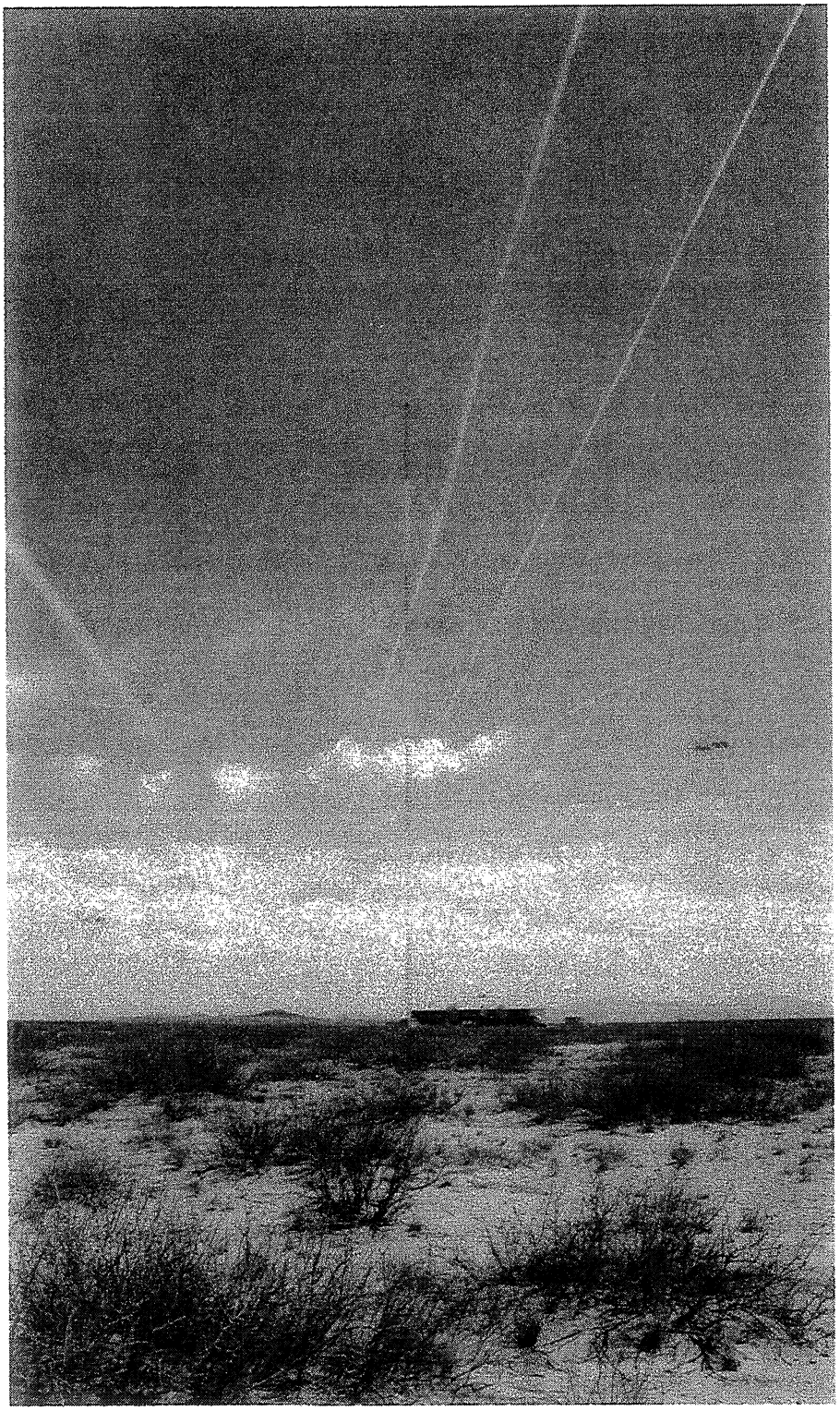
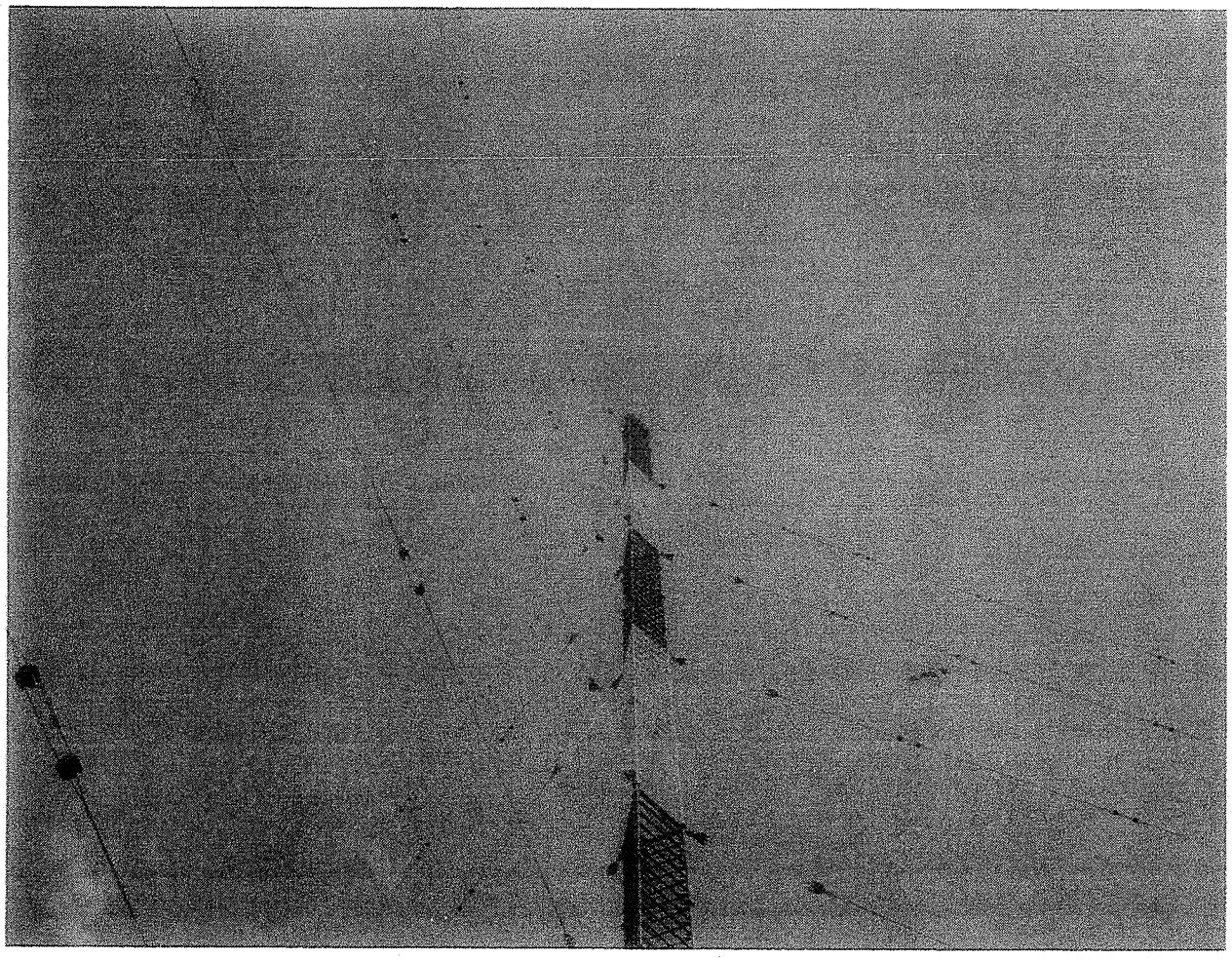
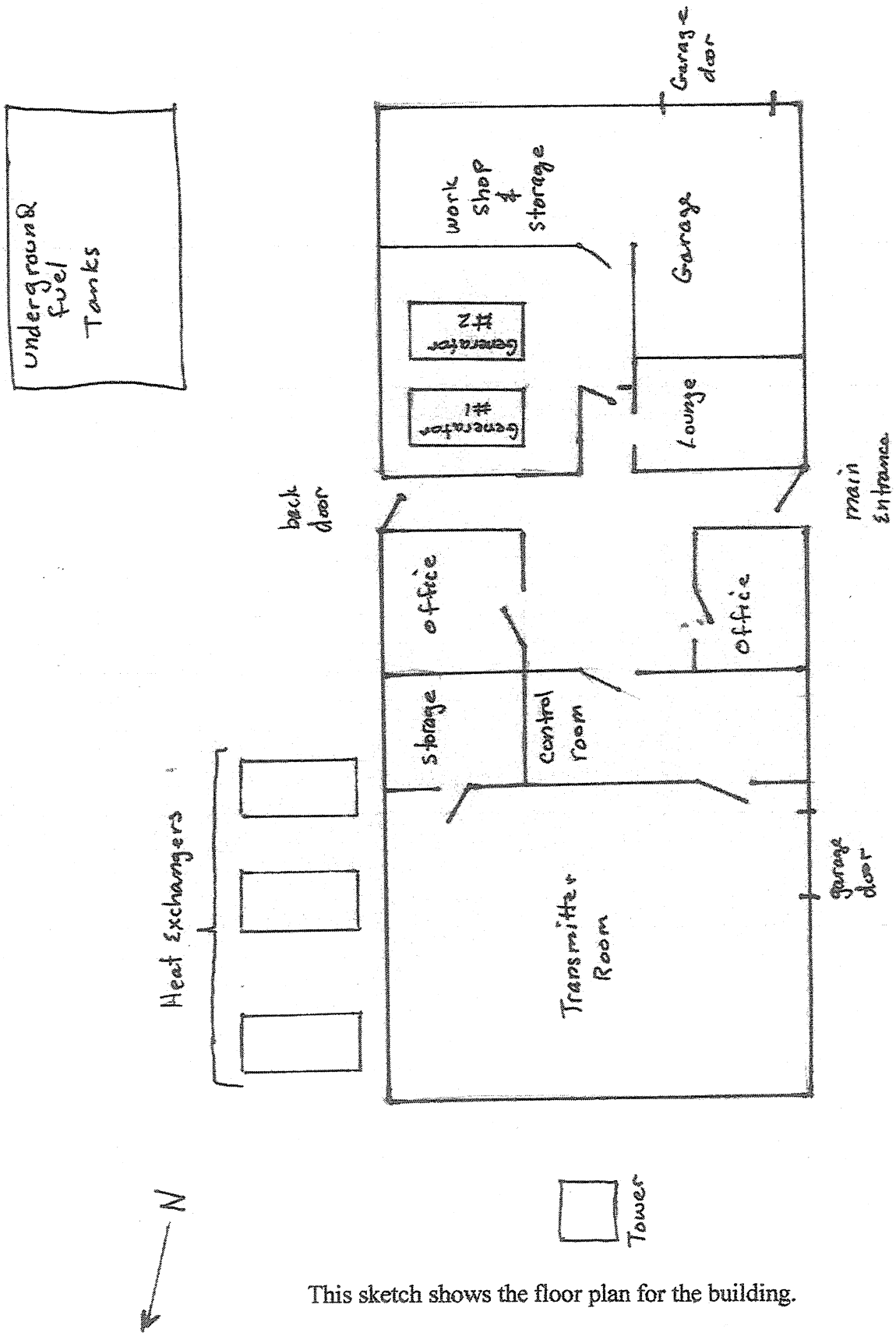


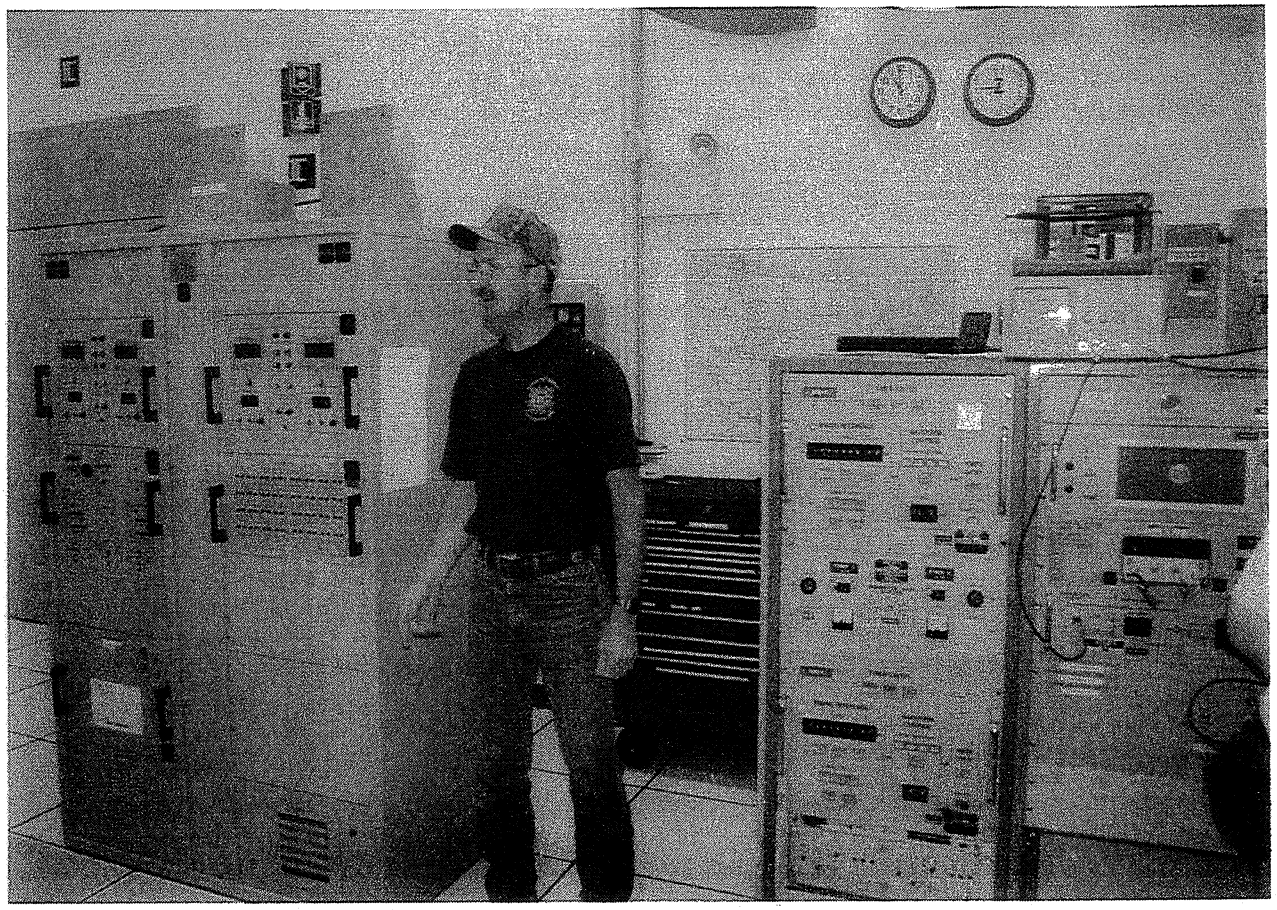
Photo of the site showing the size of the antenna in relation to the building. The tower is 750 feet tall and is insulated from ground. Some of the many guide wires that support the tower are visible in the photo. Note that the guide wires are broken at frequent intervals with insulators.



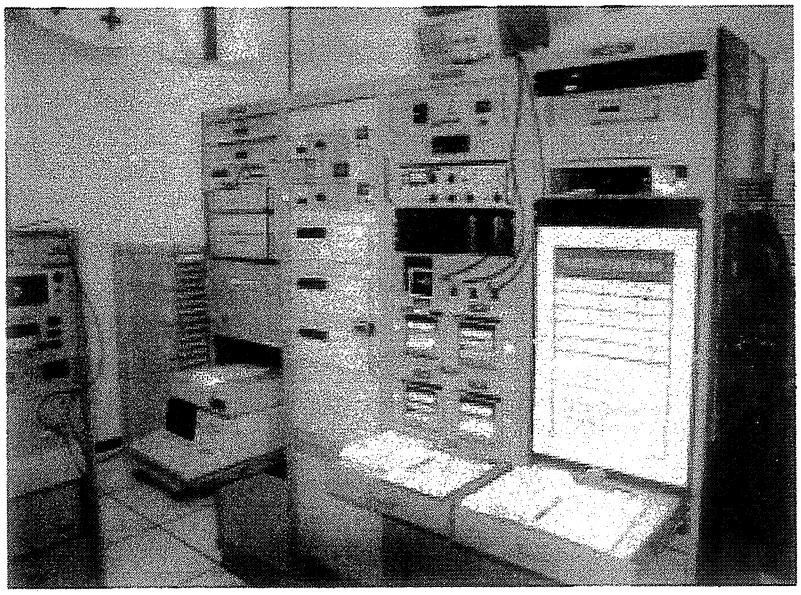
This is a picture of the top of the tower. The wires at the very top are not guide wires but form the capacitive top hat for the antenna. The top hat is used to increase the antenna's capacity to ground thereby making it resonant at 100 KHZ. Notice the many insulators in the guide wires.



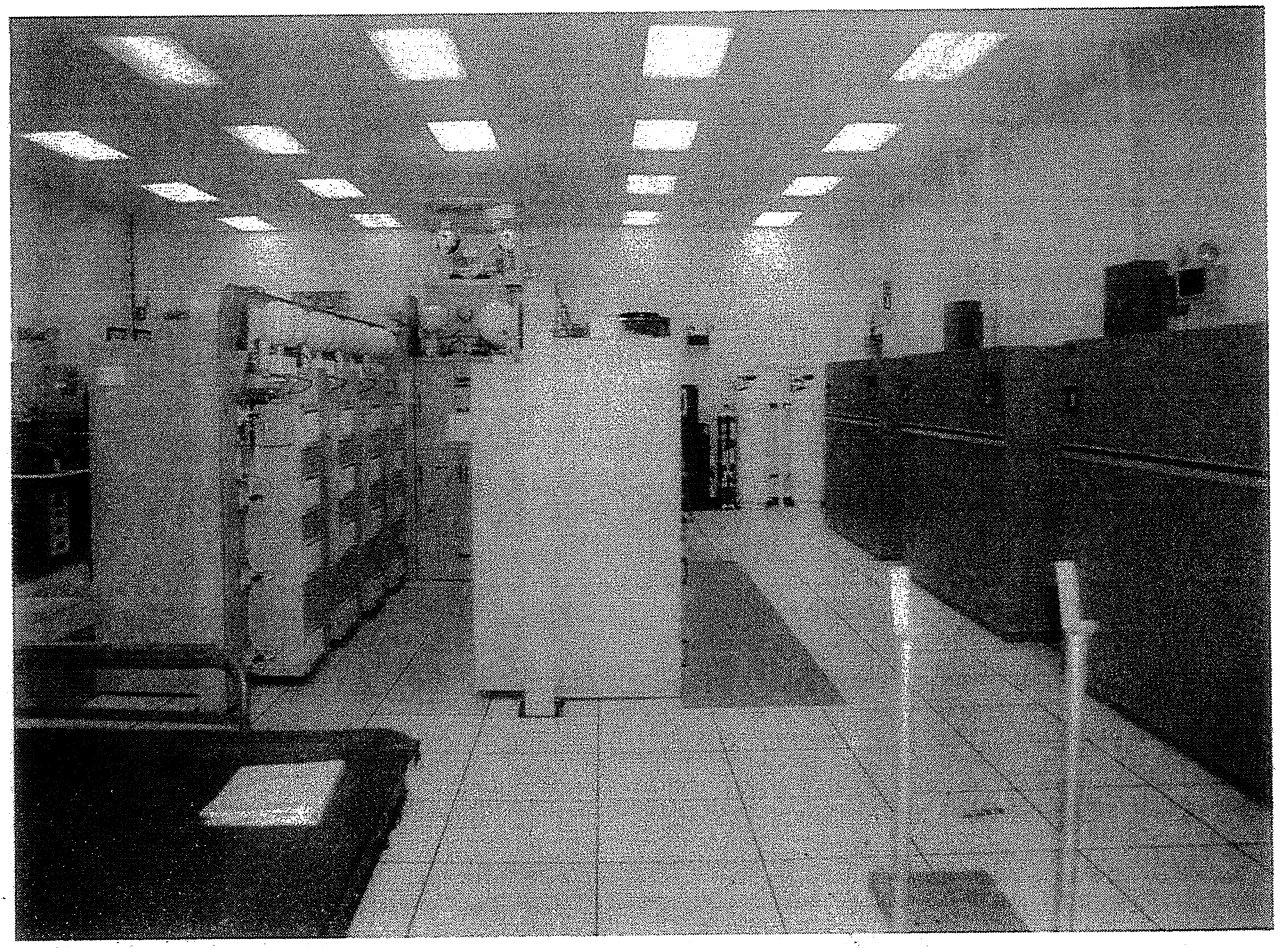
This sketch shows the floor plan for the building.



This is a view of about half of the control room equipment. The two racks to the left of the man (our tour guide) contain status monitors. The rack to the right contains the controls for the two Loran Transmitters (primary and standby) and the rack on the extreme right is monitoring the transmitter output waveform.



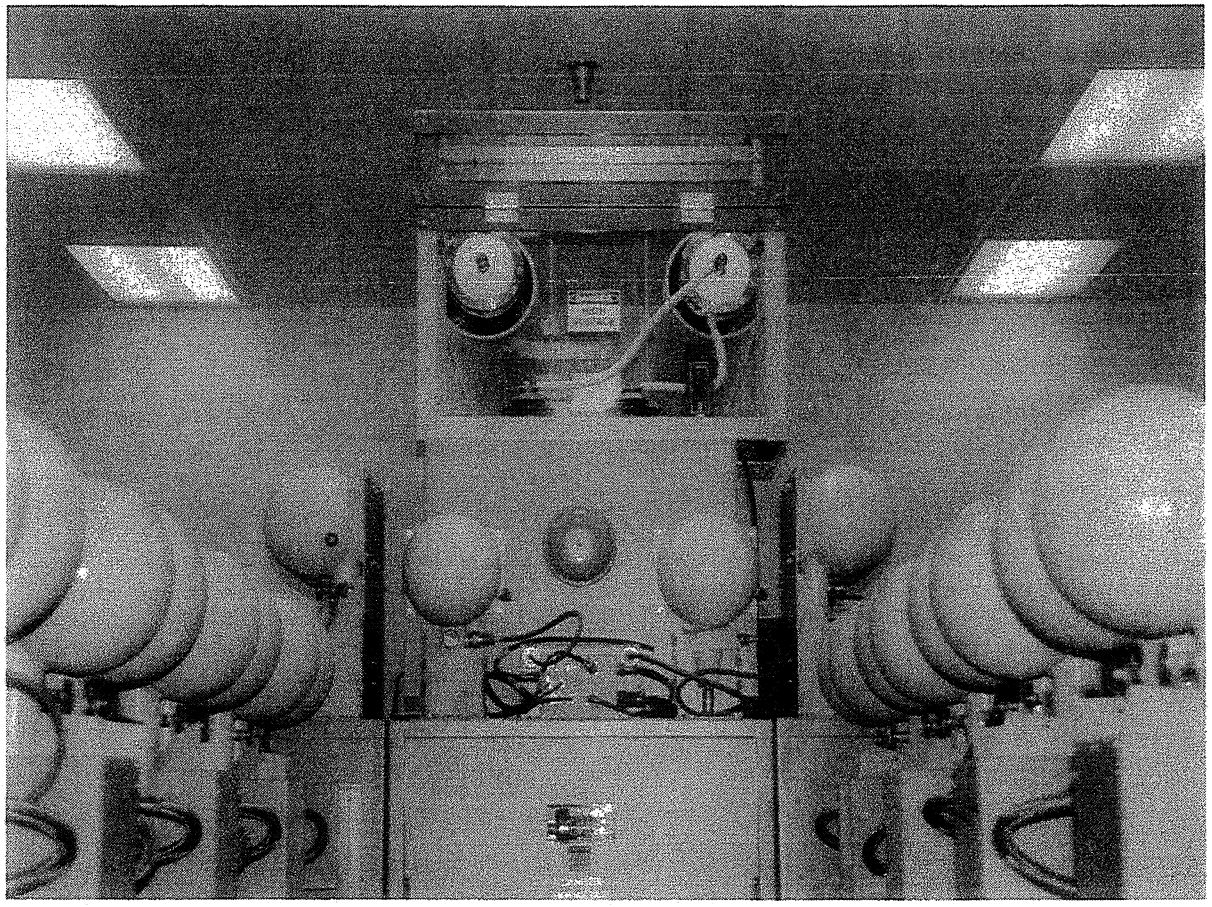
These racks contain the station's primary atomic frequency standards (three of them), a receiver which is phased locked to WWVL for frequency comparison, and receivers tuned to the Loran master station. The Las Cruces station is a slave station and thus gets it main timing from the master station.



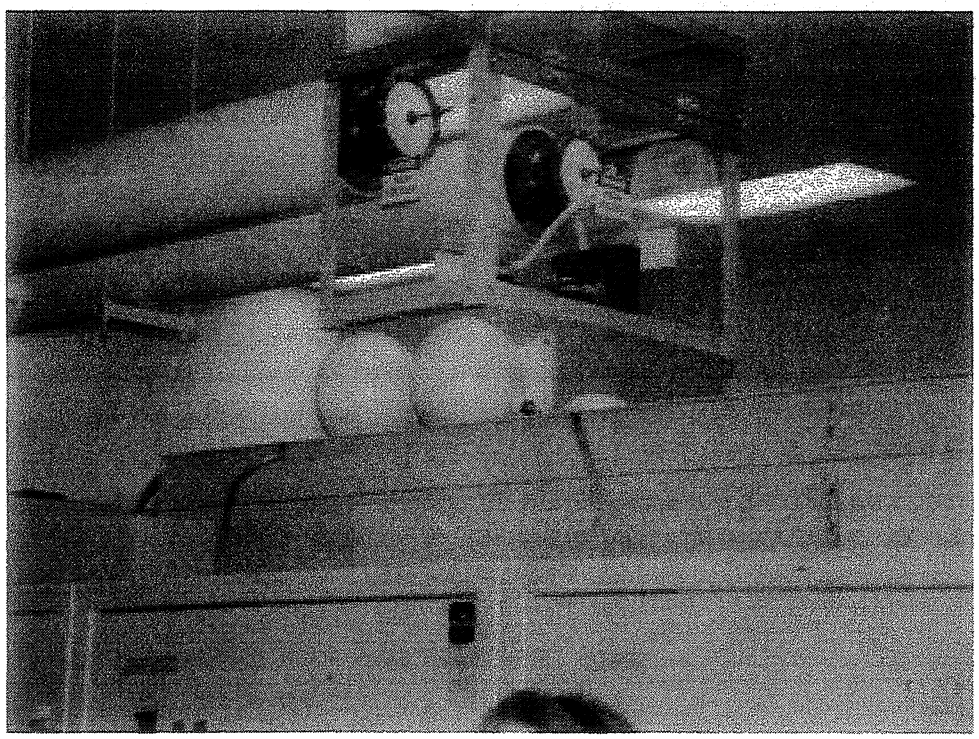
View of the transmitter room. There are two identical transmitters in the room. The one on the left is the primary and normally on the air. The right one is used as a standby in case the primary fails. The cabinets near the wall on the right side of the room are air conditioning units that use exterior heat exchangers.

The white tanks on the right at the rear wall and the small white ball shaped objects attached to the transmitters are part of the fire suppression system. If a fire is detected, an alarm will sound and then after a short delay, the room and all the equipment racks are flooded with a fire suppressing gas. A human cannot survive in the room without special breathing apparatus once the suppressant dumps. The alarm gives the people in the room time to get out before the gas dumps.

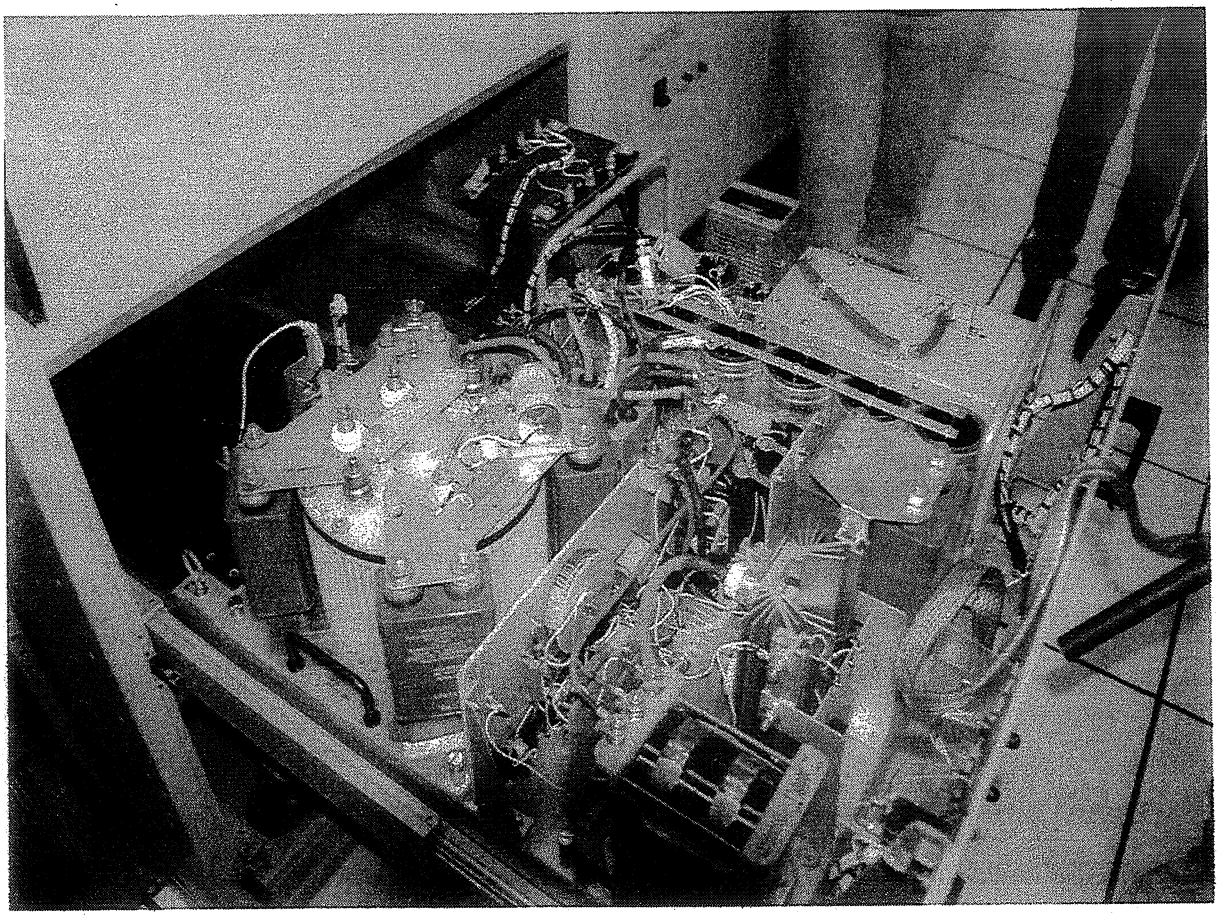
Notice the area between the two transmitters. It contains two identical coax transmission lines connecting to the antenna and the switching gear to select either the primary or standby coax.



Close up picture of the fire suppression tanks and the coax feed lines.

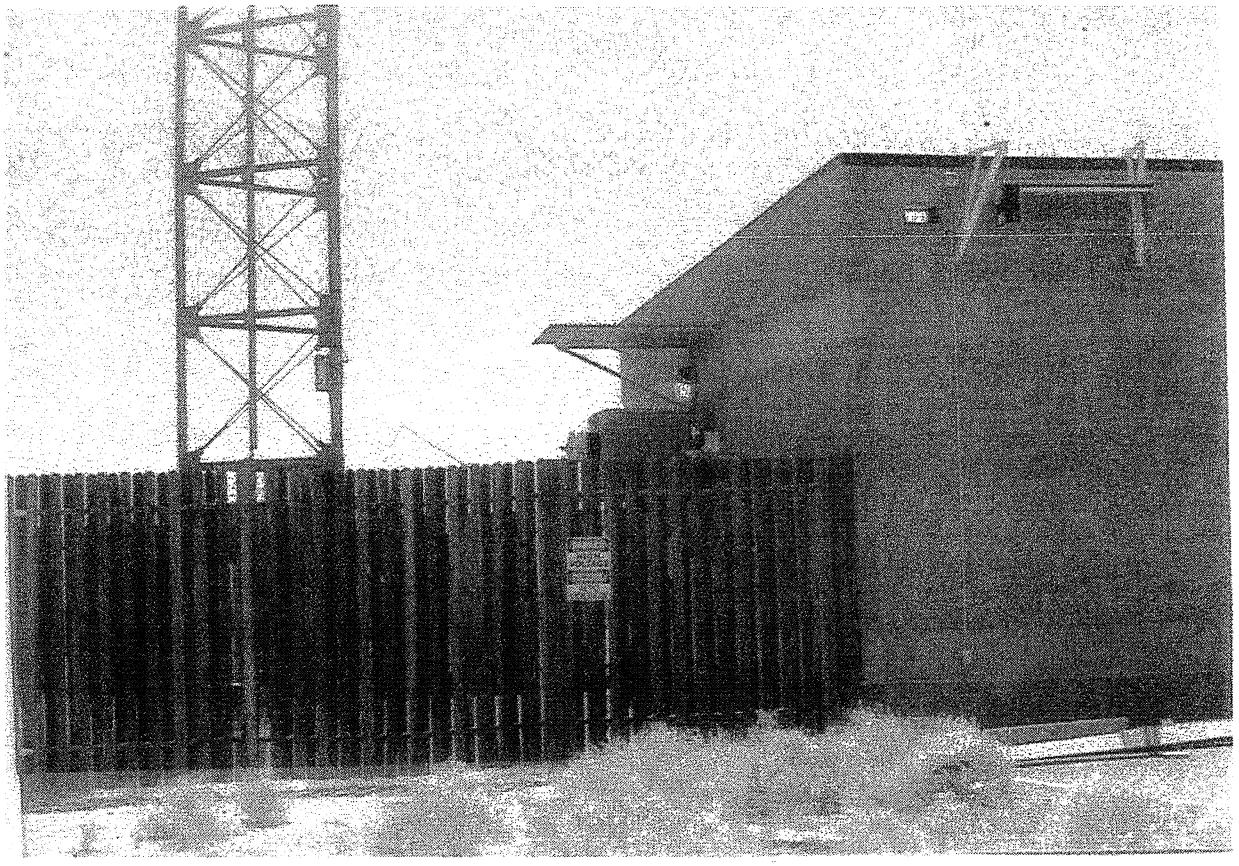


Close up view of the coax feed lines.

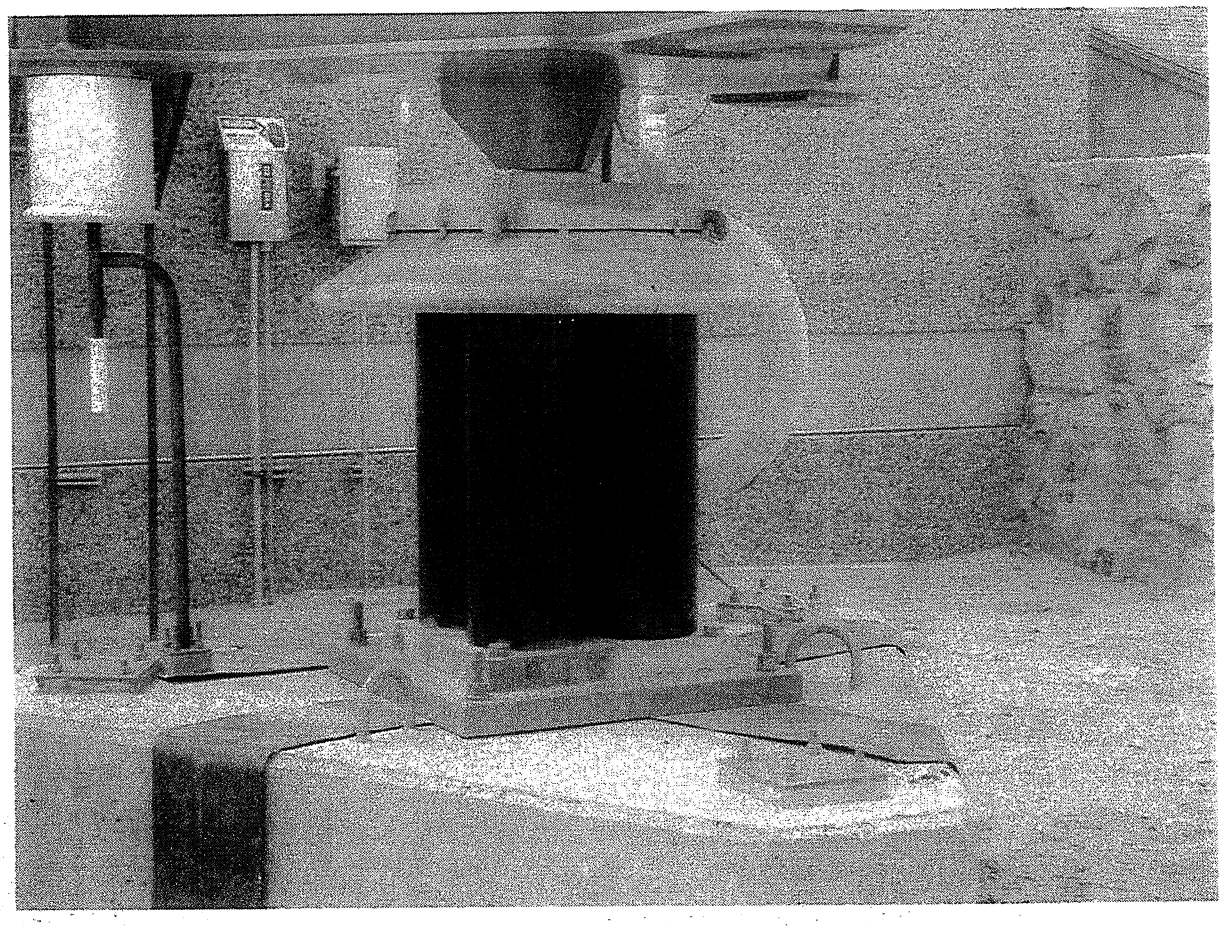


One of the transmit modules. Each transmitter contains 16 of these modules. Each module produces a portion (1/16th) of the output waveform and the outputs are coherently combined to produce the transmitted signal. Each module outputs a signal with a peak power of 500 kW. The cylindrical object in the rear of the drawer is the actual power amplifier. The rest of the components are for the power supply and monitoring. Most components in the module operate at a voltage of 10,000 volts.

Some of the spare parts maintained at the site. The bottom of the rack contains high voltage capacitors. The center shelf contains variable high voltage inductors and the top shelf contains high voltage variable capacitors and fixed inductors. These are the kind of components that cannot be easily replaced; they are not the type of item your local radio store would be able to supply.



Picture of the wooden protective fence around the antenna. Note the warning signs.

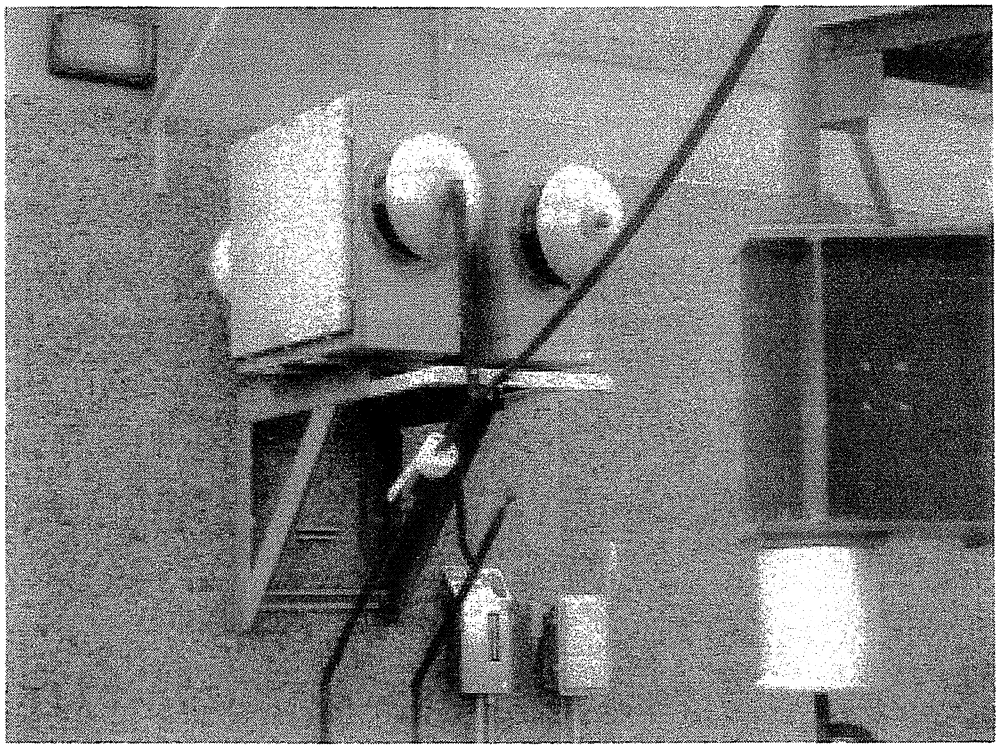


Base of the antenna. The antenna is actually a 750 foot tall triangular guided tower with a top hat. The tower is isolated from ground by the base insulator. This insulator consists of four thick glass tubes filled with oil. The white object on the left connected to the red metal tower is part of the instrumentation.

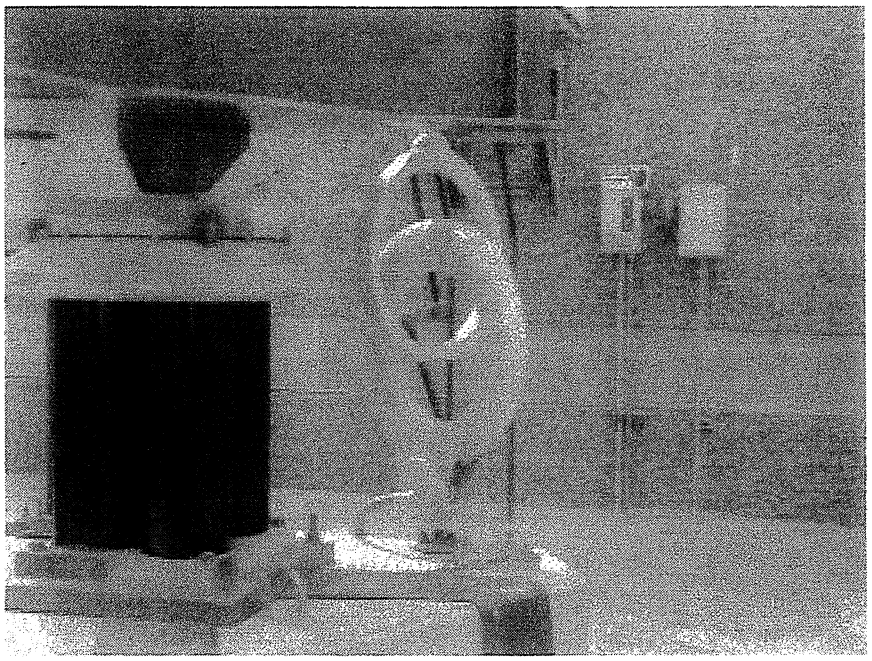
Notice the four copper ground straps running from the base plate into the ground. These actually connect to a circular ground radial system that extends for a mile around the site.

The tower is always "hot" and lethal to humans. The tower voltage peaks at about 30,000 volts during the transmission of a Loran pulse and decays to about 10,000 volts between the pulses. Normal visitors to the site are never allowed to get this close to the antenna. We were allowed to get to within 10 feet of it.

I noticed an interesting effect while near the antenna. I could actually "feel" the Loran pulses; I could easily sense the Loran pulse repetition rates.

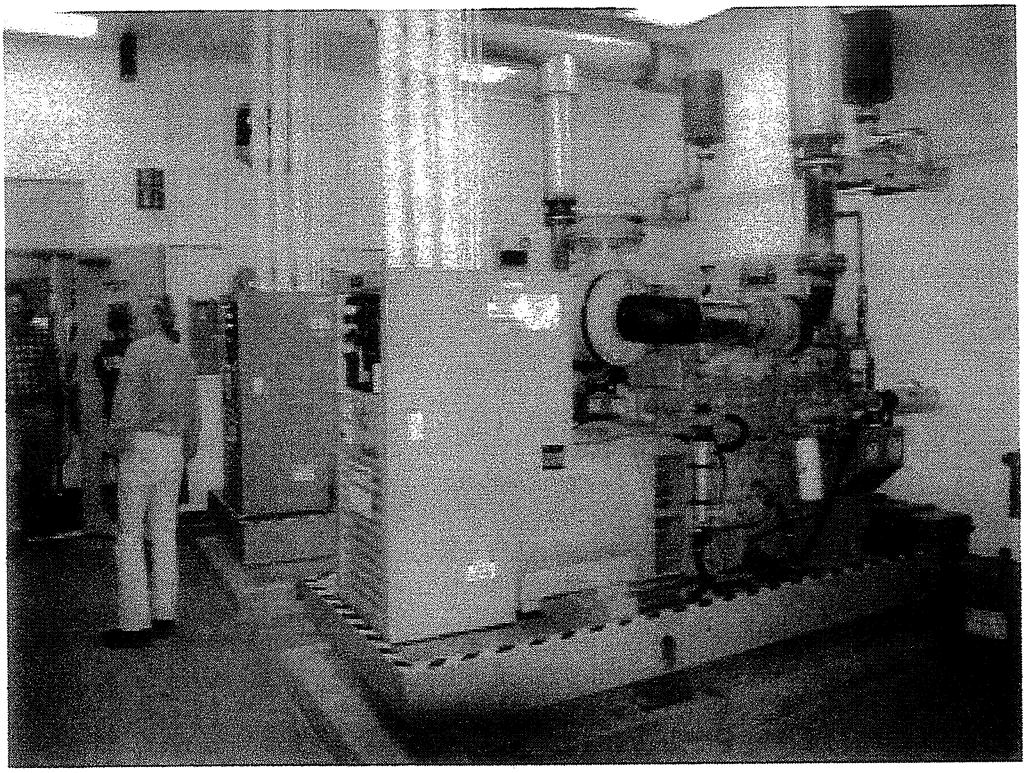


Picture of the coax feed line termination. Notice the spark gap lightning surge arrestor on the strap connecting the coax to the tower.



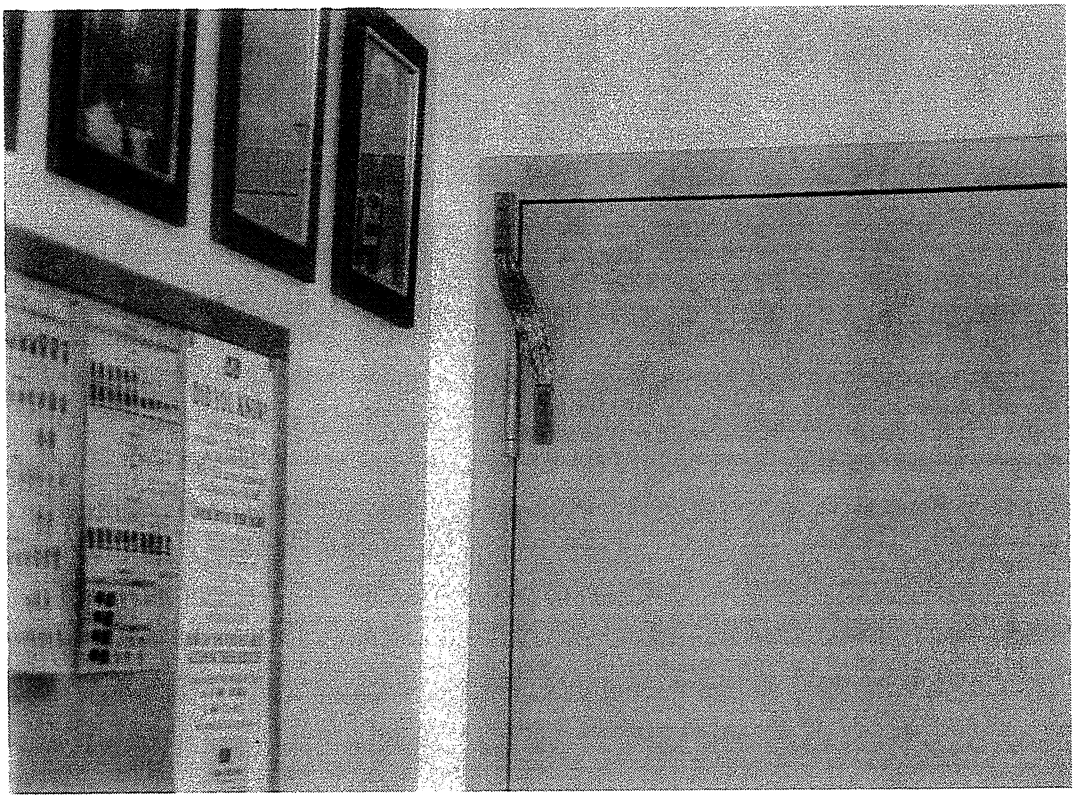
Picture of the special air core transformer used to couple AC power to the tower. The AC power is used to operate the tower obstruction lighting.

The tour guide related an interesting story concerning the tower lighting. They have to change light bulbs on a regular basis and this requires climbing the tower while it is "hot". To do this, they use a special fiberglass ladder to stand against the tower so they can start climbing several feet above the base insulator. The drill is to put the ladder in place, climb to the top of the ladder, take a deep breath and then grab the tower. The climber always gets a jolting shock at this time. As soon as the climber's body voltage equalizes with the tower voltage, he can continue climbing without getting any more shocks.

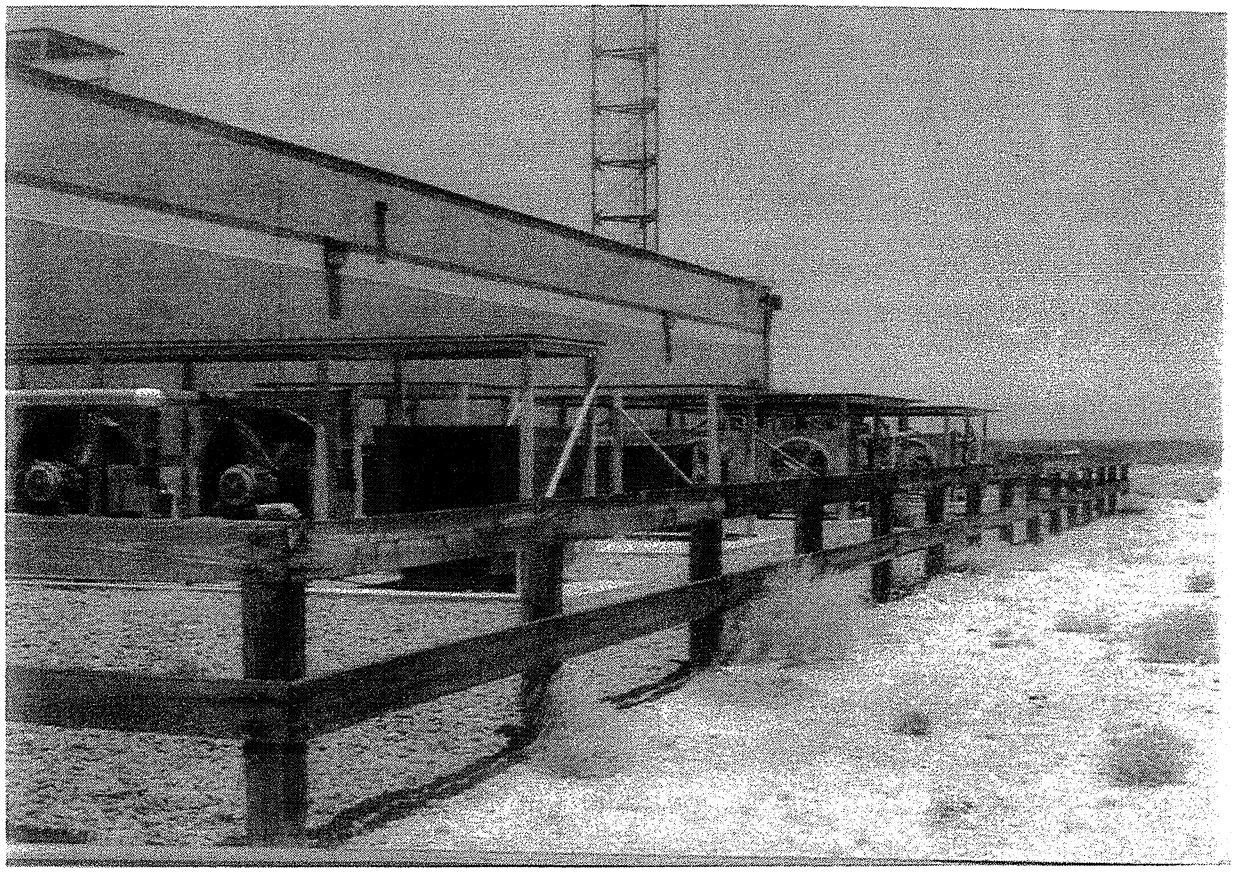


The site's standby generators.

The generators can power the site for several days should commercial power fail (which it frequently does in N.M.).



The entire building has a metal shield around it. Even the internal doors are bonded to the building frame as shown in the picture.



This picture shows the outside of the building and the heat exchangers for transmitter cooling. There are 12 units available. During the summer, they are sometimes stressed to keep the facility cool. Note the wood fence. Due to the strong RF fields around the site, all fences close to the building and antenna are made of wood. If metal fences were used, RF currents would be introduced causing potential safety hazards.

The Future of the Site.

I asked the USCG tour guide about the future of the Loran system. He said that Loran is being phased out and GPS will some day replace it. However, Loran still has many users, mostly military and private aviation. The Coast Guard conducted a survey in 2000 and found that enough people still use Loran to justify the continued operation of the system until at least 2008. The system is adequately funded to continue operation until then. The Loran site personnel believe that the US Loran chains will start being closed probably no later than 2010.

INSPIRE FIELD OBSERVERS

November/2002

New to the roster of observers is Andrew Collier, Team S-8.

(Unless noted otherwise, all longitudes are West and latitudes are North.)

Team #	Observer	Location	Longitude/Latitude
S-1	Kathryn Robinson. O'Connor High School	Helotes, TX	98° 47' / 29° 35'
S-2	Mark Mueller Brown Deer High School	Brown Deer, WI	87° 56' / 43° 10'
S-3	Elizabeth Quick John Marshall High School	San Antonio, TX	98° 72' / 29° 54'
S-4	Bill Pine Chaffey High School	Ontario, CA	117° 41' / 34° 14'
S-5	Jim Hoback John Jay High School	San Antonio, TX	
S-6	Loren Lund La Salle High School	Union Gap, WA	120° 30' / 46° 33'
S-7	Bill Combs Crawfordsville High School	Crawfordsville, IN	86.9075° / 40.0219°
S-8	Andrew Collier University of Natal	Durban South Africa	71°40'24" S / 02° 50' 03" W
I-1	Shawn Korgan	Gilcrest, CO	104° 67' / 40° 22'
I-2	Linden Lundback	Watrous, Sask,	105° 22' / 51° 41'
I-3	Robert Bennett	Las Cruces, NM	106° 44' / 32° 36'
I-4	Mitchell Lee	San Jose, CA	120° 40' / 39° 16'

Report on Field Observations 4/2003-10/2003

By Bill Pine
Ontario, California

All INSPIRE participants are encouraged to make observations and send their data tapes and logs in for analysis. The *Journal* would like this report to reflect the activities of all observers. Any data is good data! Please send data tapes regardless of how "successful" the session turned out to be.

The guidelines for observations are:

1. Fill out a log cover sheet and data sheets for each observation.
2. Place a voice introduction on each tape indicating name, date and start time.
3. Insert a time mark every two minutes during the observations.
4. Submit the data to:

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

The observations in this report will be given in chronological order. The convention for naming files is the following:

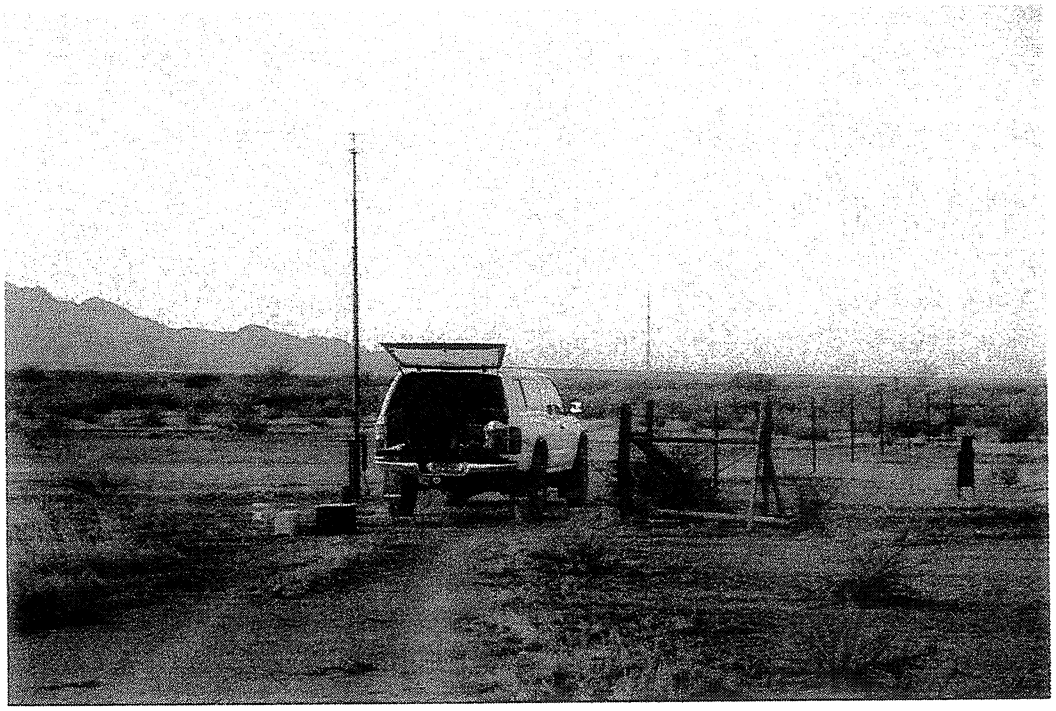
Name 4-26-03 13UT 06CST

Observer Name Date Start Time UT. Start Time Local

Spectrograms made for data analysis include the first 2 minutes 0-22 kHz range; the first 2 minutes 0-11 kHz range; the first minute 0-11 kHz range and the first 30 seconds 0-11 kHz range. When circumstances dictate, other formats for spectrographic analysis may be used. Spectrograms are also made of any portions of the tape requested by the observer.

On all spectrograms, the frequency range appears at the left of the spectrogram and the time interval appears at the top of the display. The time scale always starts with "0", rather from the actual time. An arrow on a spectrogram indicates the time interval shown on the following display.

4-25-03 Robert Bennett Las Cruces, NM

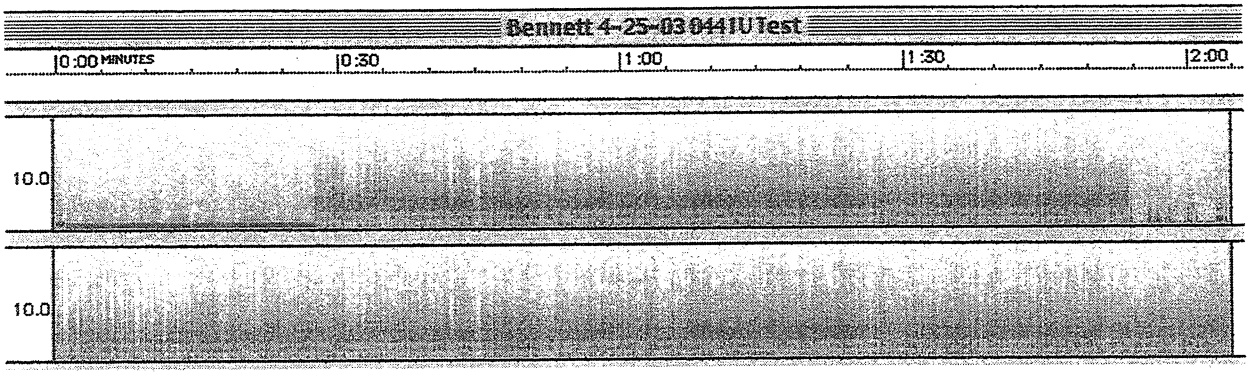


Robert's field setup. The INSPIRE antenna is on the right. The telescoping antenna on the left is for a scanner. Robert also has an antenna for his amateur transceiver for communicating with home.

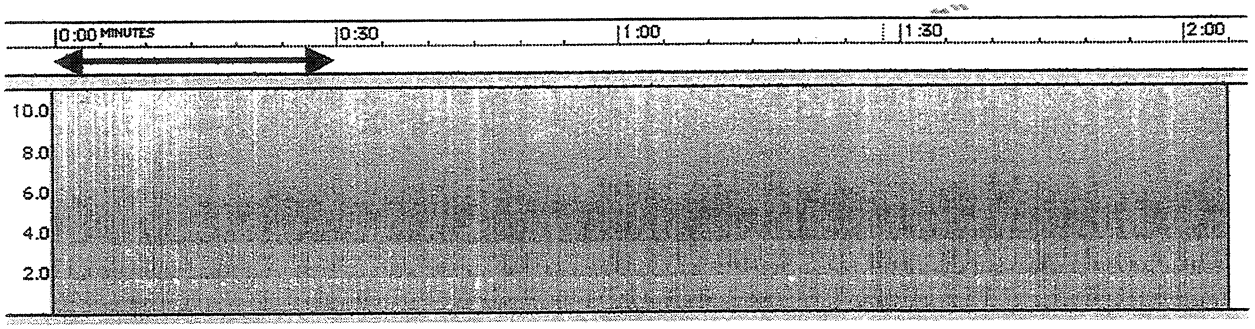
This view is through the windshield showing the receiver and recorder on a board from the dash to the passenger seat back.

Bennett

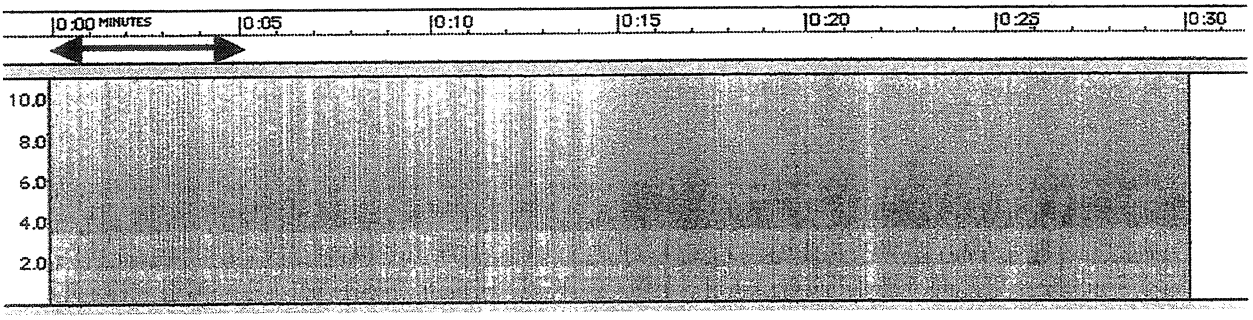
Robert's first session was an evening session. The purpose of the session was to test a repaired Marantz recorder. Most of Robert's observations are made in the morning, so this session was unusual. Evening sessions are often characterized by the presence of tweeks that appear near sunset and continue through the night. Robert's tapes show this well.



The Marantz recorder is a stereo recorder. Robert puts WWV on one track (the top one) for time marks and data on the other track. When time marks are not being taken, the top track is switched so that data appears on both tracks.

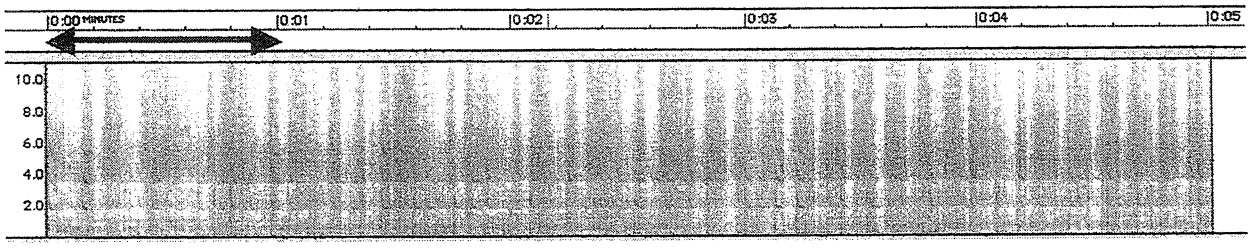


This is the data track only. The arrow indicates that the next spectrogram is of the first 30 seconds.

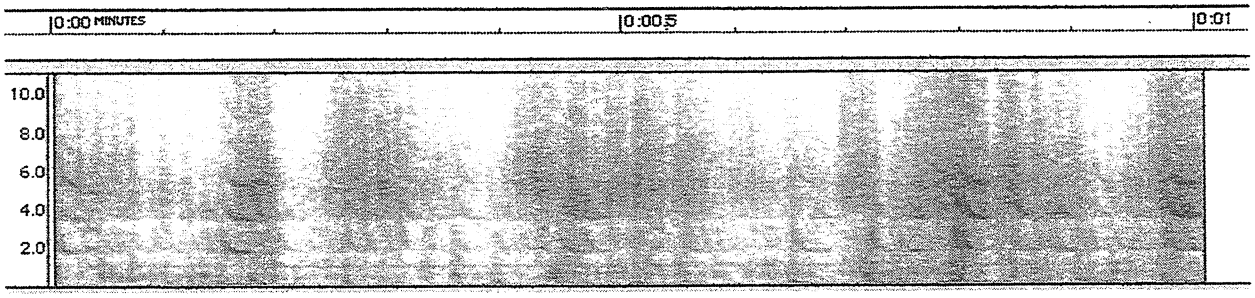


The next spectrogram is of the first 5 seconds.

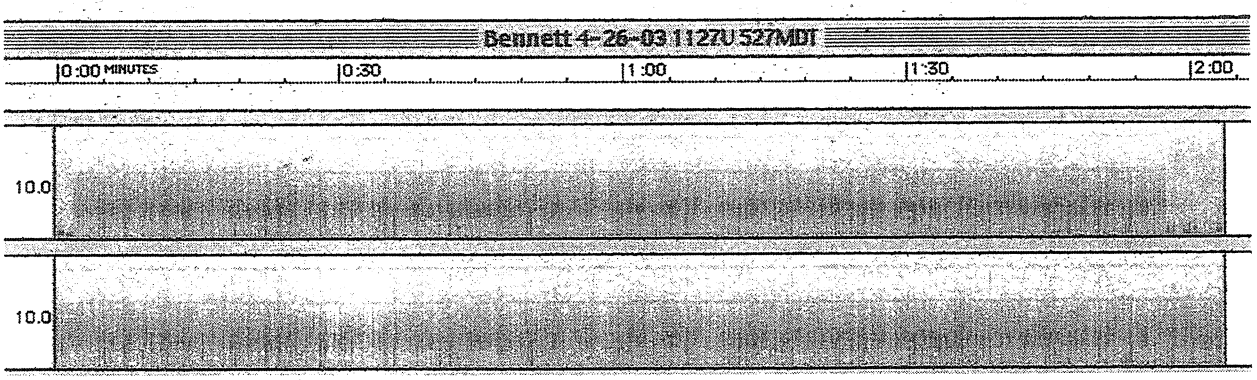
Bennett



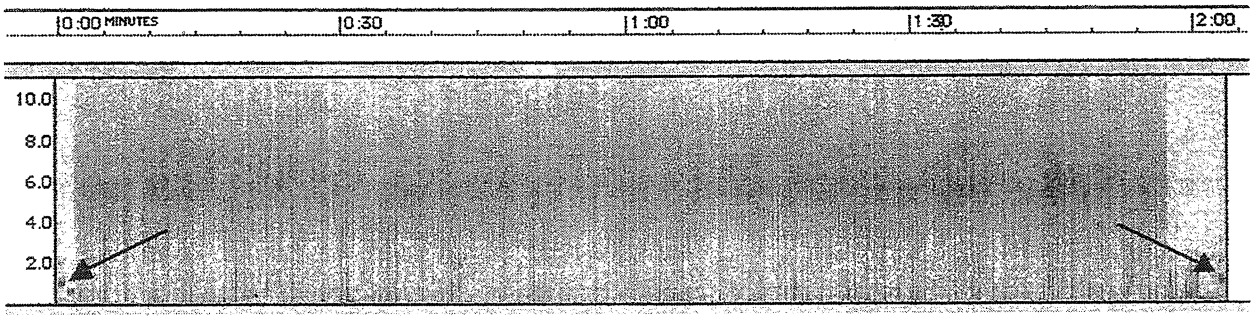
The next spectrogram is of the first 1 second to show the tweeks individually.



The strength of the tweeks is indicated qualitatively by the presence of several harmonics of the stronger tweeks. The tweek density is more than 10 tweeks per second.



The next morning, Robert was observing starting at 5:27 AM MDT (1127 UT).



The arrows above point to the 1 kHz WWV tones at 112700 UT and 112702 UT.

Bennett

Below is a sample from Robert's log for 4-26-03.

DATA COLLECTION FORM

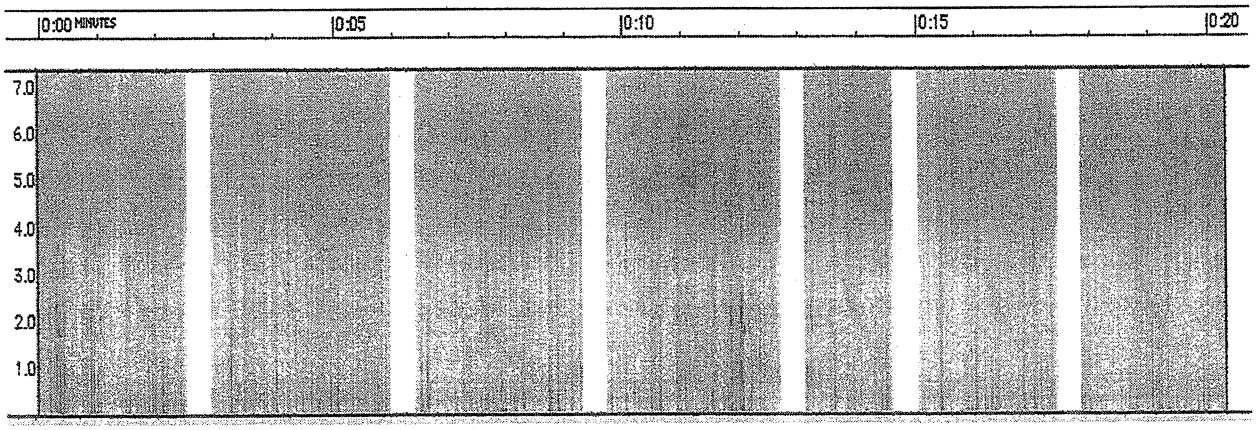
0530 MDT Start

Operation: Coordinated Monitoring

Date: 26 Apr 03

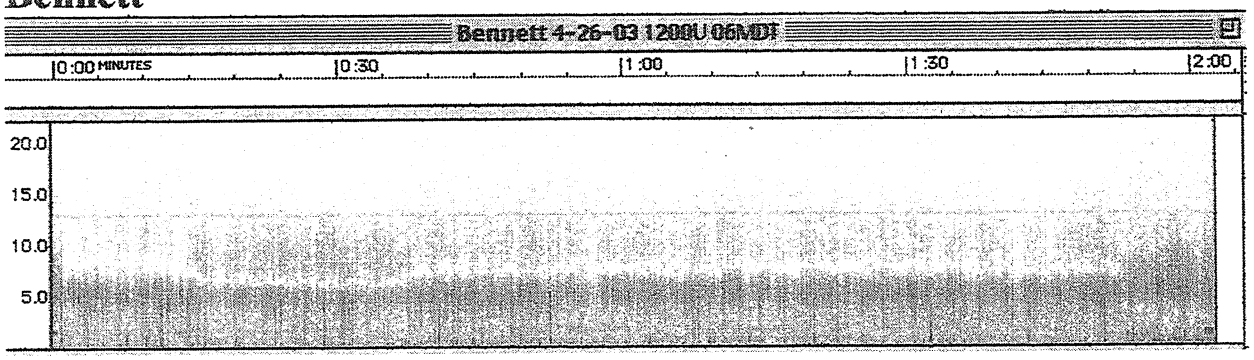
TAPE RECORDER COUNTER	TIME UT	EVENT	SFERIC LEVEL	COMMENTS
0		Voice Announcement		Antenna filter
18	1127	WWV	7-8	is "in", too much
		many strong Tweeks		Loran. Recorder
36		Triggered whistler		on 2, Limiter in,
52		whistler		Natural Radio Signals
57	1129	WWV		Strong.
64		whistler		WWV on Right
78		strong whistler		channel.
108	1132	WWV		
124		weak whistler		Very dry - I am
137		strong whistler		getting a lot of
140	1134	WWV		static electricity.
141		chorul whistlers		
183	1137	WWV		Starting to get light
263		strong whistler		outside.

Spectrograms of some of the whistlers logged above are shown below.

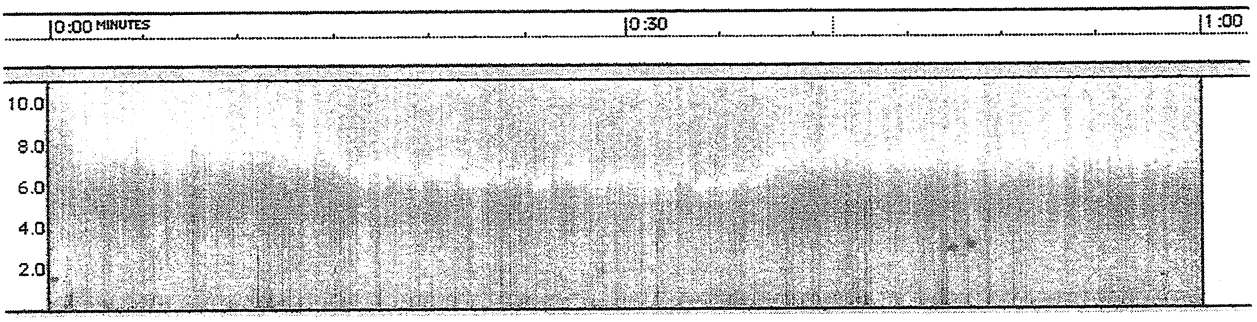


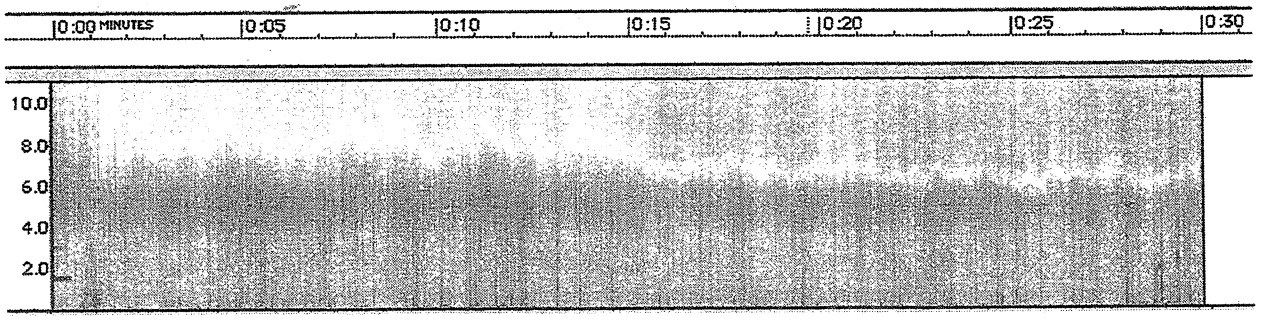
One thing that was unusual about this session is that the sferic density was high. The whistlers are easily heard on the tapes, but are harder to find in the spectrograms because of the high sferic density. Whistlers are generally more common (or easier to hear?) when the overall sferic density is lower.

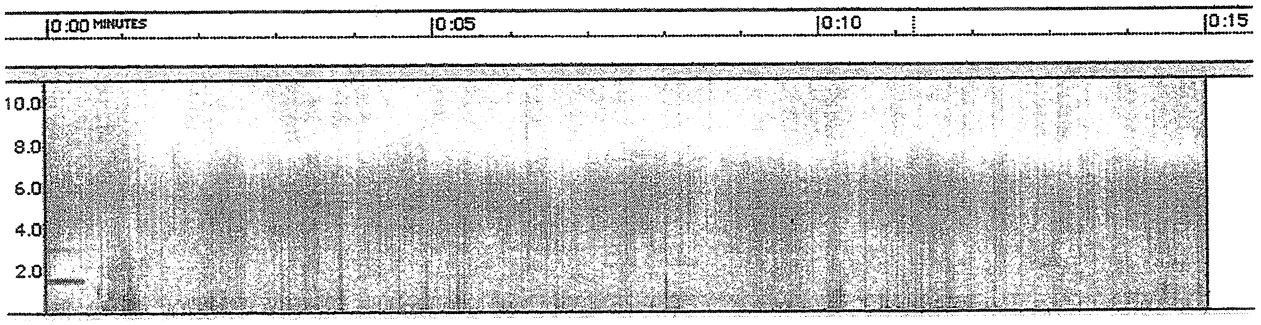
Bennett



This data is part of the coordinated observations starting at 6 AM MDT (1200 UT). The sferic density has dropped somewhat and whistlers are less common.





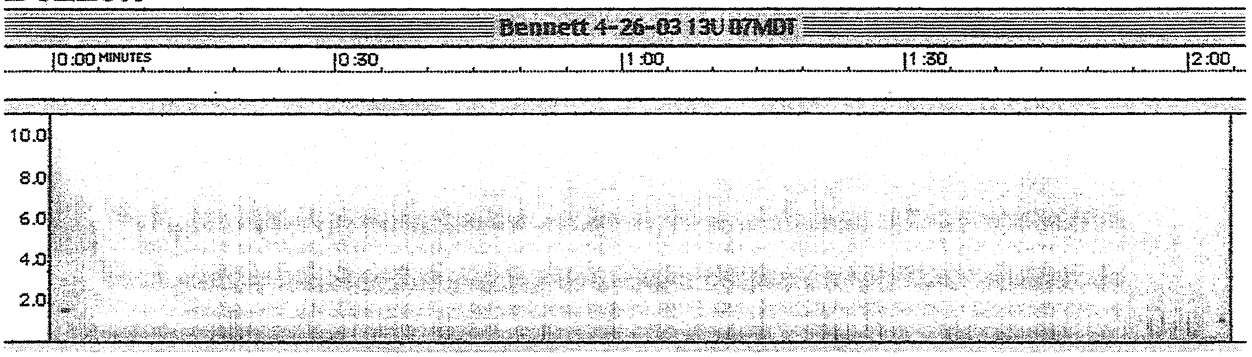


Bennett

The view from Robert's "quiet site". Buildings in the distance are the NASA TDRSS satellite communication facility.

The approach road to Robert's site. After a rain, this road is impassible, even with 4-wheel drive. It is strictly "Driver beware!".

Bennett



The log for the above session is shown below. Whistlers have stopped and sferic density has declined to "near normal daytime levels". Notice the log entry "WWV starting to fade" at 1315UT indicating the change in the ionosphere.

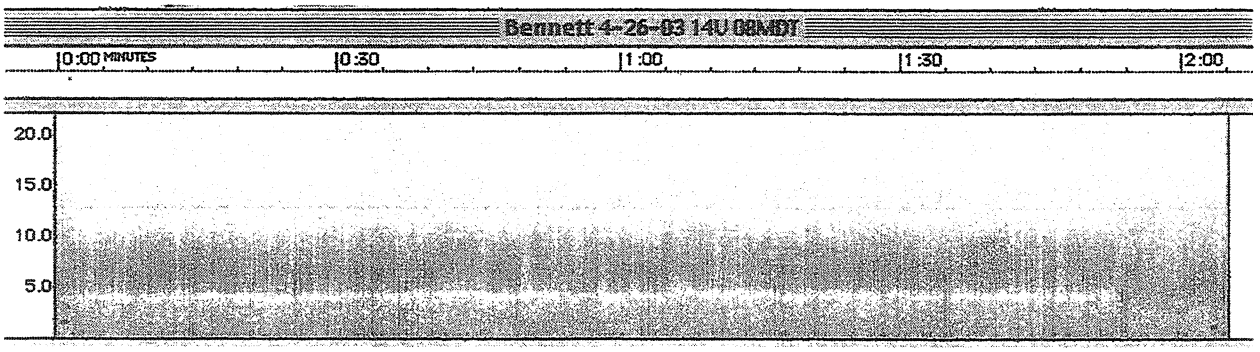
DATA COLLECTION FORM

Operation: Coordinated monitoring 0700-0715 MDT

Date: 26 Apr 03

TAPE RECORDER COUNTER	TIME UT	EVENT	SFERIC LEVEL	COMMENTS
0		Voice Announcement		
11	1301	WWV	5-6	1. Ant attenuator
49	1302	WWV		"in", Recorder
				limiter "out".
58		Strong static caused		Record level are
		by me moving RX.		4.
86-90		movement (me) noise		2. levels weaker
112	1306	WWV		than at 0600,
134	1307	WWV		Near normal
164	1309	WWV		daytime levels.
172		Whistler [redacted]		
192	1311	WWV		
219	1313	WWV		
244	1315	WWV	WWV	starting to Fade.

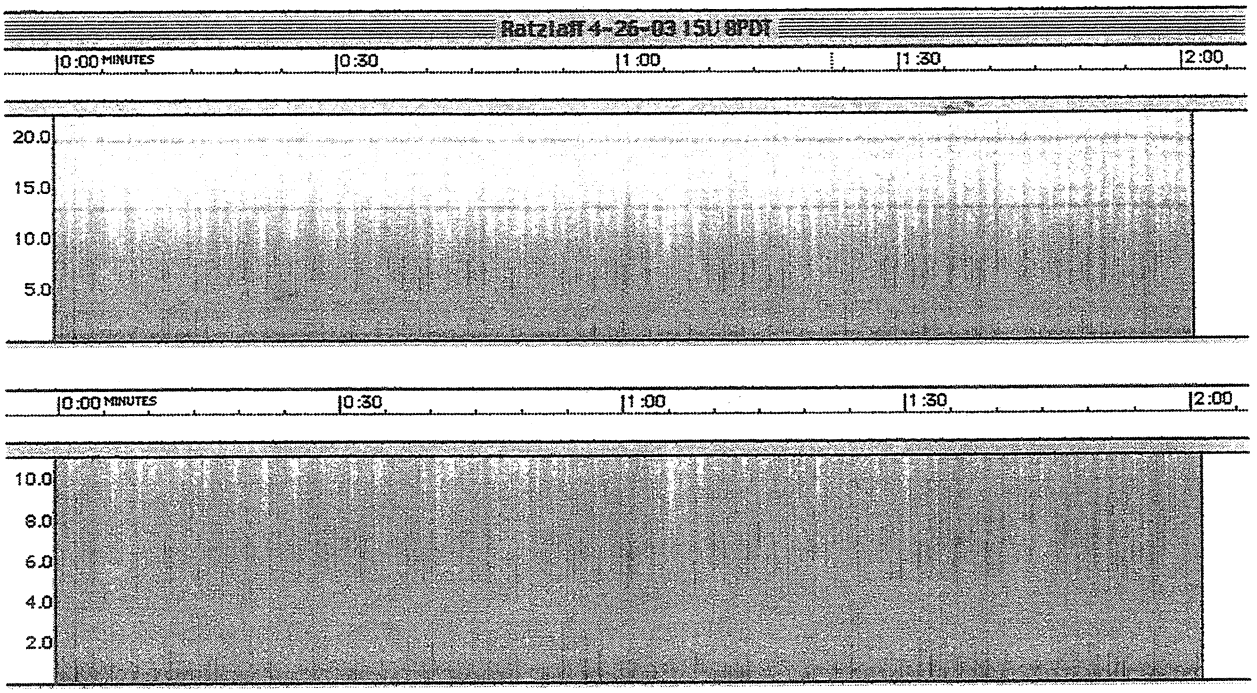
26 April 03



4-26-03 Steve Ratzlaff Elgin, OR

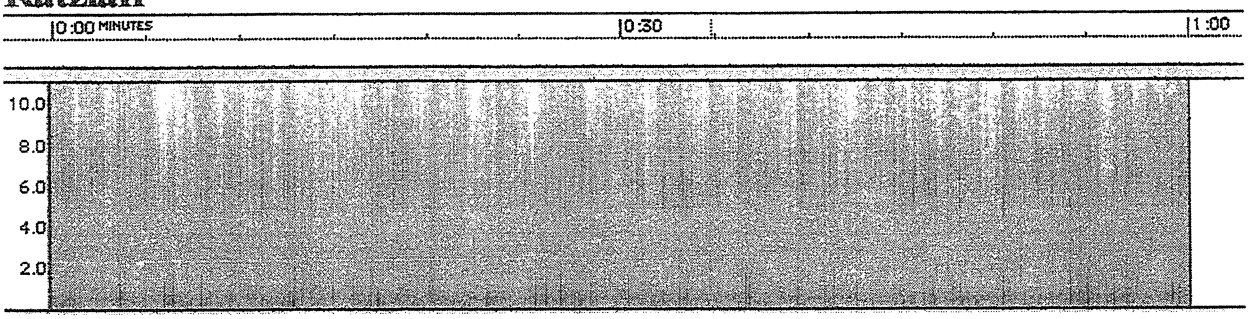
"For the Saturday session I arrived at the site about 30 minutes early. I was planning to use the loop antenna and receiver; everything was already setup and in place, all I needed to do was put an external ground rod out, attach the loop preamp and connect the remote feedline to the receiver in the vehicle where I do my monitoring, about 130 feet away from the loop. This distance is necessary to prevent recorder motor whine from being picked up by the loop. All this takes no more than 5 minutes to be set up and ready for listening. But my initial check of the loop receiver showed nothing heard, not even background noise. Quick checks of the equipment didn't find anything obviously wrong. I'd used this setup just the previous day with no problems.

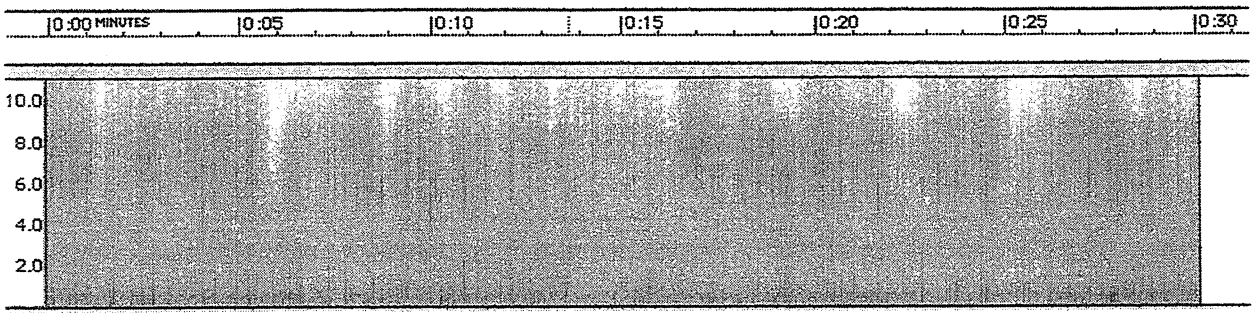
Time was running out to meet the 8 a.m. session start time. I hastily set up my vertical mast, got the VLF3 set up, got the recorder set up with the VLF3. Finally I was hearing VLF in the headphones, but not using the loop receiver. And I was already 7 minutes late in the session. But I got the final 5 minutes recorded of the 8a.m. session, and was also rewarded with a weak whistler. There was no other VLF activity occurring, like chorus or frequent whistlers—just strong sferics."



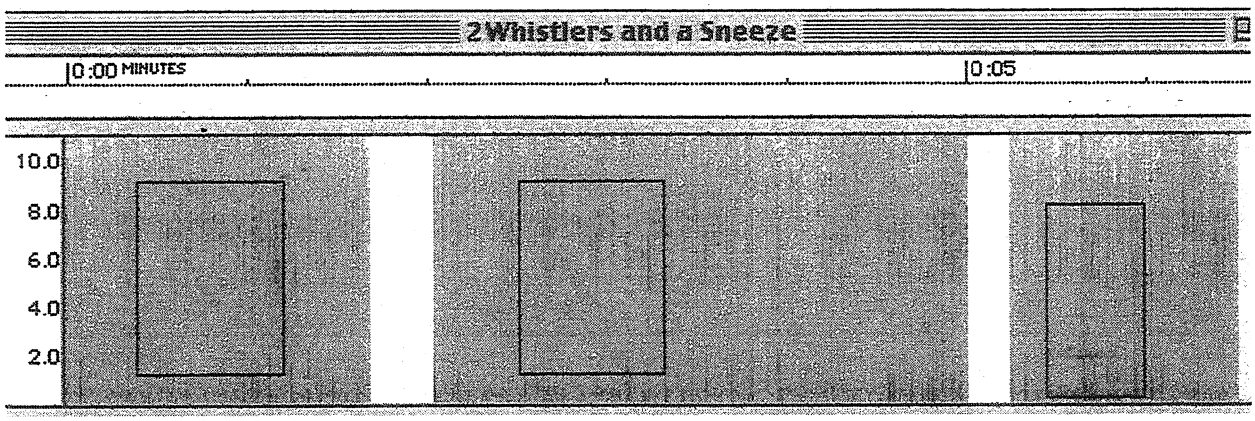
Strong, dense sferics.

Ratzlaff



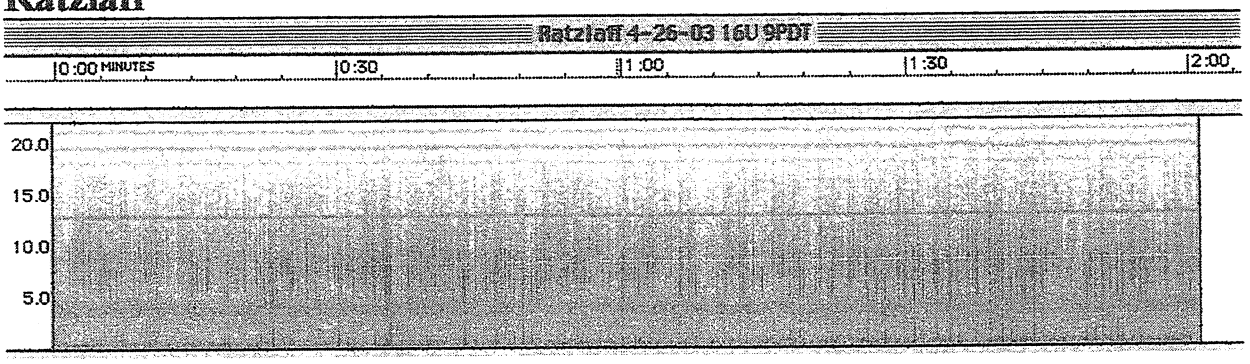


"Nine to 10 minute—10:16 I sneezed and somehow this is received and is on tape, even though no mic is attached or turned on—this is "unnatural" VLF data!"

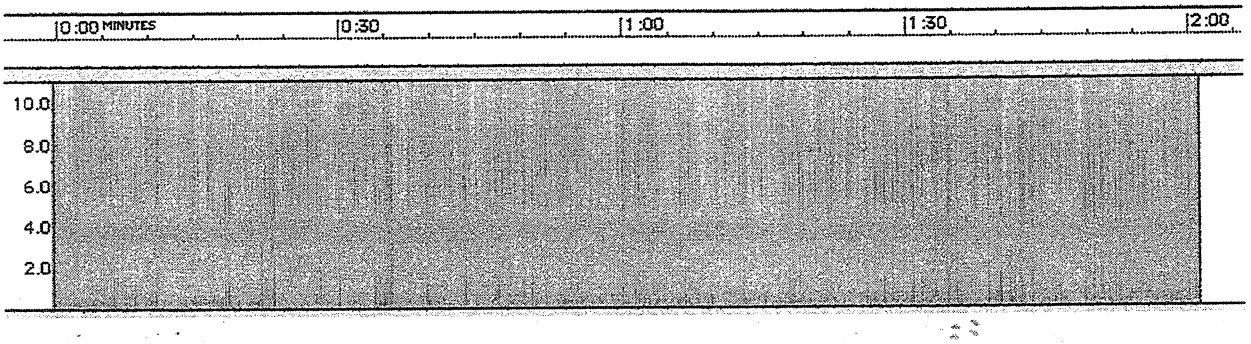


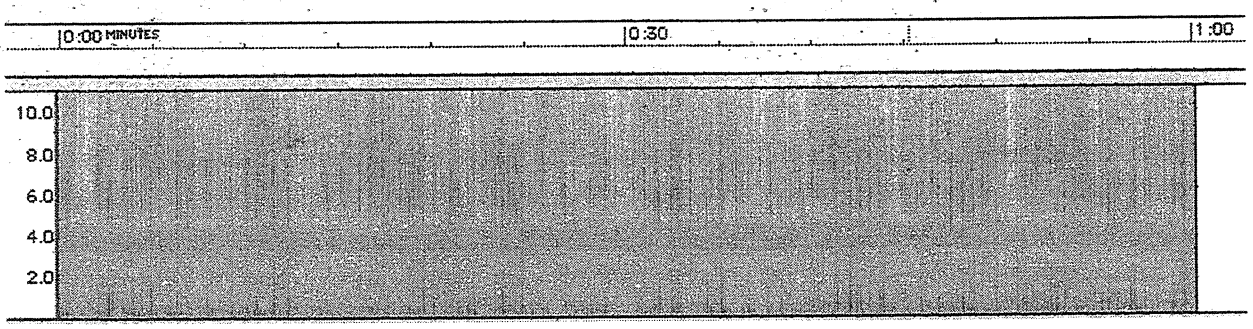
Whistler Whistler Sneeze

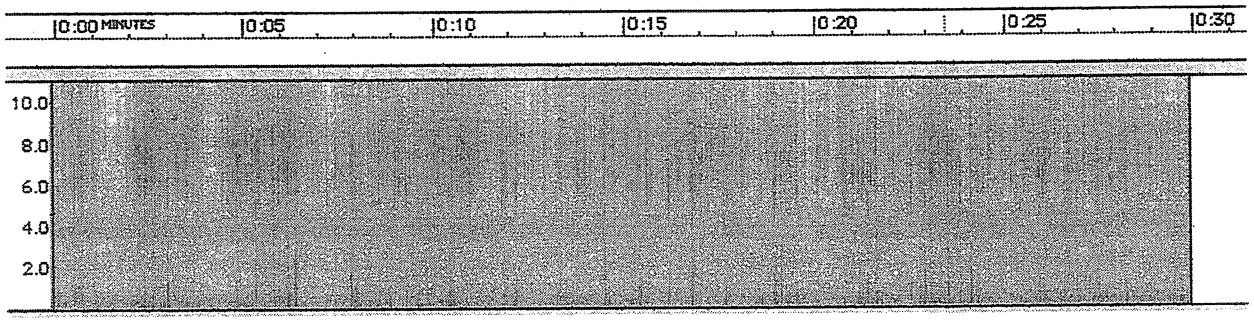
Ratzlaff



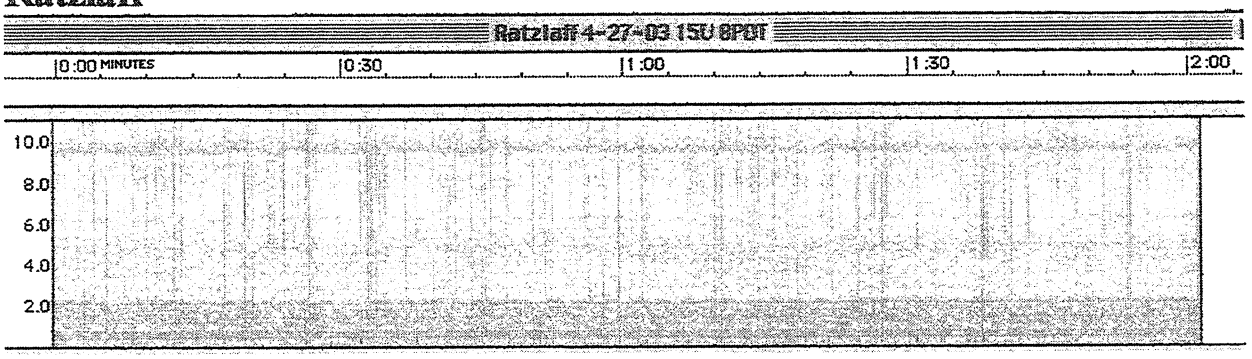
Still strong, dense sferics.

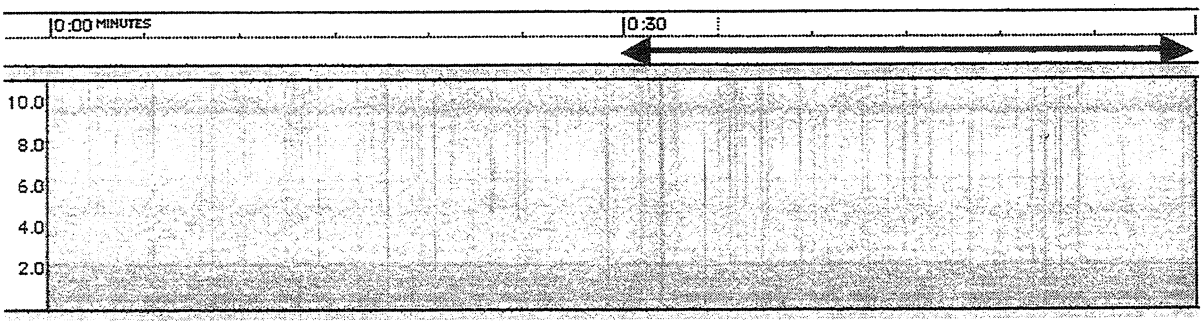


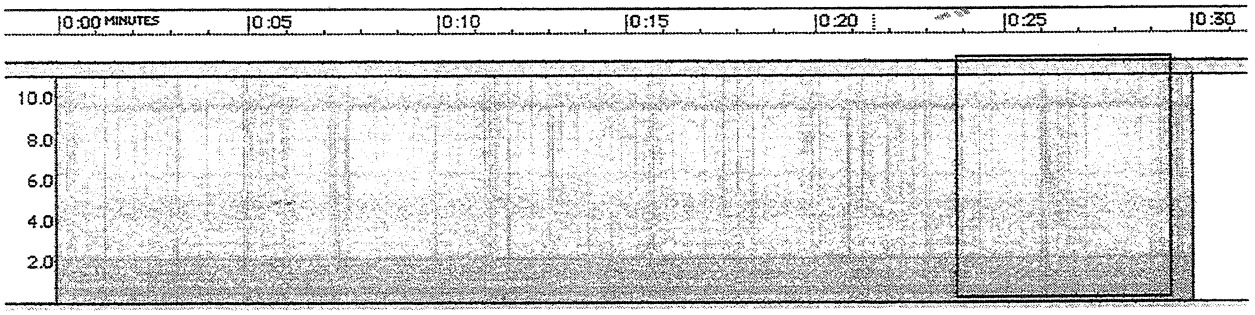




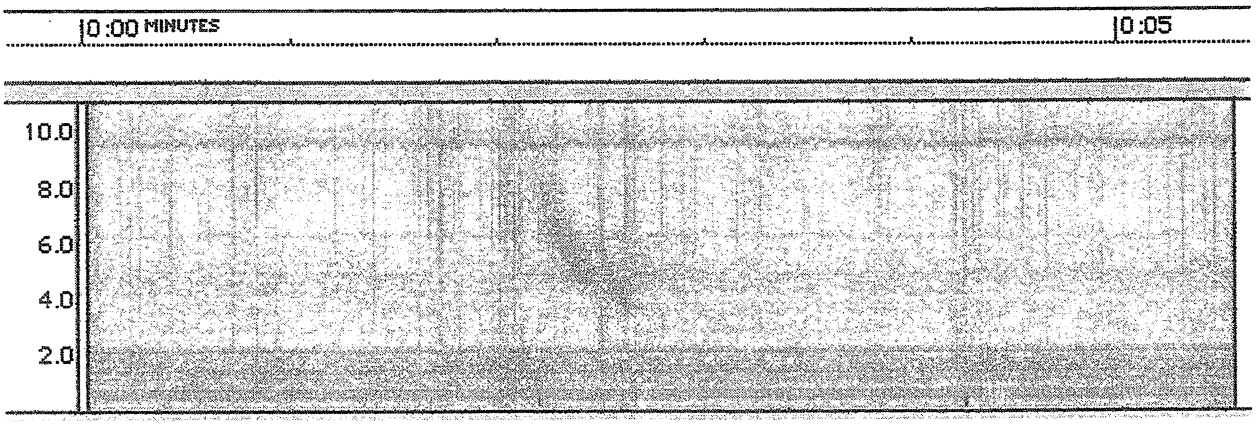
Ratzlaff





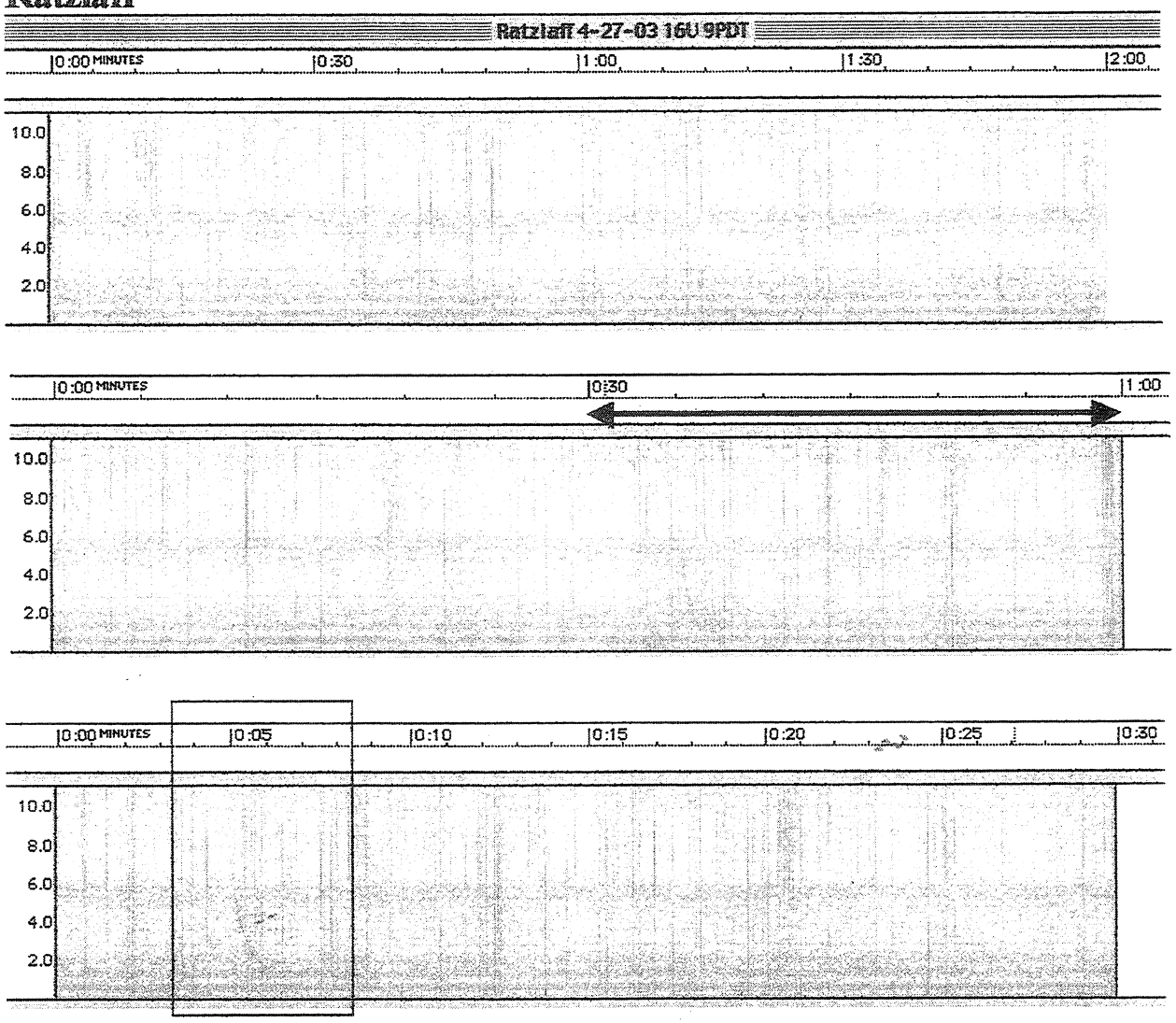


"One to two minute—1:03 high-pitched fast weak whistler. 1:46 medium level sferics crash "

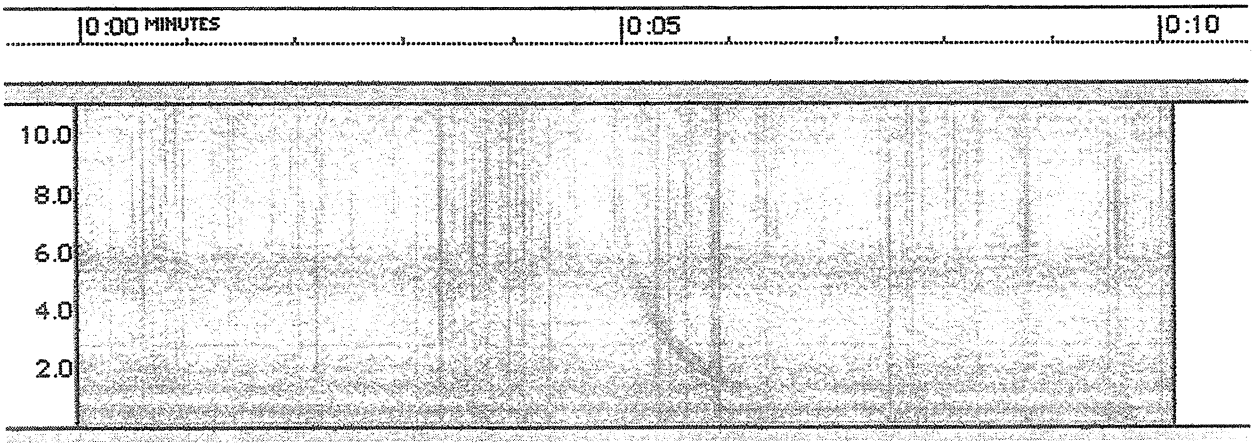


Whistler logged at 1:03 shows up at :57 seconds due to poor time sync with spectrogram.

Ratzlaff



Whistler.



Close up of whistler.

Ratzlaff

"4/27/03 Sunday

Large 130 foot circumference loop antenna and receiver used for both Sunday sessions. Hum is significantly higher as the loop is a lot more sensitive than the VLF-3 e-field receiver with 25 foot vertical antenna..

9a.m./1600UTC, 4/27/03 Sunday session; continuing to record data with the loop receiver (Tape has a 15 second blank period between end of 8a.m. session and start of 9a.m. session—data playback begins at exactly 9:00:00a.m. (There is no voice data on this tape.)

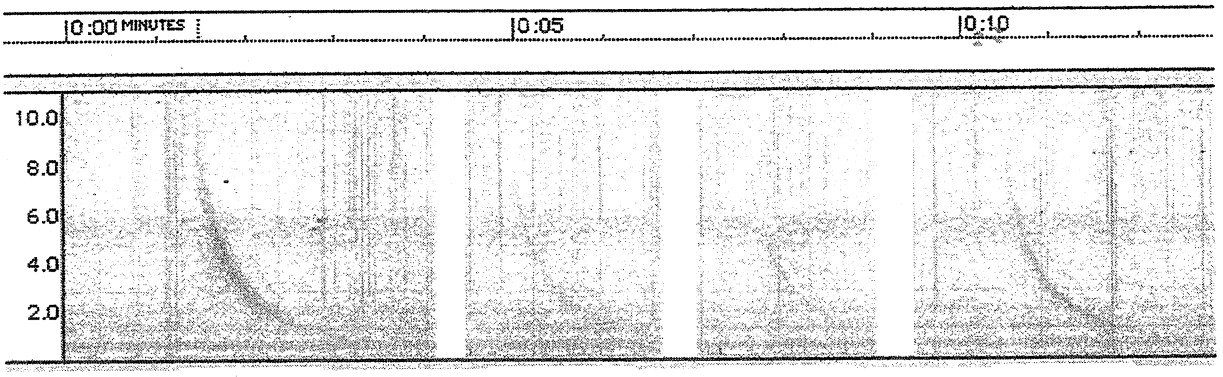
Zero to one minute--:10—faint chorus noted in the background, throughout this session, too weak to be recorded. Sounds like medium-pitched chirping.

One to two minute—1:28 sferic crashes

Two to three minute—2:12medium level high-pitched whistler lasting 1.5 seconds

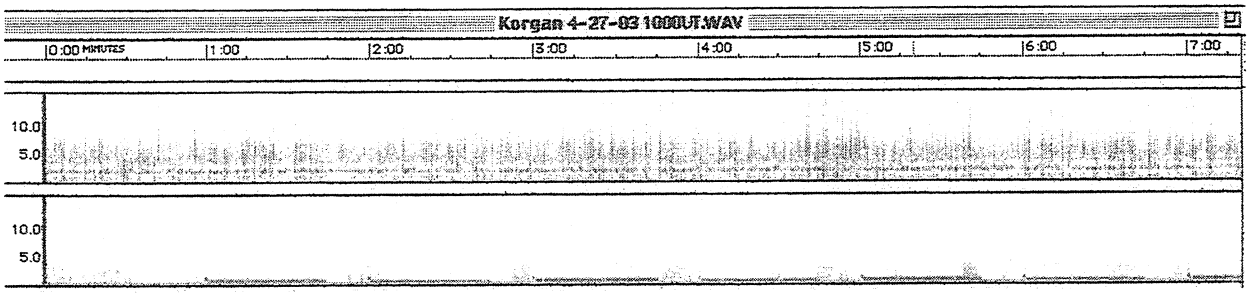
Three to four minute—3:49 long weak whistler

Four to five minute—4:19 weak whistler; 4:44 long medium level whistler"

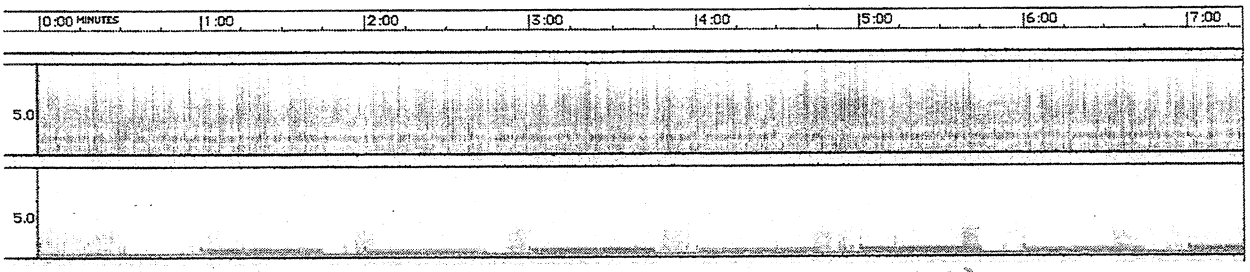


1602:12 1603:49 1604:19 1604:44

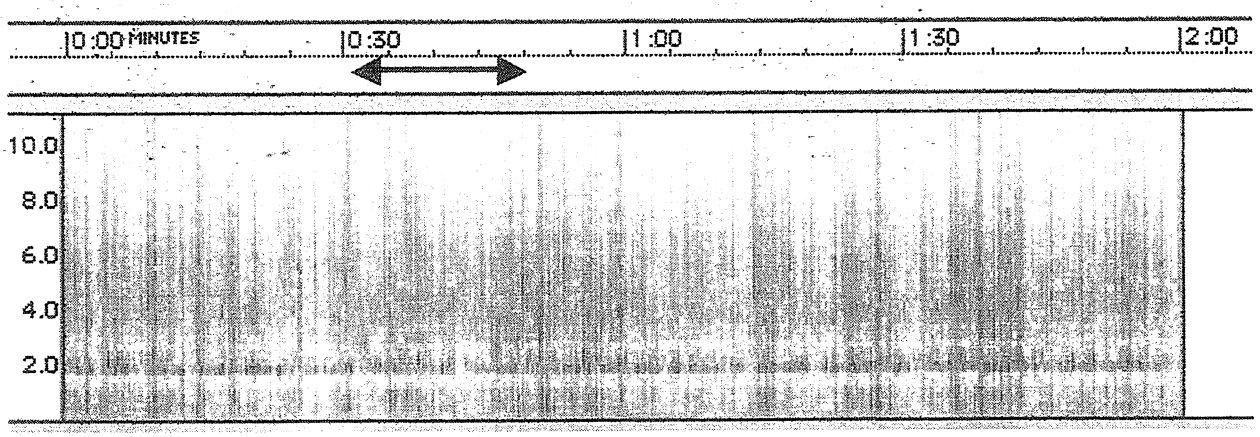
4-27-03 Shawn Korgan Gilcrest, CO

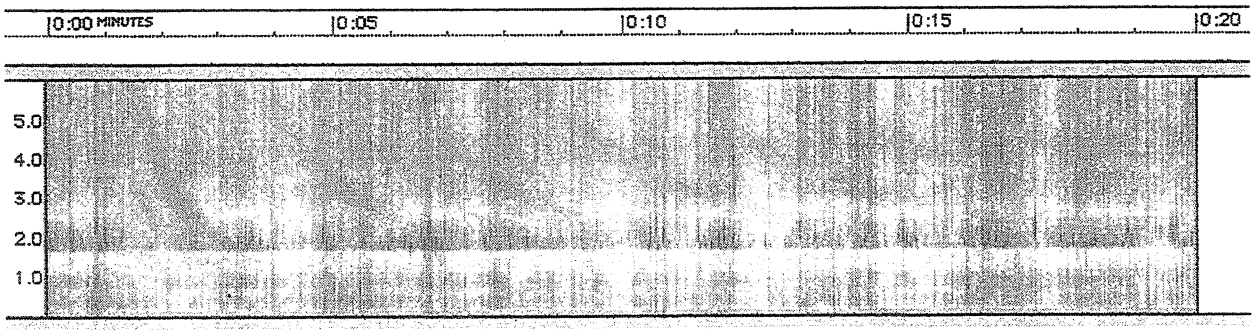


Shawn provided .WAV files of his sessions. This is a 7-minute file starting at 10 UT on 4-27-03. Data on the top track, WWV on the bottom track.



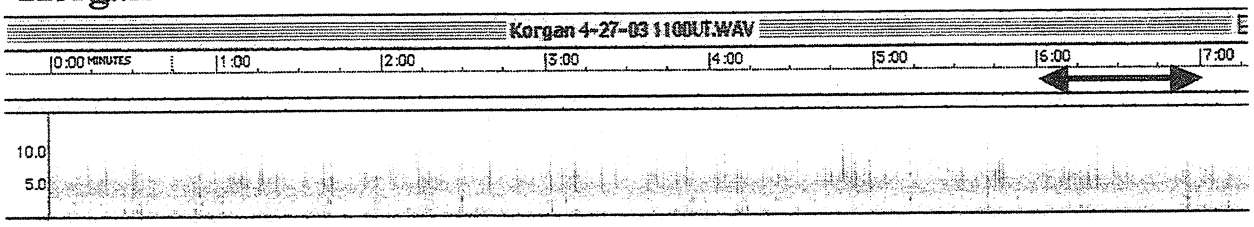
The first 2 minutes.





Whistler with many echoes.

Korgan



pg 1

INSPIRE Data (copy as needed)

INSPIRE Observer Team: DAWN RIVERS Team Number: I-1

Coordinated Observation Date: April 27, 2003 Receiver: SK-1

Tape Start Time (UT): 11:00 Tape Start Time (Local): 5:00 AM MST

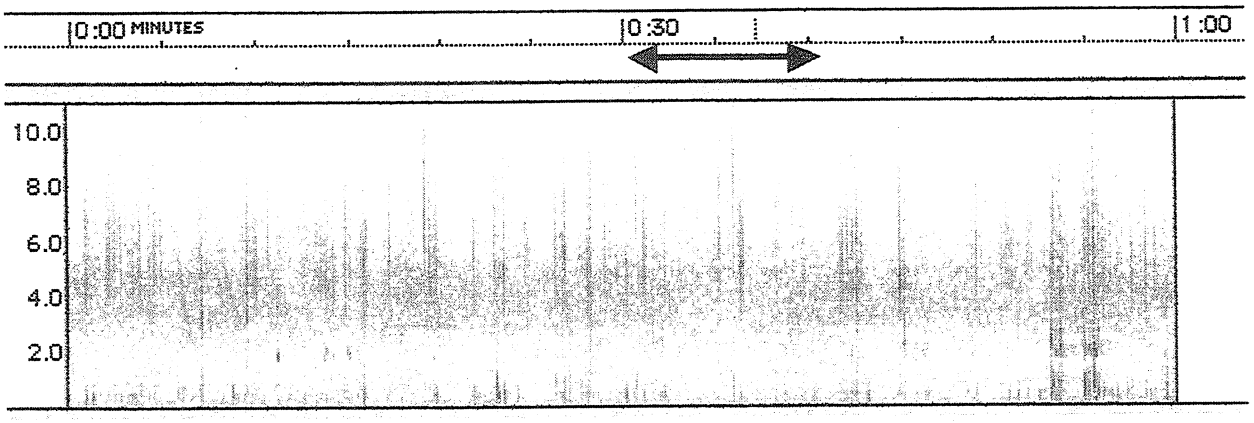
Local weather: Calm partly cloudy, 45°

Code: M - Mark (WWV or Voice) S - sferics T - tweek W - whistler A - Alpha C – chorus
Sferic Density: D: 3 Scale of 1-5 (1 – Very Low, 3 – Medium, 5 – Very High)

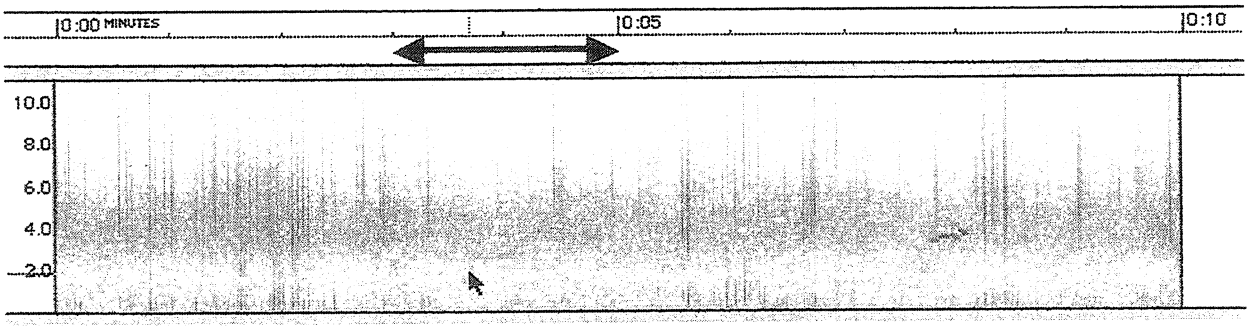
	Time (UT)	Entry		Observer
00	01	M-WWV M-V STC (W)	D: 1	
	11	M-WWV M-V STC (W)	D: 1	
	29	M-WWV M-V STC (W)	D: 1	
	35	M-WWV M-V STC (W)	D: 1	
	39	M-WWV M-V STC (W)	D: 1	
	48	M-WWV M-V STC (W) with echoes	D: 2	
	53	M-WWV M-V STC (W)	D: 1	
02	03	M-WWV M-V STC (W)	D: 1	
	15	M-WWV M-V STC (W)	D: 1	
	53	M-WWV M-V STC (W) freq. lapse?	D: 1	
04	30	M-WWV M-V STC (W)	D: 1	
05	39	M-WWV M-V STC (W) with several echoes	D: 1	
	55	M-WWV M-V STC (W)	D: 1	
06	07	M-WWV M-V STC (W) with many echoes	D: 2	
	27	M-WWV M-V STC (W)	D: 1	
	34	M-WWV M-V STC (W) emission	D: 1	
	52	M-WWV M-V STC (W)	D: 1	
	58	M-WWV M-V STC (W)	D: 1	

Note the emission logged at 110634 MDT. That is the target.

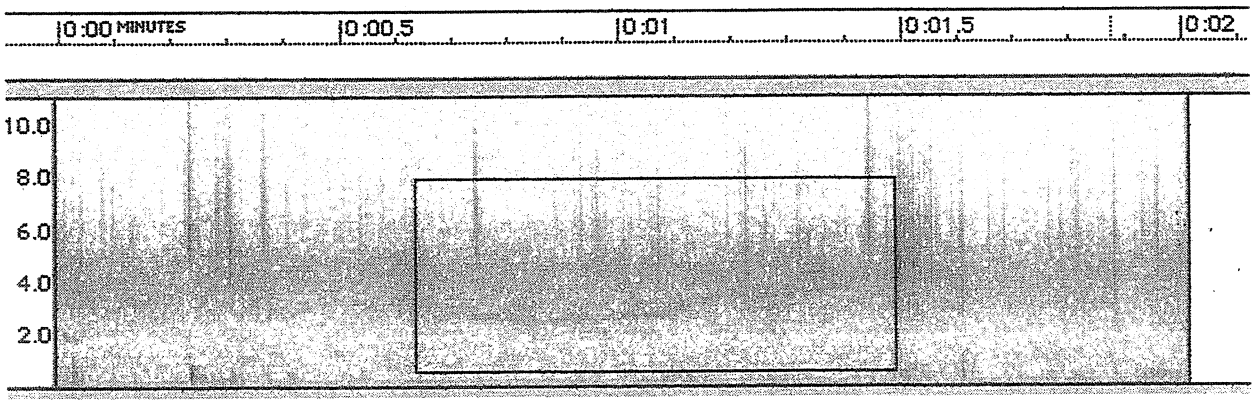
Korgan



From time 1106 UT to 1107 UT.

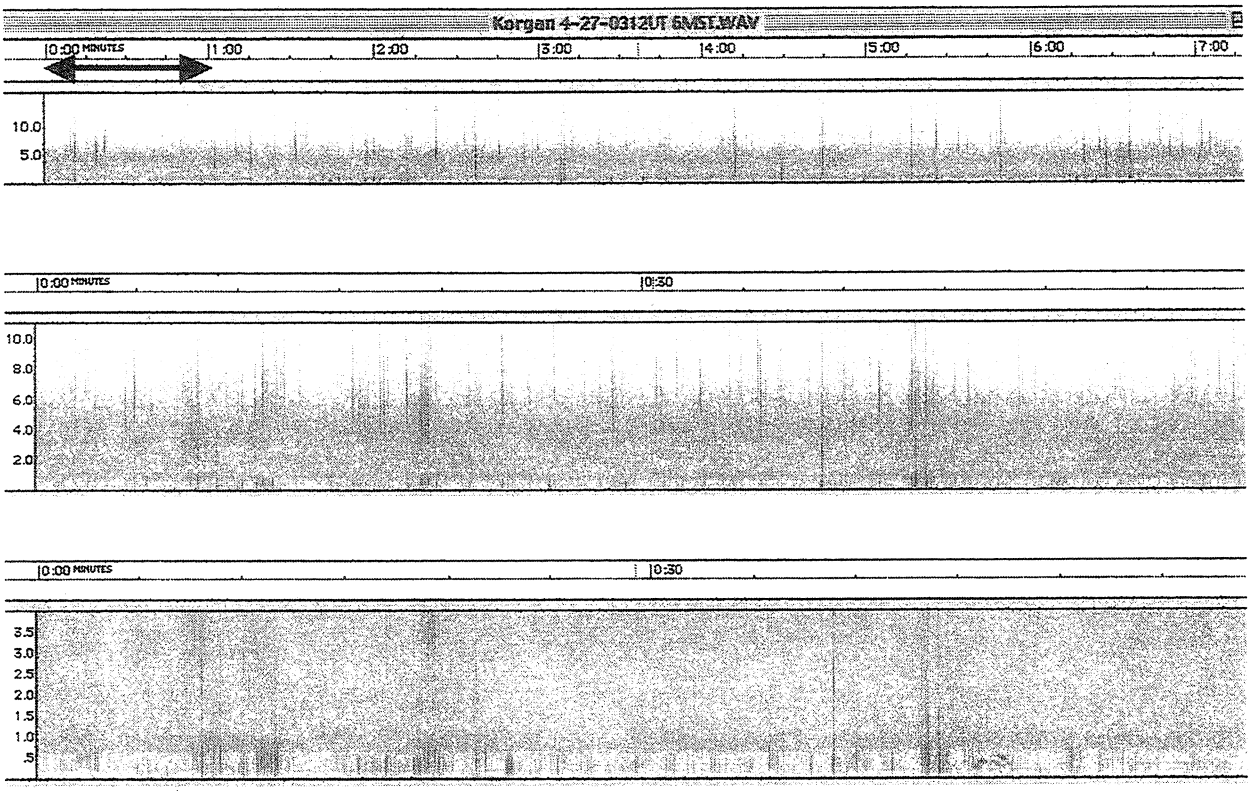


The small arrow points to the emission.

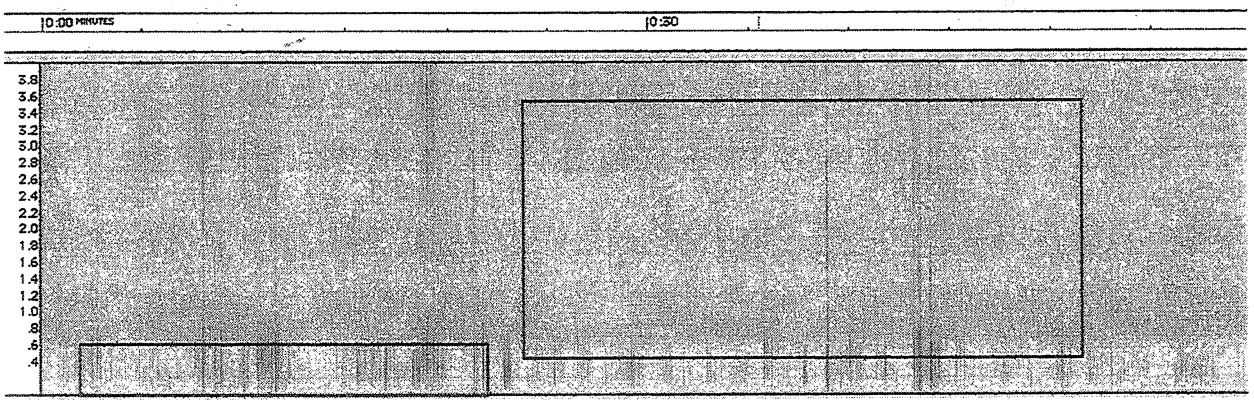


Emission logged at 110634 UT.

Korgan

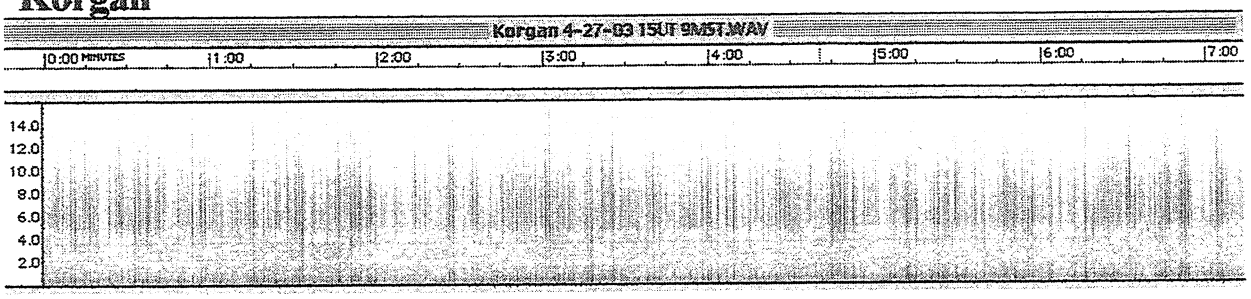


The first minute using a frequency range of 0-4 kHz.

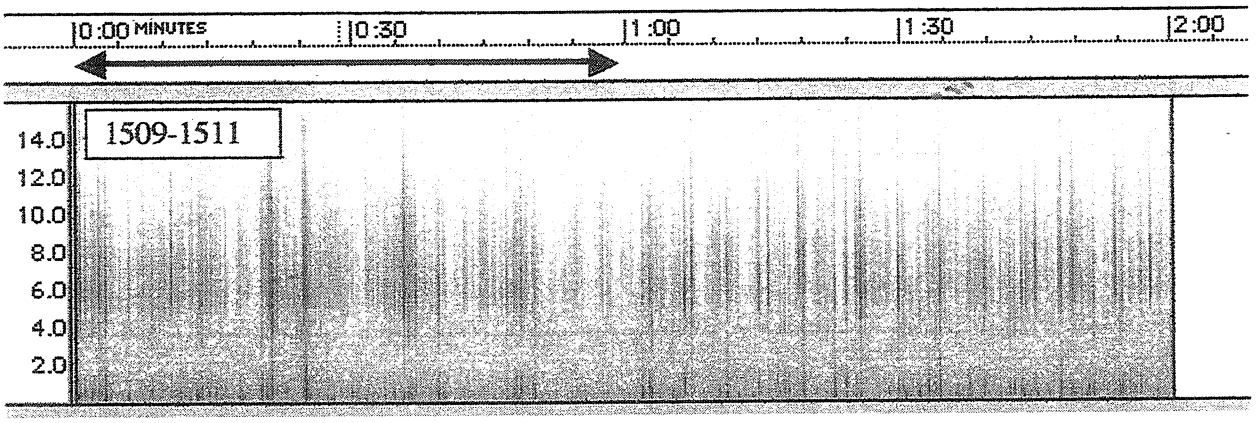


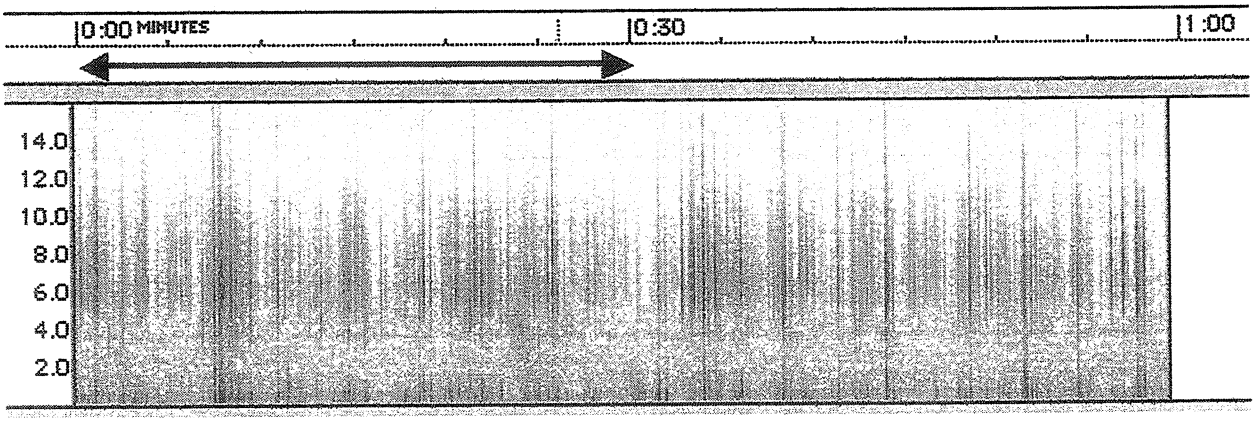
He first rectangle shows the strong sferics that are getting through the high pass filter of the VLF3. The second rectangle shows the sferics as a dense collection of vertical lines.

Korgan

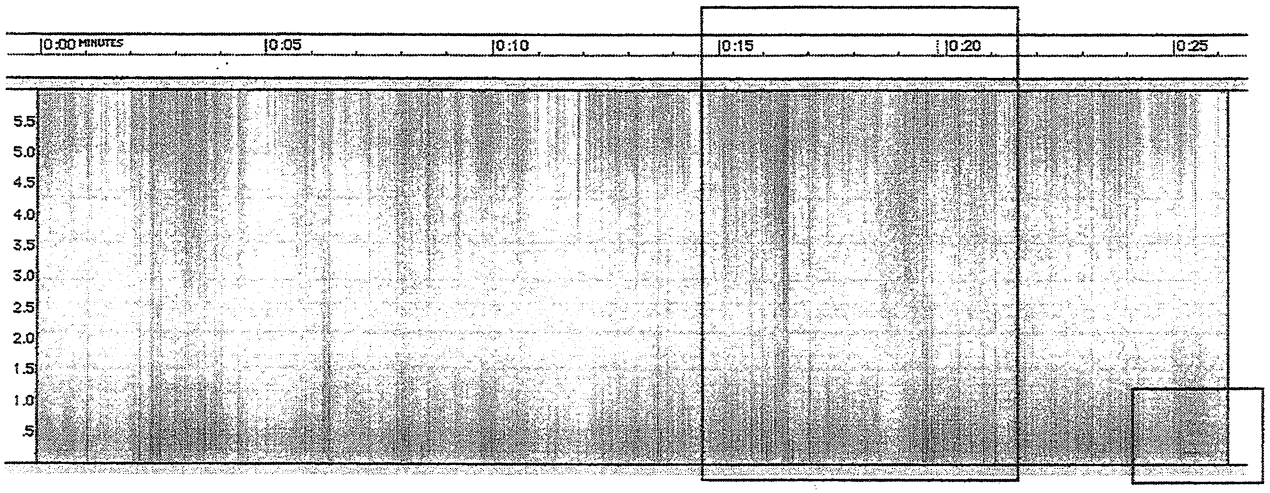


	11	M-WWV M-V	STCW	fly	D:
09	04	M-WWV M-V	STCW	Not sounding with echo	D: 2
	10	M-WWV M-V	STCW		D: 1
	13	M-WWV M-V	STCW	fly	D:
	26	M-WWV M-V	STCW	with echo	D: 2
	32	M-WWV M-V	STCW	fly	D:
10	02	M-WWV M-V	STCW		

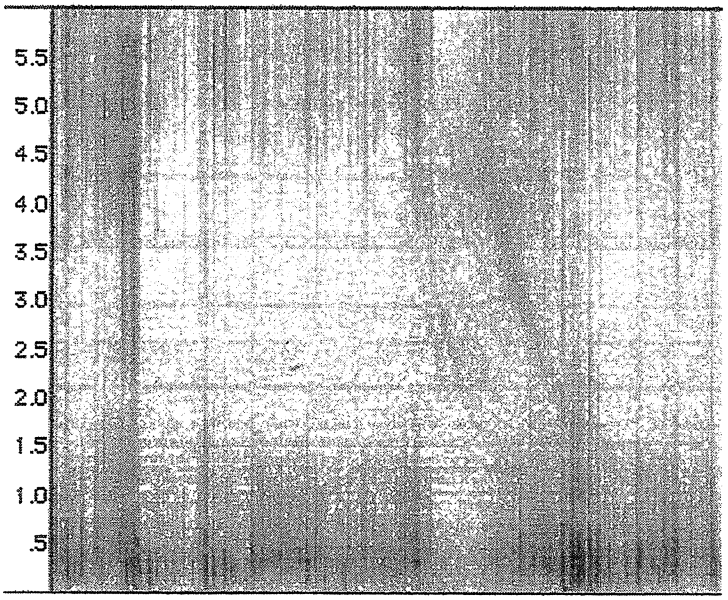




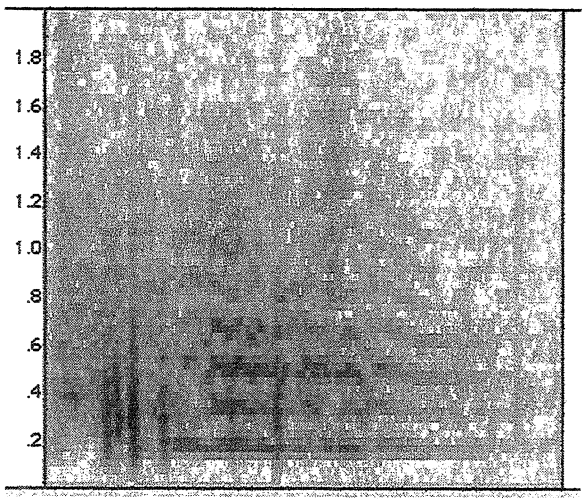
Korgan



The first box holds a whistler; the second is the fly.



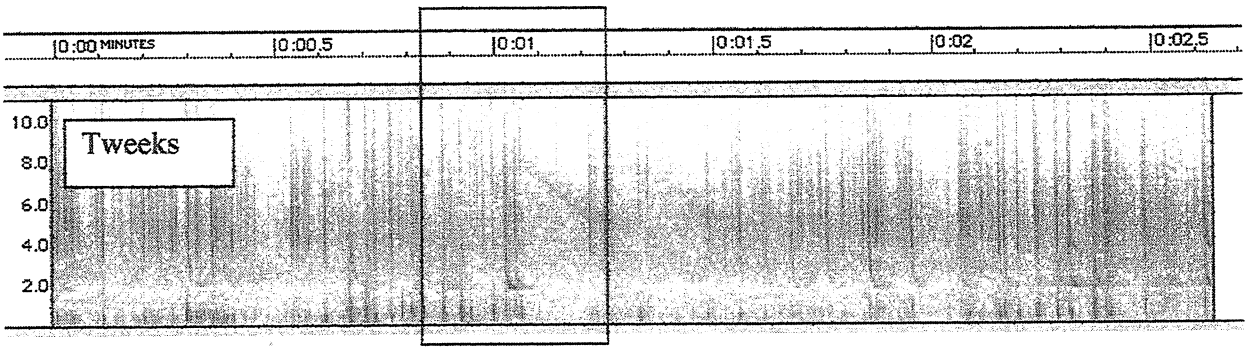
Whistler logged at 150926 "with echo". On closer examination of the spectrogram, it is actually a double whistler and a 2-hop one at that. The olriginating sferics appear at the far left of the sample.

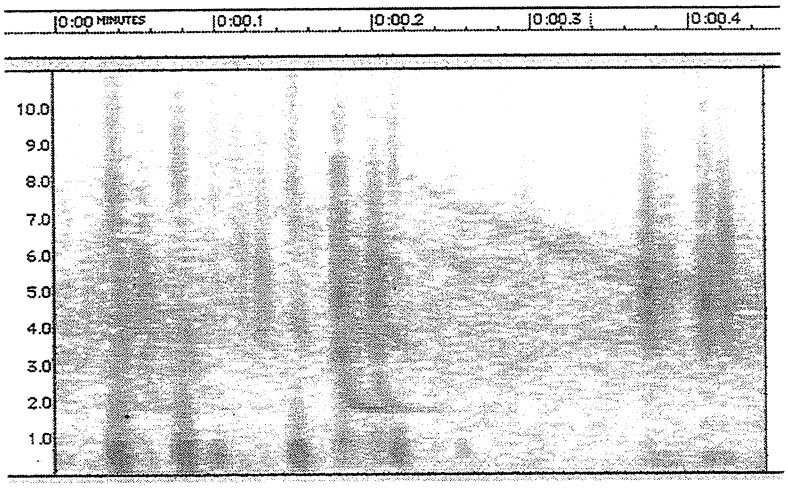


The characteristic signal from a fly!

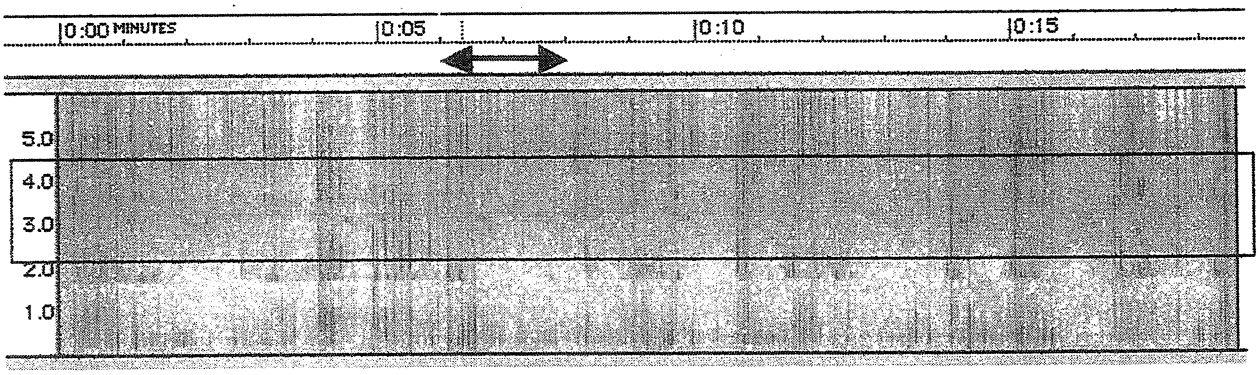
Korgan

Shawn included some miscellaneous signals recorded on April 27, 2003.



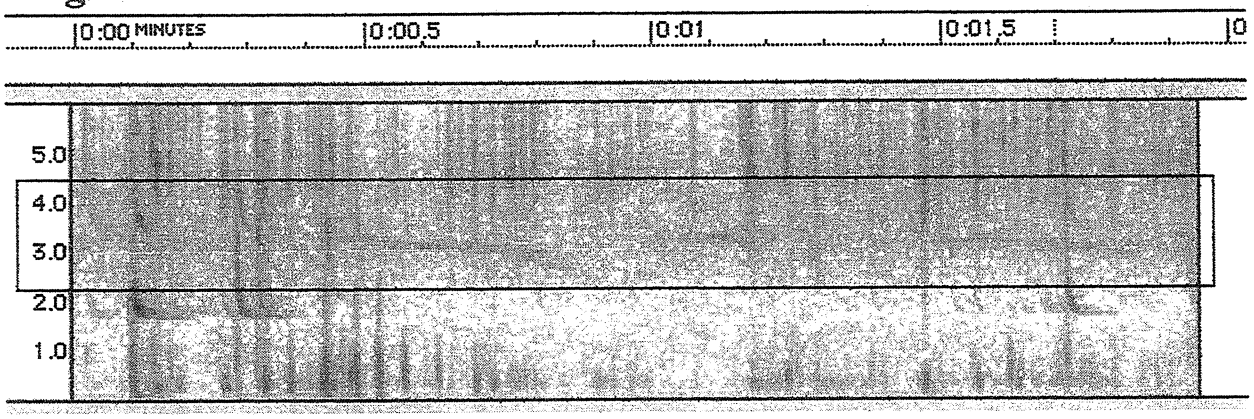


Close up of a double tweek with a whistler in the background.

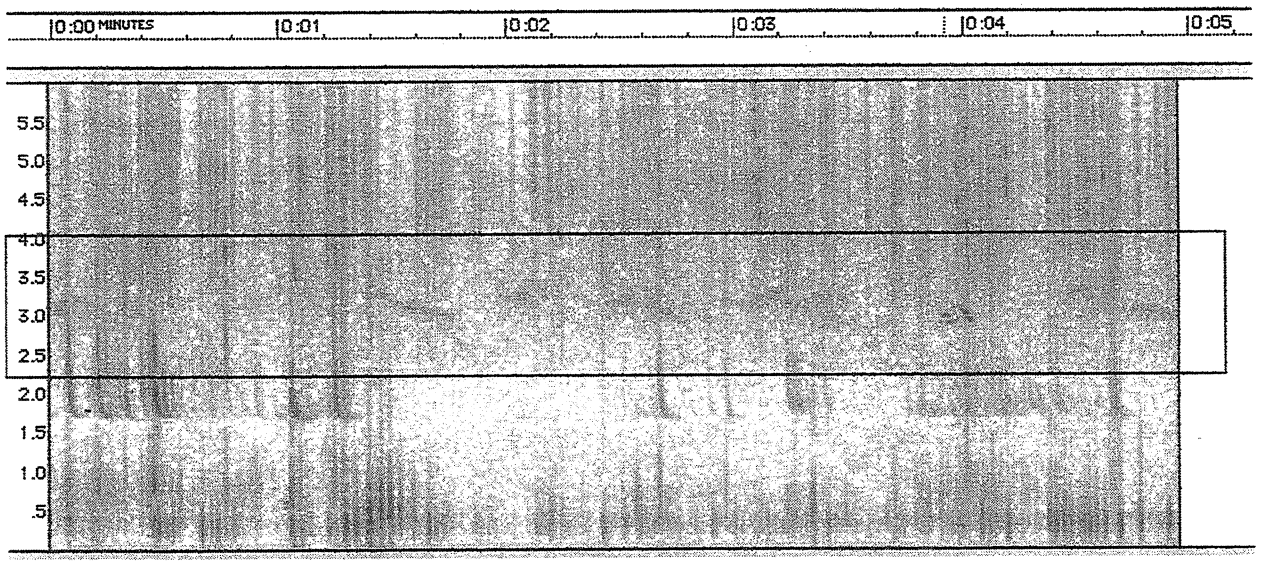


Chorus

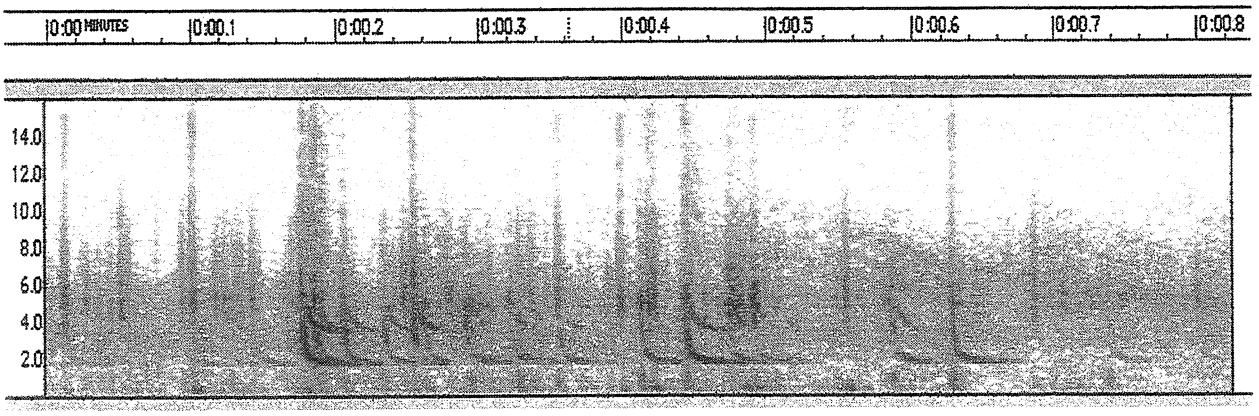
Korgan



Close up of the chorus emissions.



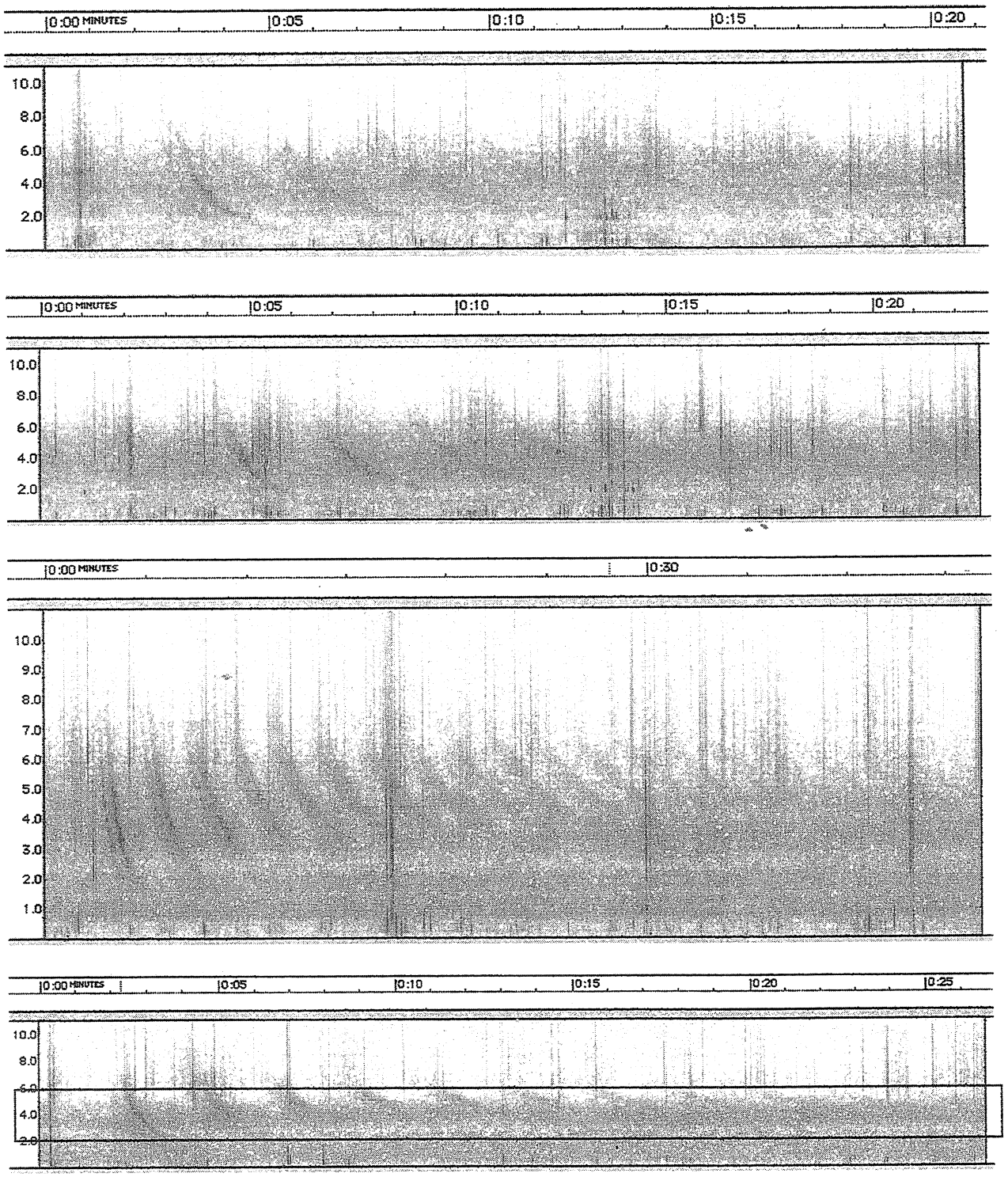
More chorus.



A 0.8 second spectrogram showing dense tweeks.

Korgan

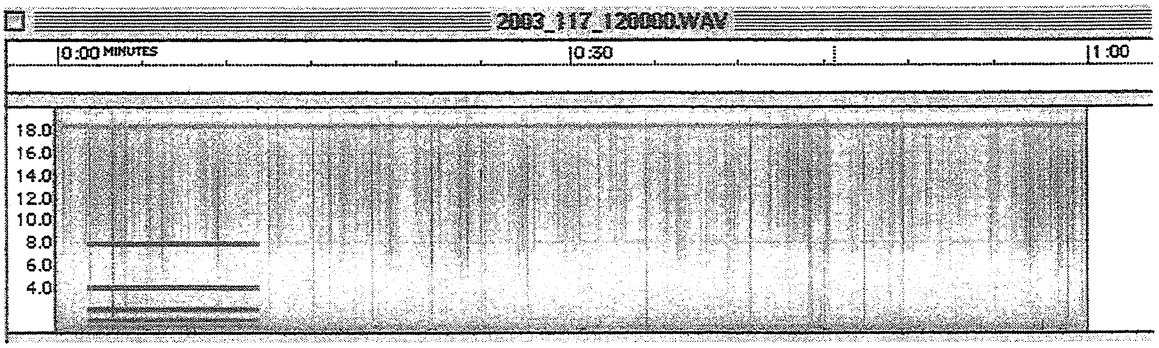
2-hop whistlers with echo trains.



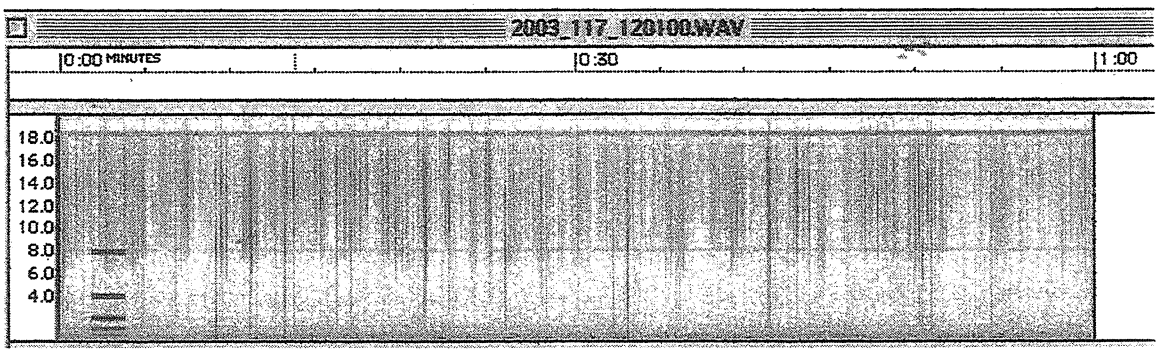
The box contains a band of hiss.

4-27-03 Andrew Collier University of Natal Durban, South Africa

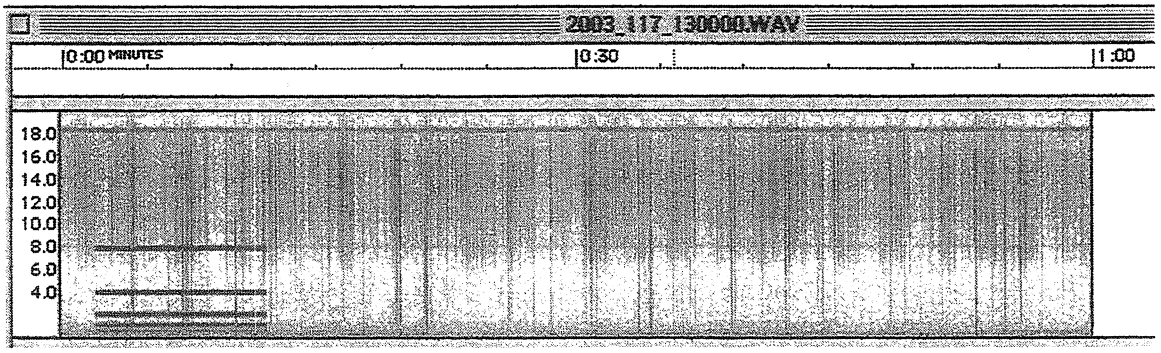
Andrew and Shawn Korgan did some coordinated observations with Shawn observing in Colorado and Andrew observing remotely with a receiver located on top of Mount Vesleskarvet in Antarctica. Andrew's observations consisted of stereo recordings of two loop antennas, one oriented north-south and the other oriented east-west.



First one minute starting on April 27 at 1200 UT.

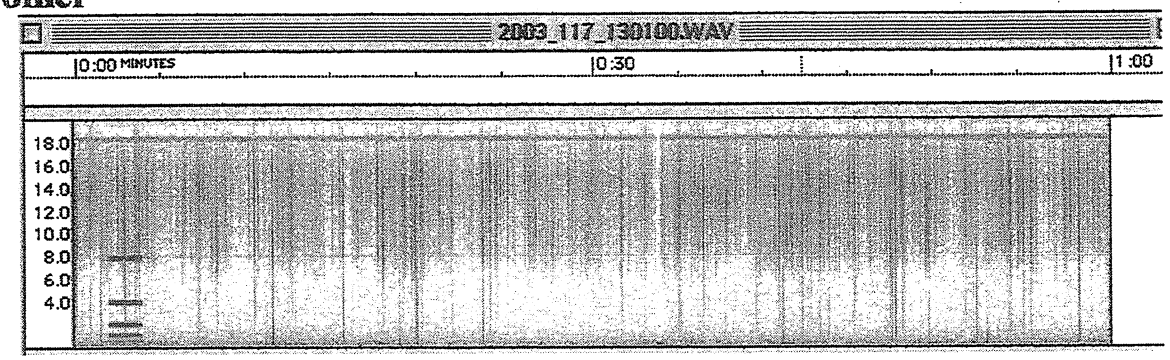


Second minute of the 1200 UT hour. Note the time mark tone near the start of each minute. The tone on the hour (1200 UT) has a longer duration that the other minute tones.



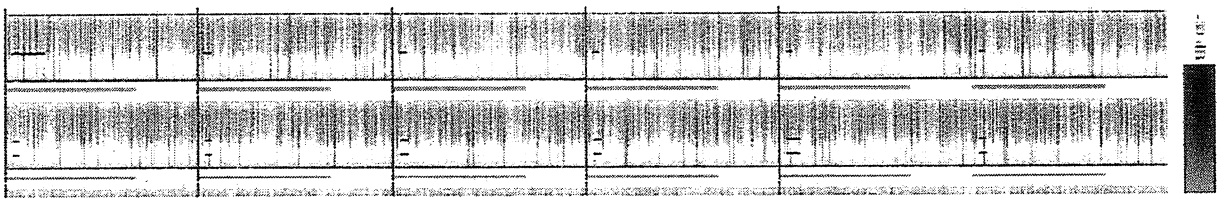
1300 – 1301 UT

Collier

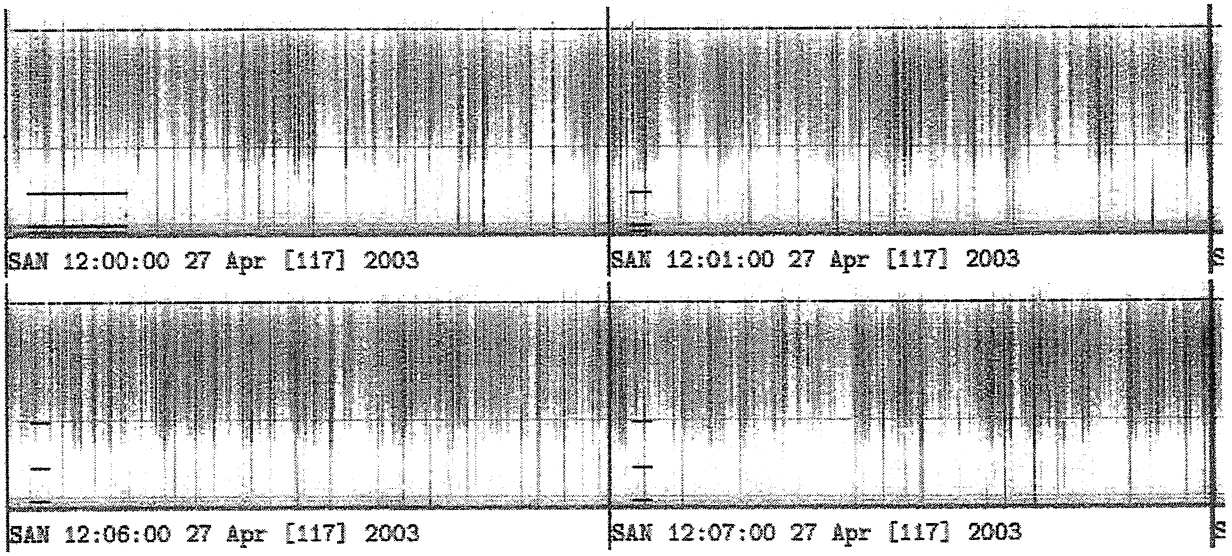


1301-1302 UT

Andrew also provided a PDF file containing spectrograms of his data.



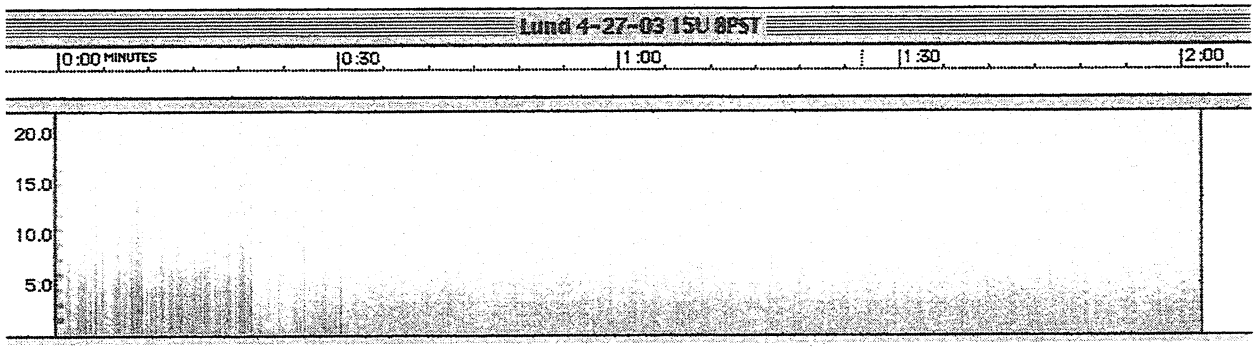
This is the first 12 minutes starting at 1200 UT..



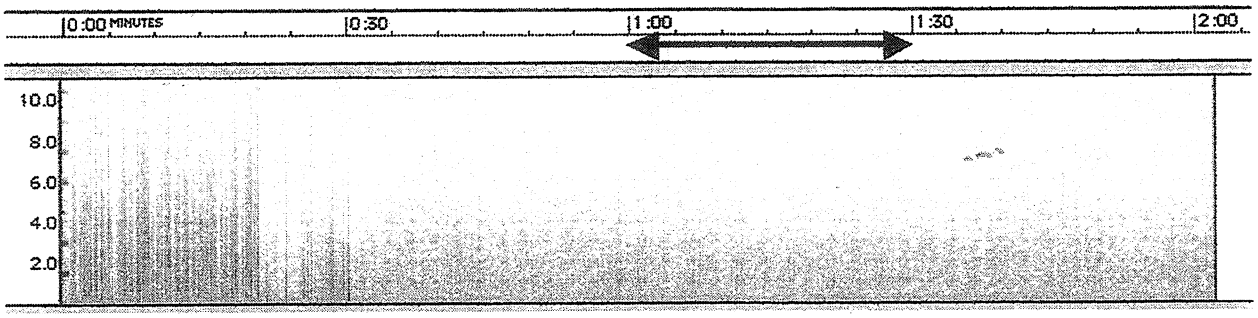
This is a close up showing detail from the four minutes in the upper left corner above.

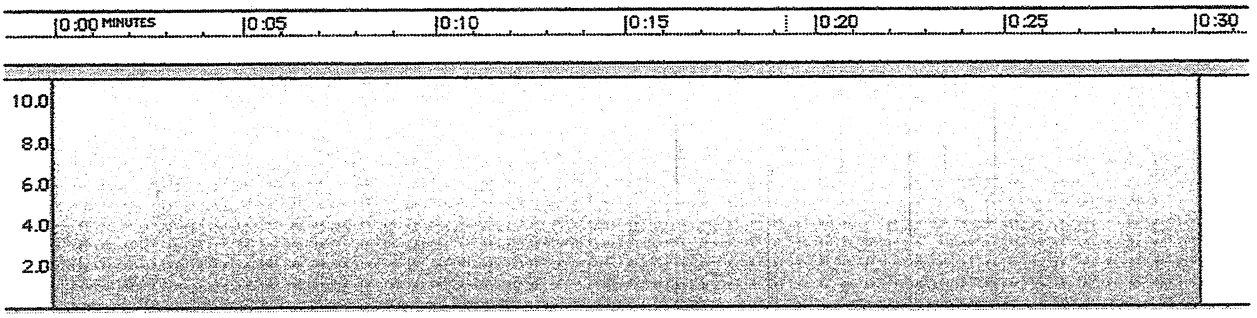
4-27-03 Loren Lund — Union Gap, WA
LaSalle High School

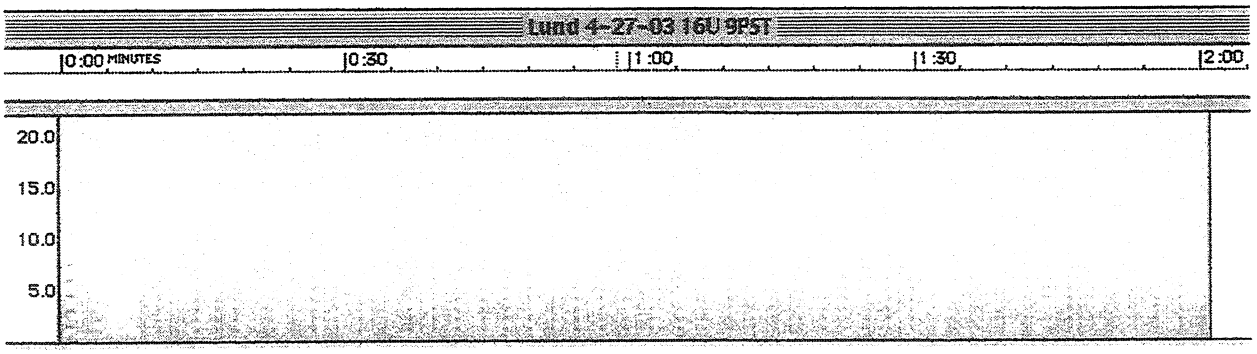
Loren and his son, Brian, observed on Sunday, April 27, 2003.



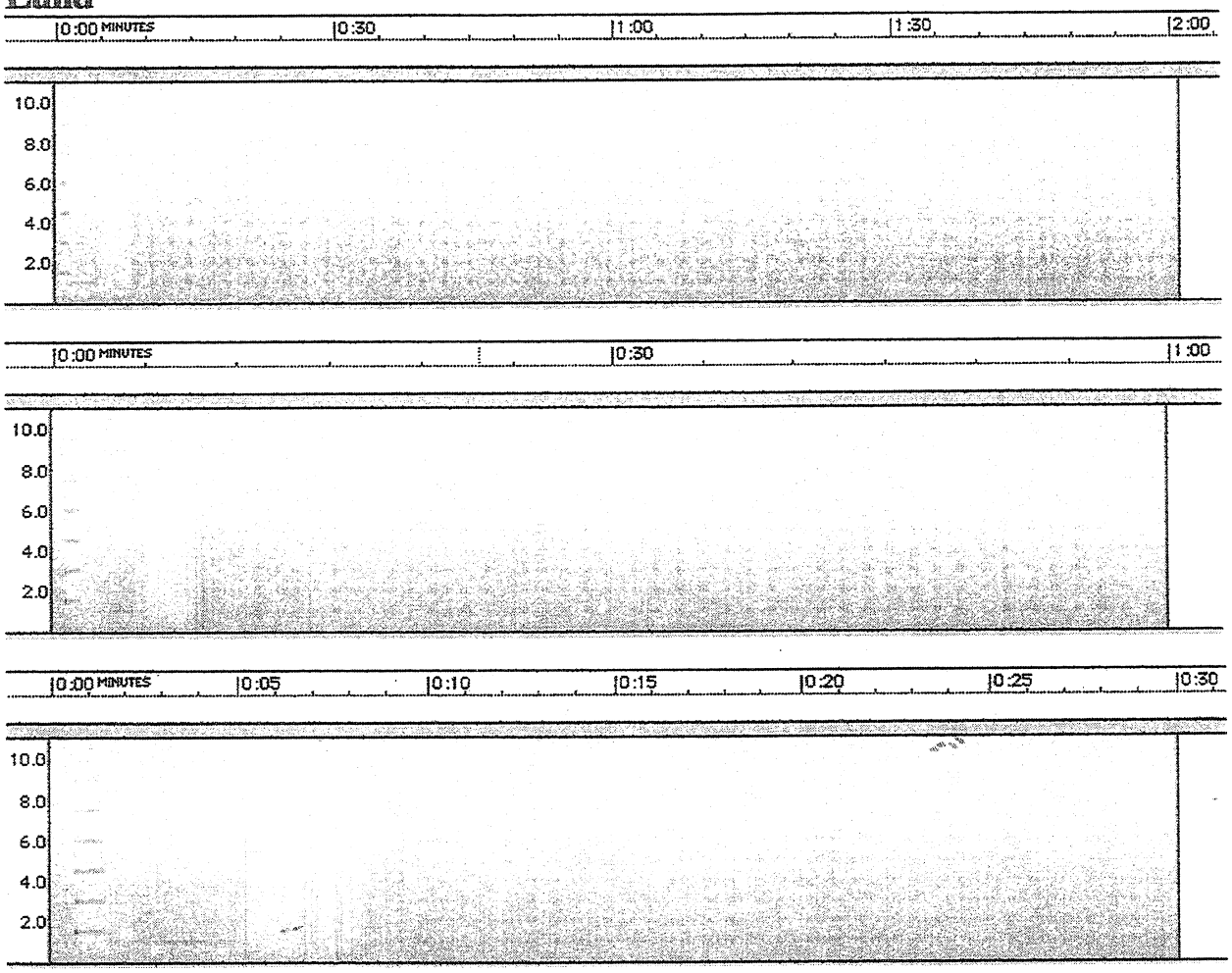
WWV appears for the first 30 seconds followed by VLF data. Sferics appear prominently, but at low density.. LORAN is also present indicating that the receiver is working well.



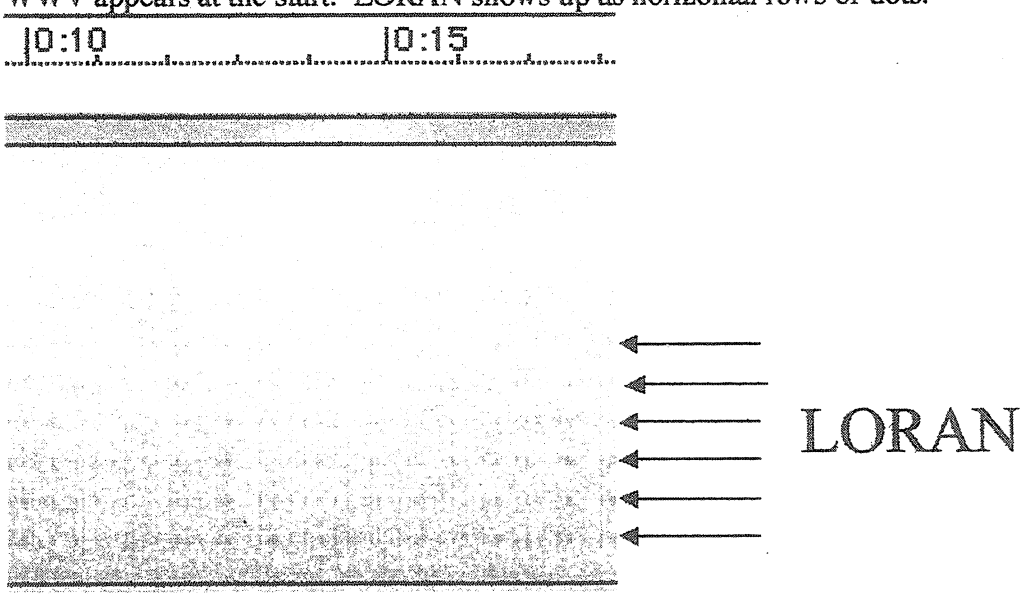




Lund



WWV appears at the start. LORAN shows up as horizontal rows of dots.



Data Log Cover Sheet (copy as needed)

INSPIRE Observer Team _____ Team Number: ____

Equipment: Receiver _____

Recorder _____

Antenna _____

WWV radio _____

Site description: _____

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

Personnel: _____ _____ _____

_____ _____ _____

Team Leader address: Name _____

Street _____

_____

City, State, Zip, Country _____

email: _____

Local Time to UT Conversion Table

EST + 5 = UT	EDT + 4 = UT
CST + 6 = UT	CDT + 5 = UT
MST + 7 = UT	MDT + 6 = UT
PST + 8 = UT	PDT + 7 = UT

INSPIRE Data (copy as needed)

INSPIRE Observer Team ____________________ Team Number: ____

Coordinated Observation Date: __________ Receiver ________

Tape Start Time (UT) __________ Tape Start Time (Local) __________

Local weather: ______________________________

Code: M - Mark (WWV or Voice) S - sferics T - tweek W - whistler A - Alpha C – chorus
Sferic Density: D: ___ Scale of 1-5 (1 – Very Low, 3 – Medium, 5 – Very High)

Time (UT)	Entry		Observer
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________
________	M-WWV M-V S T C W____________________	D: ___	________