

Archival Data Sonification Tools for the Radio Jove Project

Jim Sky 7/6/2006

The effort to make the Radio Jove Project more accessible to people with limited vision includes the development of a number of software tools that are friendlier to the blind user. Year one of this two-year effort included within its goals the production of:

- A sonified version of the Radio-Jupiter noise storm prediction program.
- A sonified tool for reviewing Radio-SkyPipe strip charts.
- A tool for converting Spectrograph files into a sonified format.

This document describes the results of the programming effort. Much of this work should be considered experimental. Considerable testing and revision will be needed before optimum programs will be achieved, however, I believe the results so far are a great start in the right direction towards the goals of this project.

The Human Interface

Much time was spent deciding on the human interface characteristics of the programs. How would the user interact with the computer to extract the desired information? There are a number of available screen reader programs such as JAWS that help the blind computer user navigate the maze of windows and control items that cover the typical computer desktop. It would have been possible to simply insist that the end user utilize a screen reader of this type with existing programs. This however, was ruled out because it fails to address the problem in a direct way and the solution it provides is expensive and leaves the blind user to navigate around the graphical interface and its many many controls that are of no direct value to the vision limited user.

Instead, it was decided to make the programs self-supporting with a built in speech engine. The Microsoft Speech SDK was used. It is free and easy to incorporate into the programs. With this software tool, it is possible to give verbal feedback in direct response to some user action within the program. For example, if an error occurs, a specific error description can be sent to speech engine and announced to the user without the user having to interpret a message box. No external screen reader is necessary, however, it may be possible in some cases to use a screen reader in conjunction with these programs to provide additional auditory clues during normal usage, or as an aid in debugging the overall design. Below I discuss the use of Microsoft Narrator, a free screen reader that accompanies Windows Xp.

Interaction with the programs is simplified by limiting the number of available controls. The primary interface point with the program is a text box in which the user can type commands. This major downside to this approach is that it requires some memorization

of possible commands by the user in order for him or her to effectively use the programs. The alternative is to have all possible commands listed in some way and to have the user navigate between the commands using a tab key, arrow key, etc. This can be tedious and slow. If however, we find that the memorization requirement is too much to ask from some users, we may later implement the running command list as an optional way of interfacing with the software.

Commands are generally in plain English but often have abbreviated forms that may also be used. For example, the command “current directory” can also be expressed as “cur dir” or “curdir”. The command “change directory” can also be expressed as “cd”, the old DOS command for the same action. In some cases, commands accept or require a parameter. To set the volume of the sonification in the SkyPipe file reader you would type “vol” command and then enter. You are then prompted to enter a number 1 to 10. In most cases, you can cancel the input of a parameter and the associated command action by pressing escape before entering the parameter. All commands are converted to upper case before comparison to keywords. The user does not have to be concerned with case.

Spoken help is provided by use of the F1 key. The main problem with this type of help is that one may have to listen to many help topics that are not relevant to the question at hand. Context sensitive help would be better in this respect however the context is limited by the simple command interface. Currently the help function will look to see if anything is typed in the command box. If so it will search the help for any help statement that matches the string in the command box. If no string is in the help box the help function begins announcing the complete help list. No doubt this is an area that will warrant some experimentation.

Setting Limits on Software Capabilities

The original programs from which these new sonified versions are modeled were rich in features. To be frank, many of these features are seldom used. Automation capabilities of Radio-Jupiter Pro for example, allow the program to control an antenna. Most owners of the program have fixed antennas. With numerous features comes complexity in the human interface. By using a hierarchical system of windows, much of the complexity is hidden until needed. Early experimentation with non-visually controlled software pointed to a need to limit the number of windows used by the program. Multiple windows present the problem of program focus, that is, which window and which controls within that window are active at any one time. Without visual clues, a confusing situation arises quickly from just a few windows.

When writing these new programs, I tried to use a minimal number of windows; one if possible. The goal was to limit user confusion and to distill the programs into a set of core utilities that get the job done for the end user in a reasonable amount of time and with minimal effort. As a result, many of the features of the original programs were not ported into the sonified versions. I am hopeful that the end user will see this as a positive

feature of the sonified versions, well suited to a memorized text command type human interface.

I discovered that Windows Xp contains a built in screen reader called “Narrator”. Narrator is not as sophisticated as the commercially available screen reader programs; however, it is free and has a surprising amount of functionality. Some experimentation was done running Narrator in conjunction with the other programs. Narrator uses the Microsoft Sam voice so it was easy to separate out Narrator’s comments from the Microsoft Mary voice I was using these new programs. See Appendix C for more details.

In some cases we may decide to expand upon capabilities of the new programs as they currently are written. Indeed, a few new capabilities have been already added that were not present in the non-sonified versions, for example, the integrated interface to the Jove Project on line archive.

Note that this software is not at this stage capable of chart sonification in real time. Live data streams must be saved as files and then loaded into the appropriate sonification utility. This is by design. It was understood from the beginning that the challenges of real time conversion of the data to sonified form would be considerable. Thus the original project proposal set real-time conversion of streaming data as a goal for the second year. We consider the ability to do real time streaming an exciting part of the Radio Jove Project and hope to meet that challenge in year two.

Radio-Jupiter Speech Edition

Radio Jove Project participants are found all over the globe. It behooves the observers to have Jupiter storm probability and position information that is customized to their own location. While efforts have been made to publish the necessary information for various regions of the USA and Europe, better planning can be had by utilizing the Radio-Jupiter software. A Sonified version of Radio-Jupiter has been produced to fill this need.

Radio-Jupiter software supplies position information for Jupiter and the Sun. This allows the user to ascertain when the objects are within the beam pattern of the antenna. Current position information and position information for future and past fixed times can be garnered. Other real time information is available for the system three longitude of Jupiter and the relative position of the moon Io, both are important parameters in predicting when a Jupiter noise storm is most likely to be heard. Real time announcements of possible Jupiter activity may be activated.

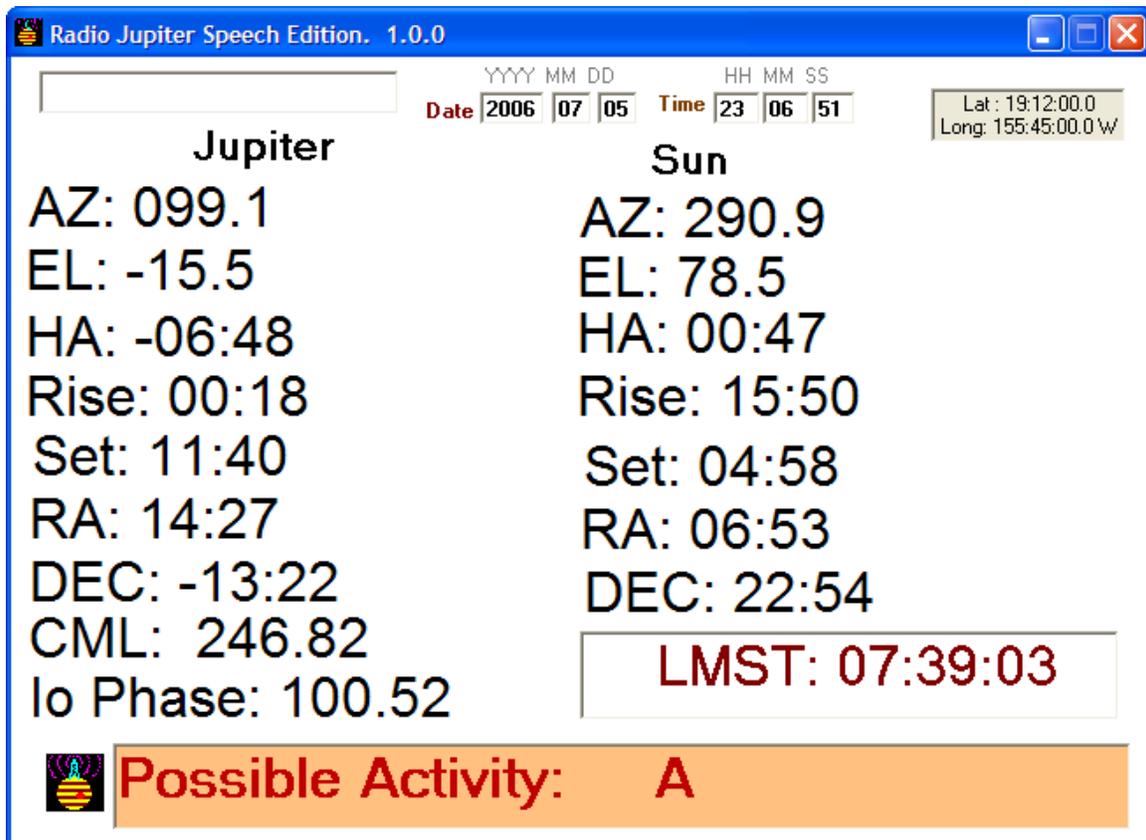


Figure 1 Screen shot of the Radio-Jupiter sonified version main window. Large print position information is used for Jupiter and the Sun to aid users with partial vision.

There are so many possible parameters that may be queried or adjusted within the program that it was decided to split program operation into two modes. The default mode

is the real time and fixed time data mode. The second mode is the Storm Prediction Mode. Each mode has its own list of commands. To switch between modes you enter “p” to go from the normal mode to the prediction mode. To go back to normal mode just type “n”. Press F1 in either mode to hear the appropriate help for that mode.

Note the small text box in the upper left corner of the window in Fig. 1. This is where the user types commands. The accent mark (next to the ‘1’ [one] key) may be typed to get feedback on what has already been typed by the user in this box.

Appendix A has a complete list of commands for both modes of operation.

Radio-SkyPipe Sonified File Viewer

The Radio Jove Project focuses considerable energy on the data that is collected by program participants and the associated school observatories. For some time now the primary data collection tool has been Radio-SkyPipe software. Interpreting this data is not trivial for anyone. The graphical interface of Radio-SkyPipe has been our main tool for examining Solar and Jupiter radio bursts. Producing a piece of software that would help make sense of these data files without visual clues is a serious challenge.

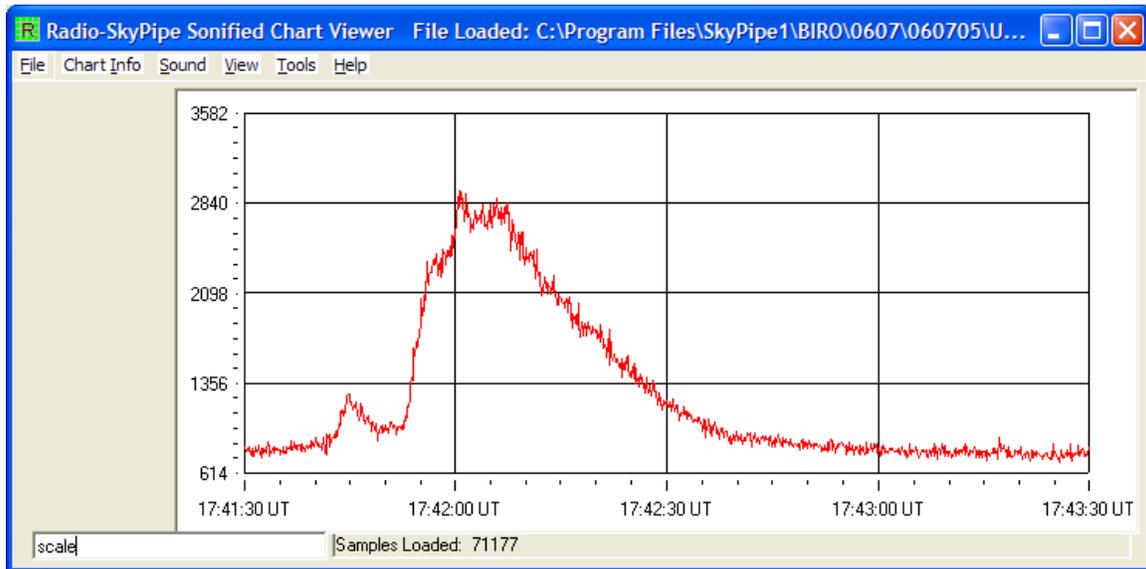


Figure 2 Main window of the Radio-SkyPipe Sonified Chart Viewer program. There is a visible chart area, just as in the non-sonified version; however, its main use is as a programming aid.

The main window of the program as shown in Figure 2 will look familiar to many current users of the regular version of Radio-SkyPipe. The main feature is the strip chart region that contains the graphical data. For those unfamiliar with Radio-SkyPipe, the vertical axis is usually in unspecified units. These Y values actually represent raw values returned from a sound card ranging from zero to 32,767. Sometimes however the Y units are converted to equivalent temperature or some other flux unit. The horizontal axis is in time. When data is loaded into the program, it is displayed in such a way that the entire chart is in the graphical area. This is called the Full View in SkyPipe terms. Often however, only small regions of the data are of interest to the user. An important consideration then is for the observer to find these regions and to narrow the “active” region of the chart to manageable size. The task of keeping tabs of what part of the chart is active and being examined is not easy, but I suspect that this type of mental management may be more familiar to the blind experimenter than it is to me.

The only other controls shown in Figure 2 are the textbox where the user types in commands to control the program. A slightly different approach is used with the SkyPipe

Sonified File Viewer than in Radio-Jupiter Speech Edition. Here we are using less abbreviated commands, hopefully, making memorization simpler. It remains to be seen which method most users will prefer. Commands are generally in plain English. Very often several variations of a command will work. Again capitalization is not an issue.

There are some menus at the top of the form. All menu items in these lists may be controlled by keystrokes, giving the user an alternative to many of the more verbose text commands. For example, one of the menu categories is Tools. ALT+T selects this menu, and then ALT+C selects the Clip tool. You could also just type "clip" (without quotes) in the command textbox. If for any reason the command text box loses focus pressing the Tab key will usually get you back to the box. The program says "Waiting for text." whenever the textbox receives focus. There is usually no reason for this to happen however there is an exception when a list of files from the Jove Archive also makes a presence in the main window. This will be discussed later.

Loading Data Files

For me, the most difficult part of using a computer with no screen display is managing and finding files. Without a screen reader to help the user, the typical dialog box method of finding files is not possible. It is thus necessary to mentally keep track of where files may be found and the directory trees that must be navigated to retrieve the data. Part of this problem can be eased by designing and using a tree structure that is not overly extended and yet provides adequate organization to separate out different types of data. This however is a task within the domain of the end user. The Radio-SkyPipe Sonified File Viewer relies mainly upon command line based directory and file navigation. It is thus suggested that the end user be especially careful as to where files are stored and how they are organized. It would be possible to use a separate screen reader program to manage data files apart from this one. Ultimately that may be the best solution.

Having said all of this, there are some nice features built into the RSSFV to help with common data file tasks. You can retrieve the last file loaded or the last file announced using simple commands. You could list all SPD (SkyPipe data) files in the current directory with the command "files spd". When you hear the file you want hit the Escape Key. That is now the Last Announced File. The trick here is that you need to be quick on the escape key and at recognizing the name of the file that you want to review. Now type "load" and hit enter twice without specifying a file name. The Last Announced File will be loaded. Note that you did not have to type a file name. To reload the last file you worked on use the command "last file".

There is another trick available. The command "load dialog" or just "load d" will initiate a typical windows file loading dialog box. Turn on your favorite screen reader to take advantage of it!

Integrated Jove Archive File Downloading

In some cases, the participant may want to rely upon data collected by others rather than their own locally collected. The Radio Jove Archive contains many hundreds of files submitted by program participants. Retrieving these files via a web browser has long been possible. It seemed to me that these files would be much more useful if there were a way to retrieve these files directly into a file viewing programming like RSSFV. An interface for accomplishing this was recently tried in the regular version of Radio-SkyPipe with good results. The engine for accomplishing the search and file transfer was adapted for RSSFV. Many of the bells and whistles for searching the data were removed but the core ability to search for all files that contain a specific time or that occurred on specific date was retained. Now with just a few keystrokes the user can get download the file onto their computer and begin examining its contents.

Key to the Jove Archive interface is a local copy of the file index of the archive. This file index can take some minutes to download depending on the users connection speed. This is why we keep a local copy, however, if the user is interested in data that was archived more recently than the last time an index was downloaded, then a new index may be required.

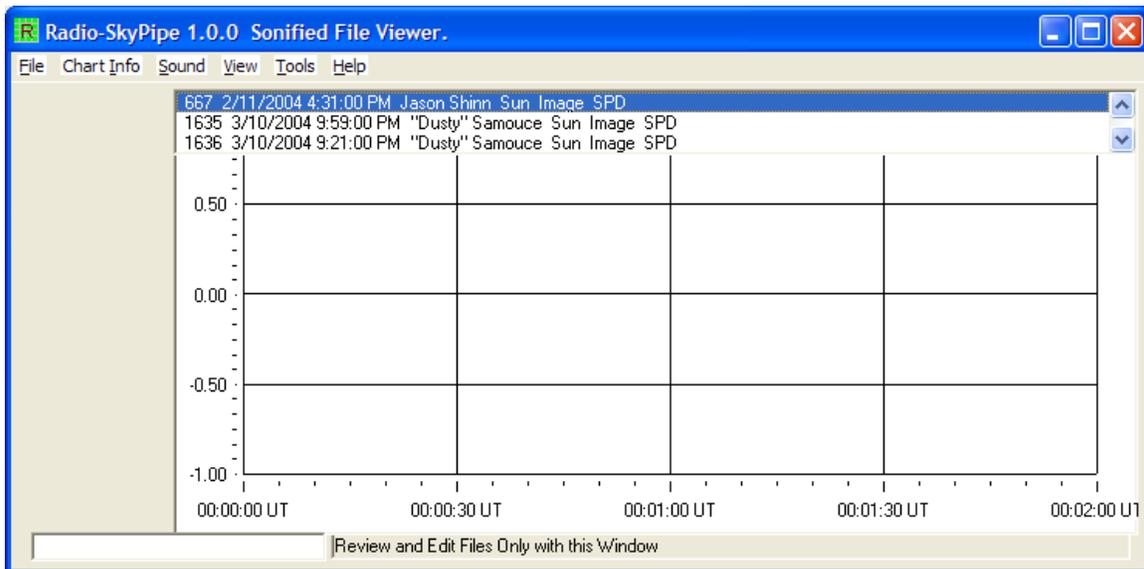


Figure 3 Screen shot of the Radio-SkyPipe Sonified File Viewer in the mode where Jove Archive Files (from the Radio Jove web site). The list at the top of the chart holds descriptions for all files that matched the date criteria input by the user.

To search for a Jove Archive file, type “rj” or “jove” into the command textbox. You are then prompted to enter a date or date and time into the box. Remember that UT is used. After pressing Enter, the program tries to interpret the date and time you entered. It then searches the index for matching records and lists descriptions of matching files in a special list box. Now we have a situation where there is a second object in the window that can receive the programs focus. The program announces which object receives the

focus. Press the Tab key to jump back forth between the list of matching files and the command text box. Use the up and down arrow keys to move between file descriptions in the list. Press Enter to have the program speak the file description currently highlighted.

The file description will include the available file types. In many cases there will be multiple file types associated with the description. Available file types include:

- SPD - SkyPipe data files.
- Image – Usually JPG but possibly other types of image files.
- Sound – Wav or MPG files.
- Text – Plain text descriptions.

With the file description of interest selected in the list press “s” to retrieve SPD files, “i” for image files, “w” for wav or other sound files, or “t” for a text file. The file is downloaded from the website. If you selected an SPD file, it is loaded into the RSSFV program. Any other file gets passed to whatever program is your default viewer for the downloaded file type. For example, Windows Media Player might play a wav file.

Navigating Within an SPD File

Once a chart is loaded, the program begins informing you of the chart limits in time and Y value as well as numerous other pieces of “metadata” related to the chart. Press escape to avoid listening to the entire list. A number of commands are available to recall metadata at any time. Of specific concern is the portion of the chart selected as the active viewing area as was discussed earlier. You can narrow or expand the current chart viewing area by utilizing commands listed in Appendix B of this document. Once you have selected a time region of the chart you may want to narrow the Y range also so that the sonification range of frequency or volume will not be diluted by some insignificant spike or a tall feature in some other area of the chart.

The Effect of Spikes

Much of the data collected for use by Radio Jove contains large spikes where the Y value for a very short duration of time, (sometimes for just one data point), will jump high above the normal data value. This is to be expected when we are measuring electromagnetic energy however, for the most part these spikes do not represent the Sun or Jupiter emissions. Moreover, these spikes can be attributed to local interference, lightning, movement of connectors, and even activities within the computer that might produce an abnormal data point.

For the sighted observer, the existence of the spikes is easy to see and the chart can be manually scaled so that the spikes are not displayed. When working with data for sonification it became apparent that some method is needed to detect and delete or ignore

these spikes more automatically. If we scale the chart to accommodate the presence of the anomalous spikes then we attribute a wide portion of the sonification range (amplitude and/or frequency) to an undeserving phenomena and our “real” data becomes represented by a small fraction of a valuable dimension of our audio representation space. It is not easy to decide by listening to the sonified version of a chart at what level we should clip the spikes. The entire chart is not available to the ear at once and a person would have to listen through the entire chart to even be sure whether or not spikes were present. In order to help the user decide a suitable threshold for spike removal the “stats” command of the program speaks the percentage of data points that are found above 75, 50 and 25 percent levels of the entire Y range of the chart. These are rounded values so you may correctly hear 0 percent as a value.

If you know that almost 0 percent of the chart data points occur above the 50 percent range of values, then it is probably safe to limit the data points to those that lie below the 50% threshold. In this case you would type “clip” as the command. You would then be asked to enter a level which when exceeded by a data point tags it for removal. The chart is then clipped and rescaled. The process can be repeated until the user is satisfied (by consulting the “stats” command) that there is a desirable distribution of data points.

Note that the data points are not actually removed. They are treated similarly to spikes processed by a noise blanker in a modern radio. A running average is kept of the last ten points. If a data point exceeds the clipping threshold, it is set at this running average and thus does not seem like an interruption in the data stream as would occur if a zero were inserted. The total number of data points for the file are preserved.

Hearing the Chart

Finally, we may discuss the process of sonification of the actual data. Sonification is available for only one channel at a time (you may select any of the possible 8 channels if they are present). Y values are used to modulate either the volume or frequency of a sound. The sound will take the form of a sine wave, square wave, or noise. In the case of noise, only amplitude modulation is available. See the command list in Appendix B to see how to set the characteristics of the sound. The sound is played as quickly as the computer can process the data. With a 2 GHz computer and built in sound card, this data rate is not too fast. If we find in the future that a throttle is needed to slow down or speed up playback, then we will try to accommodate this.

To initiate sonified playback type “scan” or “sonify” on the command line. Sonification occurs only for the “visible” region of the chart. That is why it is important to define the region using commands like “start” and “width”. During the sonified scan pressing the space bar pauses and restarts the chart. Pausing produces an announcement of the last Y value played. The Escape key cancels a scan.

The noise sonification option may be of special interest to all project participants. Much of our data is derived from radio frequency “noise” that is translated into audio frequency

noise and finally into raw data that is defined by the integrated amplitude of the audio envelope. By modulating white noise with the data values the original sound is mimicked, though it cannot be reproduced with great assurance. Still, at least for demonstration purposes, this is an interesting effect.

Sonification functions rely upon the DirectX version 7 engine being installed in the computer. It is not currently known if other DirectX version substitutions will work.

Exporting the Data

Other NASA programs have produced two very capable sonification tools, MathTrax and xSonify. These JAVA based software tools provide their own sets of capabilities not provided by RSSFV. Rather than re-invent all of the capabilities, it was decided to develop an export utility that would allow SkyPipe data files to be read by these utilities. Once a file is loaded, the visible region is exported using the command “export” or “exp”. The file must then be read into the other sonification tool.

One limitation of MathTrax and xSonify, is that these programs do specifically handle time based X axis values. For files covering short time durations this is not too serious a problem. The export function simply applies X values that correspond to the number of seconds from the chart start. These time values are estimated to milliseconds, though such accuracy is not currently actually available from the PC on which the data is recorded.

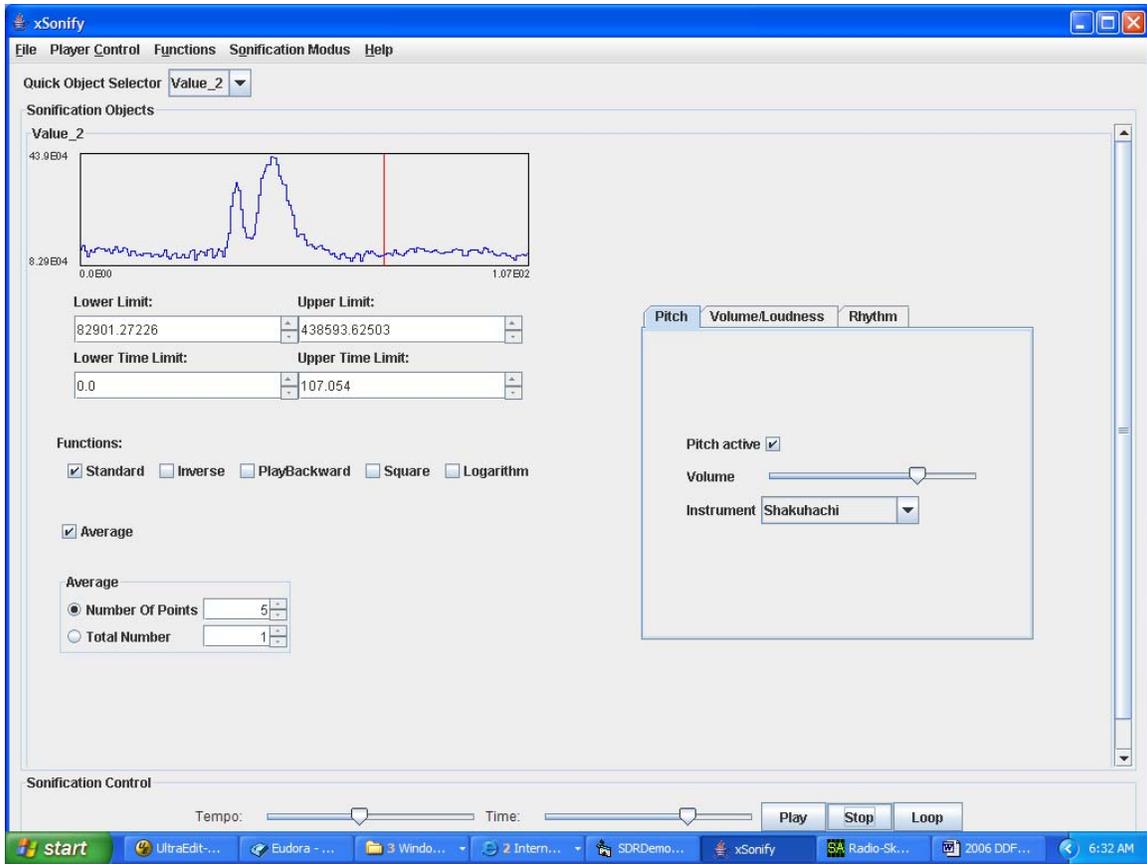
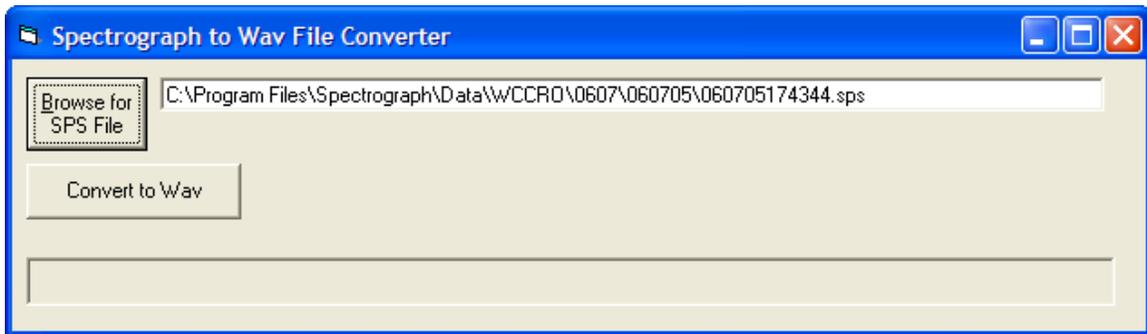


Figure 5 Solar burst file exported form the SkyPipe Sonified File Viewer and imported into the xSonify program.

The xSonify program is MIDI engine based and produces sounds with instrument voices.

Perhaps future collaborations with the xSonify and MathTrax teams will lead to better integration of Jove Project data into these nice programs.

Spectrograph to Wav File Converter



The purpose of this program is to convert files saved from the WCCRO and UFRO spectrographs into wav files that may be listened to on any wav file player. The program will extract the first 600 scan lines from any spectrograph file (extension SPS) and produce an audio representation of the file data. Higher frequency RF channels correspond to higher pitch audio channels. The program uses 200 software sine wave generators that correspond to the 200 channels of spectrograph data. The sine waves are scaled in volume to match the rf intensity recorded during each channels 0.1 second sample period. The waves are added and normalized in successive timeslots throughout the tenth of a second sample period. The wav file produced has a sample rate of 11025 hertz so during each tenth of a second 1102 iterations must be performed, a total of $1102 * 200 * 10 = 2,204,000$ trigonometric operations for each second of data! On my 2 GHz computer the conversion takes just over a minute.

Program operation is quite simple. The SPS file name is entered into the text box or may be browsed to using the browse button. A screen reader is needed if the browse button is used. Pressing the Convert to Wav button begins the conversion. The wav file is named based upon the SPS file name and is saved in the same directory as the SPS file it was created from.

This program was not developed to a great extent because I plan to incorporate its functionality into a live version (year 2) with a better feature list for vision limited users. Planned enhancements and experimental are :

- Selection of file segment and length within program.
- Offset and amplification functions to mimic those of the visual version.
- Possible live audio conversion.
- Possible stereo enhancement.

Nonetheless, the program fills the immediate need to produce sonified versions of spectrograph data. The challenge of going live with data is not trivial. The current model of software sound generators for each channel may need to be radically modified to achieve live status.

Appendix A - Command List for Radio-Jupiter Sonified Version

Commands are 1 or more letters typed by user followed by Enter. You must press Enter after typing a command or specifying a parameter. F1 elicits the appropriate spoken help for either mode. Escape cancels help. Accent Mark gives feedback on what you have typed.

Normal Mode (default)

P changes to Prediction Mode.

Q ends program.

T - Time and Date

LT or LAT - Latitude.

LG or LNG - Longitude.

TZ - Time Zone .

VR - Voice Speech Rate. -10 to +10 input accepted.

VT - Voice Type. Accepts input of voice number.

LST or LMST or ST - Local Sidereal Time.

AD - Announce Delay minutes. 0 to 1440 input accepted. Set to zero to stop voice announcements.

AJ - Announce Jupiter.

NAJ - Don't Announce Jupiter.

AS - Announce Sun.

NAS - Don't Announce Sun.

RT - Real Time.

FT - Fixed Time. Universal Time and input accepted.

J * - Speaks all Jupiter parameters.

S * - Speaks all Sun parameters

Individual parameters are called as follows.

JE - Jupiter Elevation.

SE - Sun Elevation.

JA - Jupiter Azimuth.

SA - Sun Azimuth.

JRA - Jupiter Right Ascension.

SRA - Sun Right Ascension.

JH or JHA - Jupiter Hour Angle.

SH or SHA - Sun Hour Angle.

JD - Jupiter Declination.

SD - Sun Declination.

JSR - Jupiter Rise and Set times.

SRS - Sun Rise and Set times.

JC or S3 - Jupiter System three longitude.

JI - Io Phase.

VER - program version.

Appendix A - Continued

Note you may press J plus enter, or S plus enter to begin a menu mode that does not require the J or S prefix. For example: after pressing J plus enter, you only need to press 'A' for Jupiter azimuth, or 'T' for Jupiter 'T' 'O' phase. After pressing S plus enter typing H or HA will produce the Sun Hour Angle, then just press D plus enter to get the Sun's declination, etc. In other words, once the object (Sun or Jupiter) is set by pressing S or J respectively, then you can dispense with using the S and J prefixes for many of the commands in Normal mode.

Prediction Mode (Enter by pressing P plus Enter from Normal Mode)

N - Resume Normal Mode.

T - Start Date. Accepts as input a UT date .

MNJ - Minimum Jupiter Elevation. Accepts Input in Degrees. Excludes prediction of events when Jupiter is below this elevation locally.

MXS - Maximum Sun Elevation. Accepts Input in Degrees. . Excludes prediction of events when the Sun is above this elevation locally.

I (i) - Only Predict 'i' 'O' related storms.

NI (ni) - Predict Non-Io storms and Io related storms.

NXT- Next Day.

D - Duration of prediction in days. Accepts Input.

FN - Speaks last Prediction Report File Name.

R - Read and speak last prediction report.

SR - Save prediction report to a file.

Appendix B – Radio-SkyPipe Sonified File Viewer Commands

File Functions:

"LOAD" - Prompts to enter a file name to load or just press Enter to load last announced file.

"LOAD D" or "LOAD DIALOG" - Loads a data file using a standard Windows dialog box. Requires a screen reader.

"LASTFILE" or "LAST FILE" - Reload last loaded file.

"CURRENT DIRECTORY" or "CURDIR" - Speaks current directory.

"CHANGE DIRECTORY" or "CD" or "CHG DIR" - Changes a directory. You are prompted to Enter Directory Name or dot dot (..) to move up.

"LISTFILES" or "LIST FILES" or "LIST" - Speaks file names in the current directory.

"FILES" plus space plus extension - Speaks file names of a specific extension type.

"FOLDERS" - Speaks subfolders in the current directory.

"RJ" or "JOVE" - Prompts to enter a date or date and time for a Radio Jove Archive search.

"EXPORT" or "EXP" – Exports the data in the current chart window to a text format that can be read by some other programs. You are prompted to "Enter a file name for the exported file or press enter to have the file named automatically. Escape cancels."

"QUIT" or "EXIT" - Ends the program.

Appendix B - Continued

Chart Navigation and Information

"SCALE" – Auto-scales the Y-axis to conform to the value in the visible range of data points.

"ID" - Speaks basic chart ID information, including file name and times.

"LIMITS" - Speaks the X and Y limits of the current view.

"WIDTH" - Speaks current chart width then allows entry of a new width in minutes.

"MAX" - Speaks current view Y maximum and accepts new value.

"MIN" - Speaks current view Y minimum and accepts new value.

"START" - Speaks time the current view starts and accepts new time.

"STOP" - Speaks time the current view stops and accepts new time.

"CHANNELS" or "CHANNEL" or "CHL" - Speaks the number of channels in the chart. If more than one channel is available you are prompted set the active "Cursor Channel".

"CLIP" - Use the spike-clipping tool. You are prompted to enter a percentage above which all spikes are clipped.

"STATS" or "STAT" - Speaks statistical data about the file.

"INFO" – Speaks all known metadata and stats concerning the loaded file.

"NOTES" – Speaks information contained in the Notes section of the file header.

"FULL" - Set chart to Full view encompassing entire data file.

Appendix B – Continued

Sonification Settings and Commands

"SCAN" or "SONIFY" – Begin sonification of the data within the current chart window.

"AMPLITUDE" or "AMP" or "AM" - Sets the sound generator modulation mode to AM.

"FREQUENCY" or "FREQ" or "FM" - Sets the sound generator modulation mode to FM.

"TONE" - Allows entry of a tone frequency in hertz to use with AM sonification.

"SQUARE" or "SQ" - Sets the sound generator to square wave mode.

"SINE" - Sets the sound generator to sine wave mode.

"NOISE" - Sets the sound generator to noise mode and AM modulation.

"VOL" - Prompts to "Enter volume 1 to 10. This is the steady volume of a frequency-modulated tone.

Appendix C – Microsoft Narrator

Microsoft Narrator is free screen reader supplied with Windows Xp. You may access Narrator either via the Programs list under Accessories / Accessibility, or by typing Narrator at the Run Prompt. The window below appears.

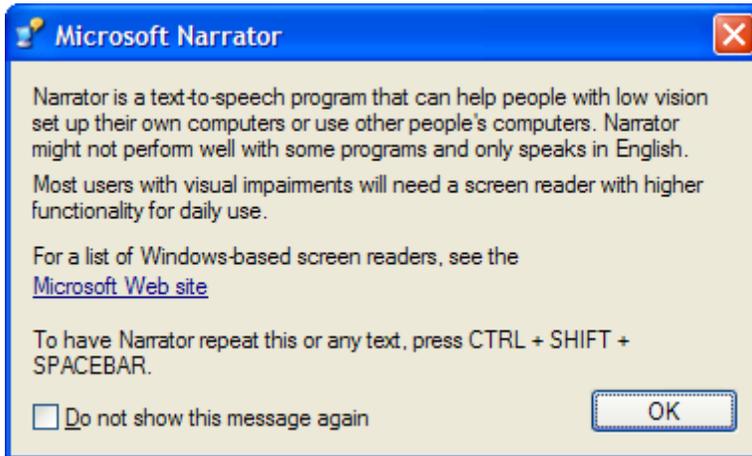


Figure 6 Microsoft Narrator screen shot.

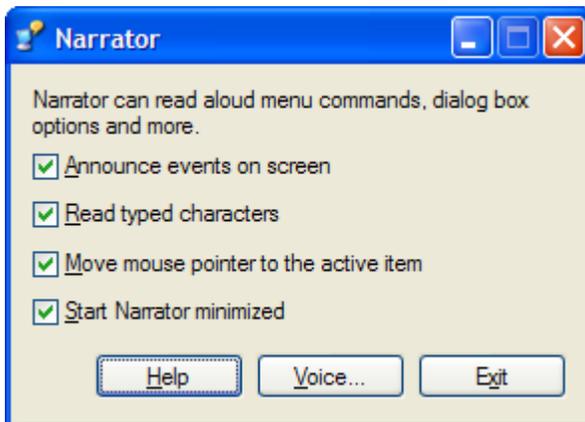


Figure 7 Narrator's options include: Announce events on screen, read typed characters, move mouse pointer to the active item, and start Narrator minimized.

Appendix C - Continued

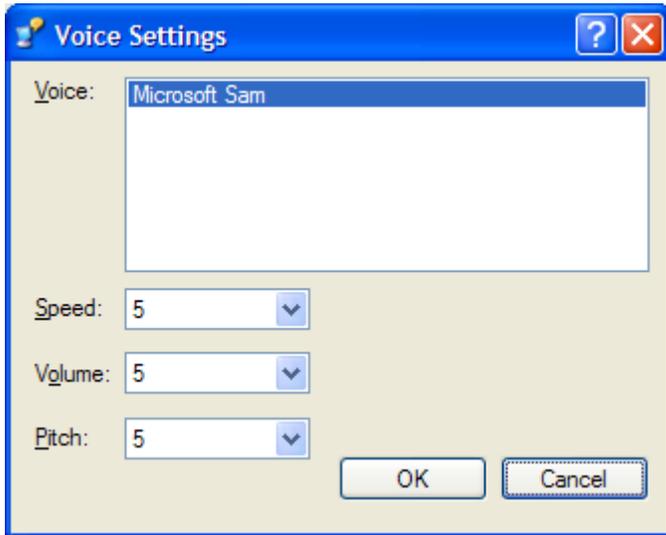


Figure 8 Additional options include speed, volume, pitch, and other voices if you can find them.

Narrator overview

Narrator is a text-to-speech utility for users who are blind or have impaired vision. Narrator reads what is displayed on your screen: the contents of the active window, menu options, or the text you have typed.

Narrator is designed to work with Notepad, Wordpad, Control Panel programs, Internet Explorer, the Windows desktop, and Windows setup. Narrator may not read words aloud correctly in other programs.

Narrator has a number of options that allow you to customize the way screen elements are read.

- You can have new windows, menus, or shortcut menus read aloud when they are displayed.
- You can have typed characters read aloud.
- You can have the mouse pointer follow the active item on the screen.
- You can adjust the speed, volume, or pitch of the voice.

The accessibility tools that ship with Windows are intended to provide a minimum level of functionality for users with special needs. Most users with disabilities will need utility programs with more advanced functionality for daily use.

Appendix C - Continued

Opening Narrator.

- To open Narrator, click **Start**, point to **All Programs**, point to **Accessories**, point to **Accessibility**, and then click **Narrator**.
- To open Narrator using the keyboard, press CTRL+ESC, press R, type **narrator**, and then press ENTER.
- Narrator is not available for all languages and is only supported on the English version of Windows XP.
- An easy way to start Narrator is to press the Windows logo key + U. Narrator is set to start by default when Utility Manager starts. However, Narrator may not start if your computer does not have text-to-speech program capability.
- Utility Manager enables users to check an Accessibility program's status and start or stop an Accessibility program. Users with administrator-level access can designate to have the program start when Utility Manager starts. Users can also start Accessibility programs before logging on to the computer on by pressing the Windows logo key + U at the **Welcome to Windows** dialog box that appears when Windows starts