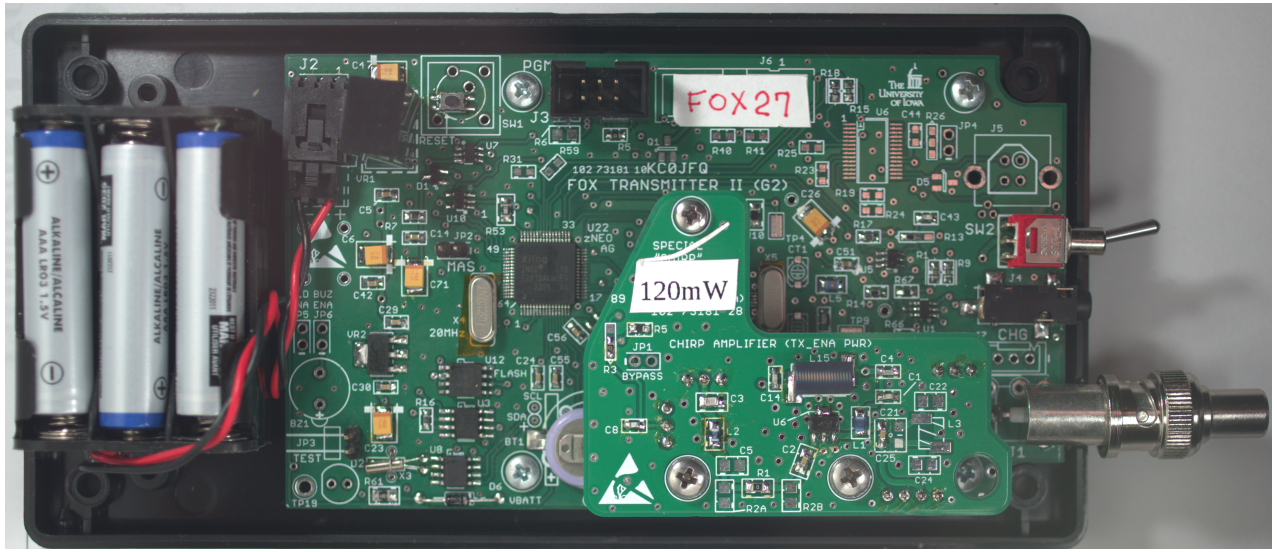


# The ICARC FOX Transmitter System

## Transmitter Audio Clips

KC0JFQ: William Robison

http://n952.ooguy.com/HamRDF/index.html
http://icarc.org/icarc_foxhunt.htm

File: fox˙present˙11.tex

April 25, 2025

Iowa City Amateur Radio Club

# Outline



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# Audio Waveform Data

**Size limit** imposed by FLASH device and FRAM device

8Mb or larger FLASH, 256Kb or larger FRAM
FRAM needs 32 bytes per directory entry
FLASH needs 4,000 ot 5,000 bytes per second of audio.

**AUDACITY** audio editor; extract utterances

**SOX** audio format conversion; down sample to 4KHz rate

**audio_util** convert from **.wav** to InTeL HEX

**fox_binary** fast loader; InTeL HEX to target

**Audio Source** your choice

Target audio file must be:

| | |
|---|---|
| RIFF/WAVE | *need the .WAV header* |
| mono | *single DAC in Tx* |
| 8-bit | *DAC width in Tx* |
| Sample rate | *4KHz or 5KHz* |

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# FOX Binary Loader

## High Speed FRAM/FLASH loader utility.

This utility implements a binary load protocol to speed up loading of the FLASH memory.

Works equally well loading FRAM.

Load speed improvement here too!

Loads command sequence files (plain text)

Loads audio clips (InTeL HEX files)

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# Fixed namespace of audio utterances

## Vocalize system status (battery, etc.)

Numbers 0 through 9

Channel name, volts, milliamps, point

Small subset to announce operating frequency

Example use **BATV V 7.2**

## Vocalize station identity

Callsign

Nickname

May want to load all nicknames everywhere!

Example use **TALK** <**CALL**> and **TALK** <**NAME**>

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# Fixed Namespace

**BATTI** "Battery Current"
**BATTV** "Battery Voltage"
**REG5** "Regulated 5V"

**POINT** "Point"
**V_MAMP** "Milliamps"
**V_VOLTS** "Volts"

**V_HZ** "Hertz"
**V_KHZ** "Kilohertz"
**V_MHZ** "Megahertz"

**V_N0** "Zero"
**V_N1** "One"
**V_N2** "Two"
**V_N3** "Three"
**V_N4** "Four"
**V_N5** "Five"
**V_N6** "Six"
**V_N7** "Seven"
**V_N8** "Eight"
**V_N9** "Nine"

**V_F144** "One forty four point"
**V_F145** "One forty five point"
**V_F200** "Two Hundred"
**V_F225** "Two Hundred twenty five"
**V_F250** "Two Hundred fifty"
**V_F275** "Two Hundred seventy five"
**V_F300** "Three Hundred"
**V_F325** "Three Hundred twenty five"
**V_F350** "Three Hundred fifty"
**V_F375** "Three Hundred seventy five"

**FOX20** "Fox twenty"
**FOX21** "Fox twenty one"
**FOX22** "Fox twenty two"
**FOX23** "Fox twenty three"
**FOX24** "Fox twenty four"
**FOX25** "Fox twenty five"
**FOX26** "Fox twenty siz"
**FOX27** "Fox twenty seven"
**FOX28** "Fox twenty eight"
**FOX29** "Fox twenty nine"

**FOX30** "Fox thirty"
**FOX31** "Fox thirty one"
**FOX32** "Fox thirty two"
**FOX33** "Fox thirty three"
**FOX34** "Fox thirty four"
**FOX35** "Fox thirty five"
**FOX36** "Fox thirty siz"
**FOX37** "Fox thirty seven"
**FOX38** "Fox thirty eight"
**FOX39** "Fox thirty nine"

**W0JV** "Whiskey Zero Juliet Victor"

**KC0JFQ**

"Kilo Charlie Zero Juliet Foxtrot Quebec"

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## Audio emulation of RADAR CHiRP

What a chrip might sound like if down converted and slowed down

These audio clips were all generated in **AUDACITY**.

**CHIRP_UP** Tone of increasing frequency

**CHIRP_DN** Tone of decreasing frequency

**CHIRP_UPDN** Tone of increasing then decreasing frequency

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# Audio Group: Field Day

**Demonstration** of the FOX Transmitter talking

**FD_W0JV** "CQ Field Day this is W0JV"

**FD_FOX** "I am your field day Fox Transmitter... "

**FD_GAZELLE** "Hey look at me, I'm a Gazelle! "

**FD_CATCH** "Hey look at me, catch me if you can "

**FD_TUNA** "I am a TUNA FISH SANDWICH "

**FD_SILLY_8K** "Allright now, this is getting just plain silly "

**SHRK_WDY_CLP** from Toy Story: "Look, I'm Woody; Howdy,Howdy, Howdy, "

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# Audio Group: Sing Sing

## The 3 Stooges The SING SING sketch

**TS_1** Shemp: "You are now in Los Angeles "

**TS_1R** Moe: "I am now in Los Angeles "

**TS_2** Shemp: "You are now in New York "

**TS_2R** Moe: "I am now in New York "

**TS_3** Shemp: "You are now in Sing Sing "

**TS_3R** Moe: "I am now in Sing Sing "

**TS_4** Shemp: "You are now in Boston "

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# HAL 9000

**2K1_H_9000** "I am a HAL9000 computer "

**2K1_FOOLPROOF** "We are all, by any practical definition of the word foolproof... "

**2K1_HUMAN_ERR** "This ... has cropped up before,... always due to human error "

**2K1_GD_EVE** "Good Evening Dave, everything is running smoothly "

**2K1_CHESS2** "Would you like to play a game of chess "

**2K1_ENJOYA** "Thank you for a very enjoyable game "

**2K1_JUST_MOM** "I know it's a bit silly, just a moment... "

**2K1_MSG_4_U** "There is a message for you "

**2K1_MSG_REP** "Do you wnat me to repeat the message "

**2K1_DANGER** "Do you think there is danger here "

**2K1_IGNIT** "Ignition, full thrust "

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# Audio Group: Star Trek

## Kirk and Spock

**TREK_ABSORPT** "You are ordered to accompany us to the absorbtion chambers "

**TREK_AYE_SIR** "Mister Scott, ready the transporter "

**TREK_ENERGY** "Pure energy, pure thought, totally incorporeal... "

**TREK_GREETIN** "Greetngs and Felicitations "

**TREK_HAILING** "Hailing frquencies are open "

**TREK_MCCOY_** "What am I? A doctor or a moon shuttle conductor "

**TREK_QUESTION** "Since before your sun burned host in space... "

**TREK_SQRE_NOST** "I fail to understand you romantic nostalgia for such a place "

**TREK_SQRE_UNUS** "Unusual captain, I'm now getting... "

**TREK_YELLOW** "This is the cpatain, condition Yellow Alert "

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# Other clips from the 3 Stooges

**HEY_LARRY** Curly: "Hey Larry "
**HEY_MOE** Curly: "Hey Moe "
**SORRY_MOE** Larry: "I'm Sorry Moe, please forgive me "
**CURLY_THINKS** Curly: "I'm trying to think bu nothin' happens "
**BIG_IDEA** Moe: "What's the big idea "
**3S_HEY_MOE1** Curly: "Hey Moe, Hey Larry, where are you "
**3S_HEY_MOE2** Curly: "Hey Moe, Hey Larry "
**3S_HEY_MOE3** Curly: "Hey Moe, Hey Larry "
**3S_HEY_MOE4** Curly: "Hey Moe, Hey Larry, hey fellas where are you "
**3S_PAUSE** Curly: "We will now pause for station identification, this is station N U T S "
**3S_SHUT_UP** Moe: "Shut up and start talking "
**3S_TAXIDERMIST** Curly/Larry: "It'll make a beautiful rug, you know a taxidermist"
**3S_TOUPEE** Moe: "Why don't you get a toupee with some brains in it "
**3S_VICTIM1** Curly: "I'm a victim of circumstance "
**3S_WISE_GUYA** Moe: "Oh, a wise guy, eh "

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## Fill in the blanks

Make your own vocalizations to meet your needs.

**Name** " "

**Name** " "

**Name** " "

**Name** " "

**Name** " "

**Name** " "

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# Morse code generator

Text to Code is handled within the Fox Transmitter

CW message is broken into small *chunks*.

Each *chunk* must fit in a 32 byte record *(in the FRAM)*.

CW parameters are programmable.
- Word Rate (up to about 50WPM)
- Weighting (4 timing parameters)

Audio parameter is programmable.
- Audio Frequency (up to bandwidth limit)

PROSigns.
- A few are implemented
  - BT -...- *begin 2 lines*
  - AR .-.-. *all received*

These settings can all change *on the fly*
*right in the middle of a message*

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# Scary Notes for the Presenter

## PAY NO ATTENTION TO THE MAN BEHIND THE CURTAIN!

Notes for the terminally forgeful

Here we go again!
-Dolly Parton

Reformat the PDF, expanding it to about 80% of the page:

```
gs -sDEVICE=pdfwrite \
        -dDEVICEWIDTHPOINTS=499 \
        -dDEVICEHEIGHTPOINTS=634 \
        -dCompatibilityLevel=1.4 \
        -dNOPAUSE \
        -dBATCH \
        -dPDFFitPage \
        -sOutputFile=fox_Print_11.pdf \
        fox_present_11.pdf
```

Reformat PDF file to PS file for printing

```
pdftops -paper letter \
        fox_Print_11.pdf \
        fox_Print_11.ps
```

Test Print

Verify Margins (for 3-hole punch)
Verify orientation (running from 3-ring binder???)

```
lp -d HP_LaserJet_M209 \
        -o portrait \
        -o media=letter \
        -o sides=two-sided-long-edge \
        -P 1,2 \
        fox_Print_11.ps
```

Print it with the presenter notes (at the end)

```
lp -d HP_LaserJet_M209 \
        -o portrait \
        -o media=letter \
        -o sides=two-sided-long-edge \
        fox_Print_11.ps
```

# Before we begin

Please feel free to ask questions.
I'll try to give an overview of the audio clips I have rate-shifted and loaded into FLASH memory.
Minimum FLASH for what I have here is 8mB.
Most of the boards have a 64mB FLASH device that will hold a bit over 30 minutes of audio at a 4KHz rate.

## Notes for page 3 Audio Waveform Data.

Audio is stored external to the SOC (system on chip). We can use any audio source that can be converted to the needed sample width and data rate.

Bandwidth is low as that is all that is necessary for audio within the bandwidth limits of our VHF handheld radio.

Other than the clips mentioned on the following pages, you are free to choose your own names assuming they don't overflow the directory records in which they are stored. That is 32 bytes for **TALK=**, the filename, and the starting point in the FLASH.

Toolchain to get from 40KHz 16 bit stereo to 4KHz 8 bit mono.

## Notes for page 4 FOX Binary Loader.

Life began using an InTeL HEX file to load the FLASH memory (command decode recgonizes HEX record as special case). Gawd this is slooooooooow.

Implement a simple protocol to send binary data over the coimmunications channel with handshake to program the FLASH. Uses same *guts* for FRAM and FLAH so we get really fast FRAM loads for free :-)

## Notes for page 5 Base Clips.

Baseline clips required to vocalize battery condition.

Numbers, units, and the like.

Namespace defined in zNEO program, have to use it the way the program flash defines it or you don't get a vocalization

small subset of commands can use the audio clips. TALK and BATTERY condition come to mind.

## Notes for page 6 Fixed Namespace

Top half of the slide are the names that **must** appear exactly as shown. The filenames are fixed in the zNEO firmware.

The bottom half of the slide are the nicknames and callsigns. Callsign must match exactly for vocalization and station identification to work correctly. There is string substitution happening to allow the callsign to be assigned in **one command** in the **INI=** file.

The nicknames must match those defined in the **INI=** file. In this example I simply called the FOX1, FOX2, etc. Just running up the number line. Most of the FOX1 through FOX19 units exist but are no longer used.

For convenience (the audio filesystem is shared between all units) all nicknames are loaded.

The RIFF/WAVE header has all the information about the audio we need to process it. **MUST** be 8 bit mono data, nothing else works. Sample rates of 4K, 5K, 8K, and 16K can be processed. Only 4K and 5K make sense for use in the Fox Transmitter.

The other rates are there to support some other projects that make use of the 102-73181-10 circuit board.

Some of the larger FLASH devices take forever to erase. They'll erase correctly, but you can't access them during the erase cycle. They will look like they died. Just give 'em time.

The FRAM doesn't need to be erased (it is a RAM, after all). Just send an updated image using the *fox_binary* loader and you're set. This assumes you keep everything well managed on the host system.

## Notes for page 7 Chirping.

This set of clips is used to implement a mode where carrier is suppressed between the "*chirp*s". This is a chicken-shit simulation of real RADAR chirping.

## Notes for page 8 Field Day.

Some yakkity-yak for Field Day

Although we are, for the most part, talking about the voice capability of the Fox Transmitter, keep in mind that we can freely intermix code (**CODE** *text to send*) and voice (**TALK** *file to send*)

We are also free to switch between FM (**CONF FM**) and CW (**CONF CW**) mode of operation.
The **CONF FM** command tells the handlers to keep the carrier on throughout the message (i.e. between **BEGN** and **DONE** commands).
The **CONF CW** command tells the handlers to interrupt the carrier when not actively sending voice waveform or dit/dah (kinda like full break-in) codewords.

## Notes for page 9 Sing Sing.

This is an old 3-Stooges comedy sketch. If you remember Dr. Max, you'll remember this sketch.

Shemp finds a playbill for *Svengali* the hypnotist and tells Moe, he can perform a hypnosis just as well.

Away we go. Shemp hypnotises Moe, having him believe he is in Los Angeles.

Moe, plays along and admits to being in Los Angeles.

Shemp takes a step to the left and tells Moe: "You are now in New York"

Moe follos to the left and replies" "I am now in New York"

Well, Shemp take Moe upsate to Sing Sing, where New Yous correctional facility is located: "You are now in Sing Sing".

Moe picks up a straight back chair, holds it in front of his face (jail bars) and makes the move to Sing Sing.

Shemp now moves to Boston: "You are now in Boston".

Moe with the chair still in place and replies "I am now in Sing Sing". to Sing Sing.

Shemp, rather flustered by this point has the chair mercilessly smashed over his head and they carry on with the episode...

This sketch is implemented on two Fix Transmitters. One voices the Shemp part, and the other voices the Moe part.

The clocks need to have been set the night before for this to work correctly.

## Notes for page 10 2001: A Space Odyssey.

For HAL9000 fans...

## Notes for page 11 Star Trek.

For Star Trek fans...

## Notes for page 12 More of The 3 Stooges.

And a few more 3 stooges clips...

# Notes for page 14 Code Generation.

Code generator is all inside the zNEO.

ISR switches audio tone on and off at selected rate. Audio wavefor is not shaped (it is harsh!).

zNEO timer is programmed to operate at the **dit** rate. This timer triggers the ISR that turns the audio on and off.

All other timing specifications are in terms of **dit**s.

Typical command is **CWPM 35,1,3,7,14**.

CWPM is the command to set code parameters

35 is the word rate we send at *(sets the interrupt rate)*.

1 is quiet spacing between individual dit/dah

3 is quiet spacing between letters

7 is spacing between words

14 is spacing after sentence (i.e. after period)

ISR runs at rate determined by the **WPM** selection.

All other timings are a result of counting interrupts *(integer counts)*.