Introduction to NBEMS

Integrating NBEMS with Broadband Hamnet

ARRL Western Pennsylvania Section

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Why Digital EmComm?

- Think back to your last public service event, drill, or deployment.
- You probably passed a lot of traffic best suited for voice communications but...
- What if you had been asked to pass
  - Roster of evacuees
  - Required prescription medications
  - Directions to a disaster scene

Why Digital EmComm?

- The needs of our Served Agencies have changed.
- They still need voice communications but...
- There's an increasing need for data communications.
- We need to be able to provide more than just voice communications from a ham with an HT.

What is NBEMS?

- Narrow Band Emergency Messaging System
- Consists of several programs:
- Fldigi – Fast Light Digital modem application
- Flmsg – ICS forms, Radiogram, text, CSV
- Flamp – Amateur Multicast Protocol
- Can download from http://www.w1hkj.com/
- Runs on Windows, Linux, and Mac.
- Released under GNU Public License, so is completely FREE.

NBEMS philosophy

- Keep it cheap.
- Keep it simple.
- Use Open Source software.
- Don't depend upon infrastructure.
- Make it fun to use between drills and disasters.
- Any computer, any radio.

Fldigi

How it works

- Fldigi uses your computer's sound card to generate and decode digital signals.
- Flmsg talks to Fldigi to send and receive messages.
- All work is done by your computer, don't need an external Terminal Node Controller (TNC).
- Audio from your computer speakers go into your radio's mike input for transmission.
- Audio from your radio goes into your computer's mike or line-in for decoding.
- Don't need an extremely powerful new computer, older machines work just fine.
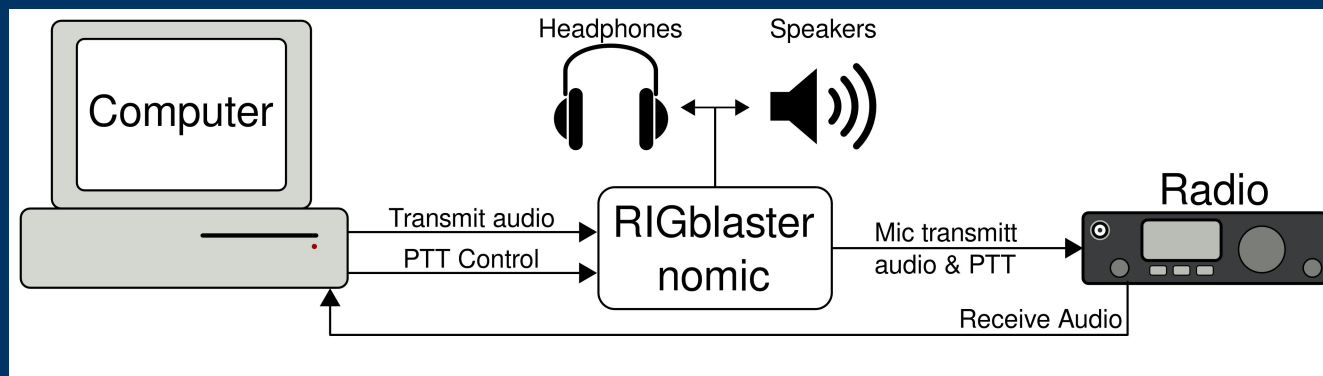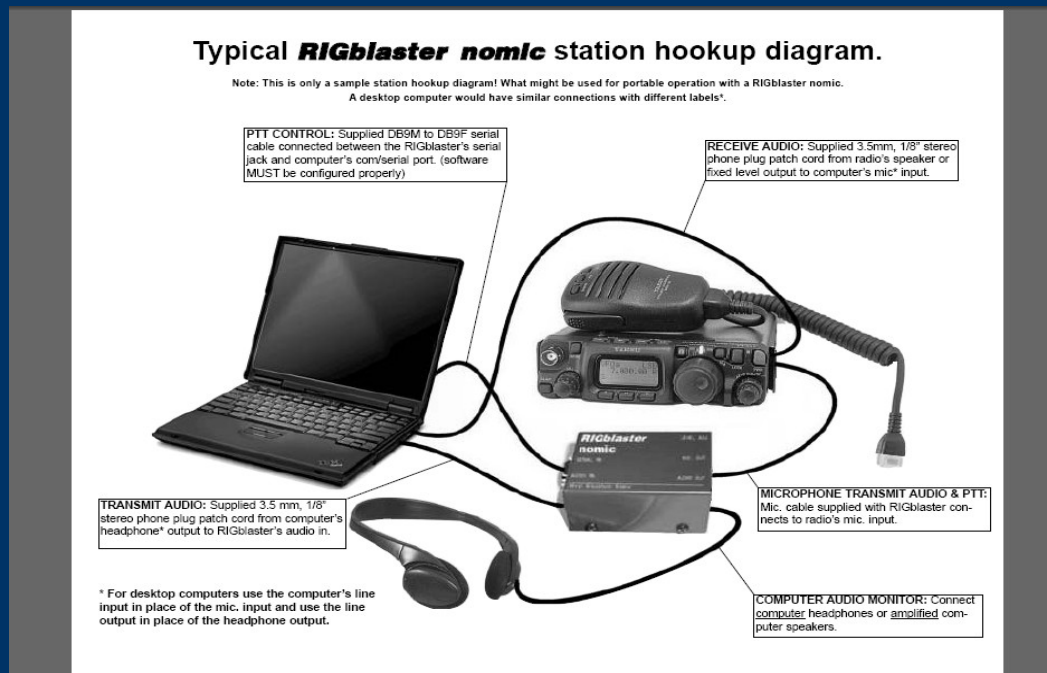
Interfacing with computer

- Many ways to interface with computer.
- Rigblaster
- SignaLink
- USB for newer HF radios.
- But, if necessary, hold radio mike up to computer speaker and...
- Hold radio speaker up to computer mike!
- In an emergency, don't really need hardwired interface.
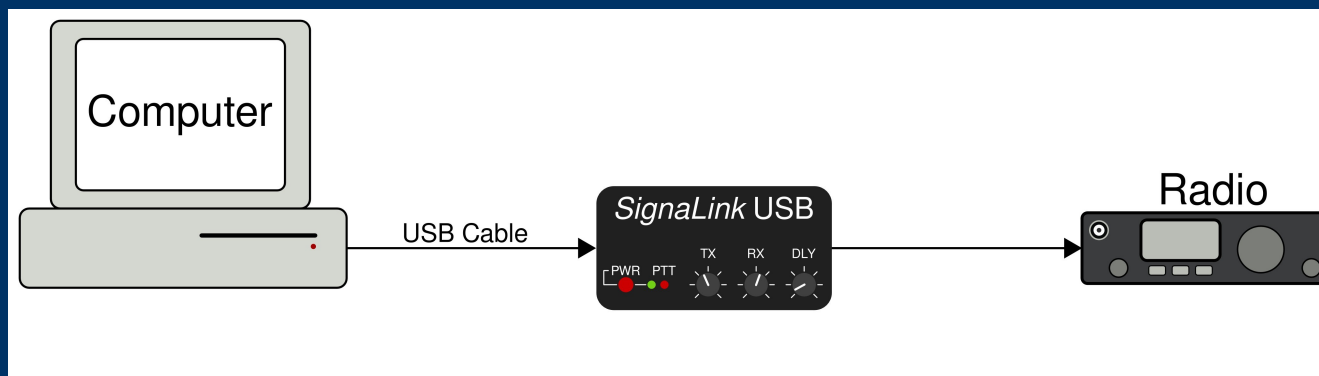- Disable all DSP "enhancement" programs on mic.

Acoustic Interface

- Easiest way to interface radio to computer is to...
- Hold radio mike up to computer speakers.
- Hold radio speaker up to computer mike.
- You do PTT manually.
- Works especially well with VHF/UHF FM.
- Real gamesaver during emergencies.
- Allows you to easily send data using any radio.
- Hams can participate who do not have a soundcard interface.
- MT63 is sufficiently robust to deal with background noise, even in a noisy EOC or field site.

Rigblaster nomic setup

Typical **RIGblaster nomic** station hookup diagram.

Note: This is only a sample station hookup diagram! What might be used for portable operation with a RIGblaster nomic. A desktop computer would have similar connections with different labels*.

PTT CONTROL: Supplied DB9M to DB9F serial cable connected between the RIGblaster's serial jack and computer's com/serial port. (software MUST be configured properly)

RECEIVE AUDIO: Supplied 3.5mm, 1/8" stereo phone plug patch cord from radio's speaker or fixed level output to computer's mic* input.

TRANSMIT AUDIO: Supplied 3.5 mm, 1/8" stereo phone plug patch cord from computer's headphone* output to RIGblaster's audio in.

MICROPHONE TRANSMIT AUDIO & PTT: Mic. cable supplied with RIGblaster connects to radio's mic. input.

* For desktop computers use the computer's line input in place of the mic. input and use the line output in place of the headphone output.

COMPUTER AUDIO MONITOR: Connect computer headphones or amplified computer speakers.

Headphones   Speakers

Computer

RIGblaster nomic

Radio

Transmit audio
PTT Control
Mic transmitt audio & PTT
Receive Audio

Signalink USB

SignaLink Configuration

- SignaLink is very easy to configure.
- Just connect to computer via USB.
- Configure Fldigi to use SignaLink USB sound card.
- Generate just enough audio from computer to trigger SignaLink vox.
- Use volume controls on SignaLink and don't touch computer audio settings
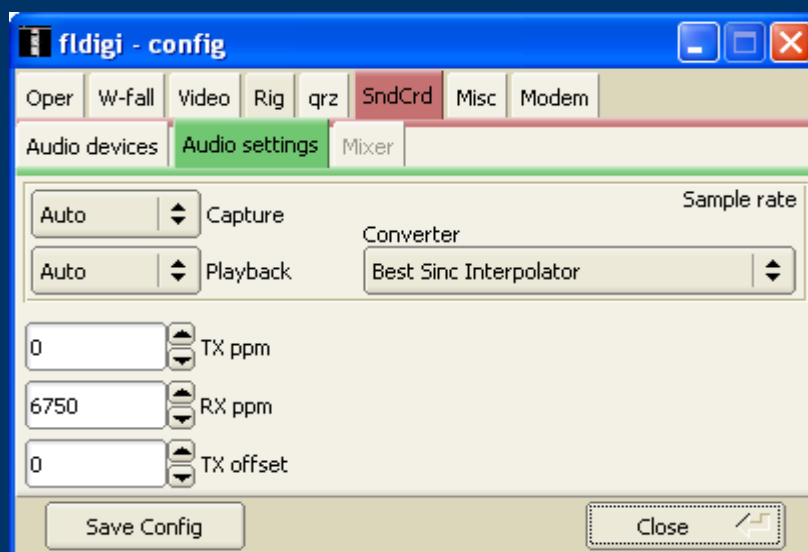
SignaLink Configuration
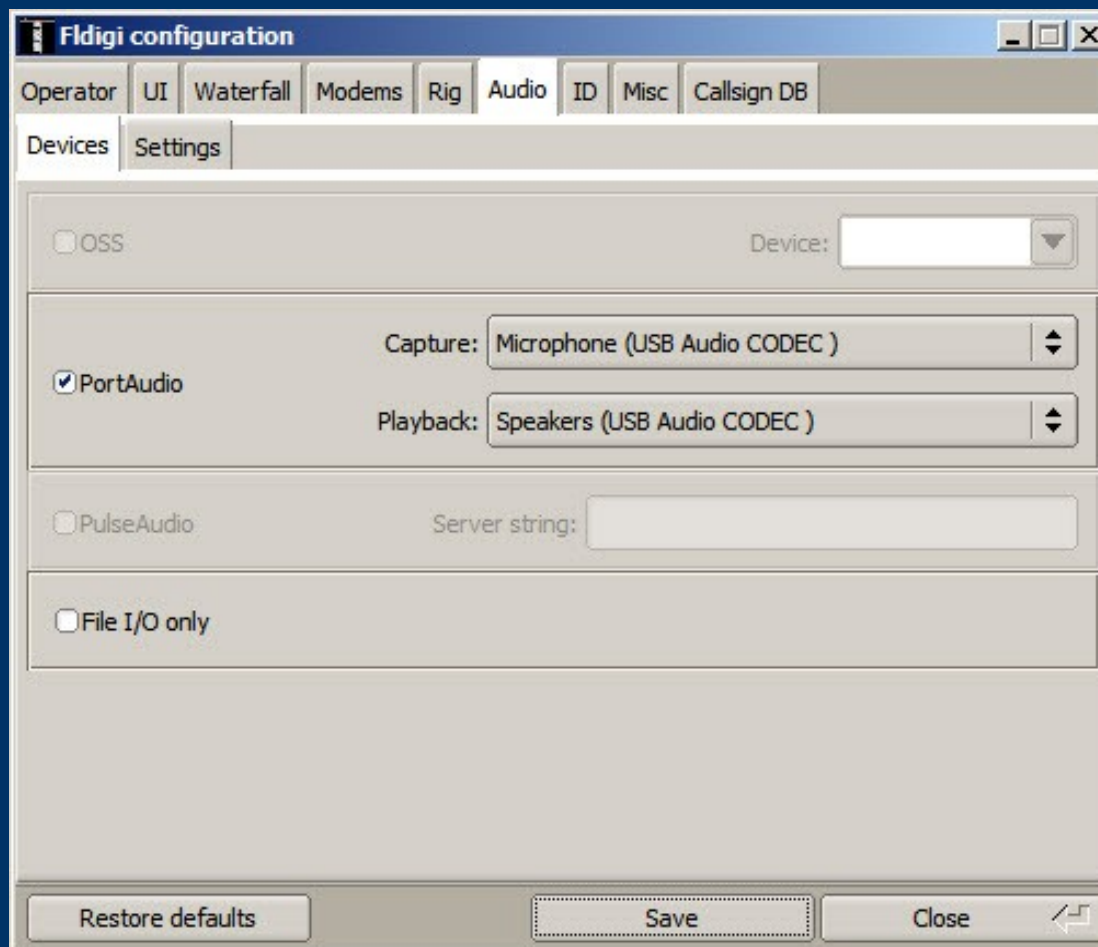
Configuring Fldigi

- First time through, wizard is run.
- Enter your personal info.
- Also configure soundcard, radio interface, and modems.
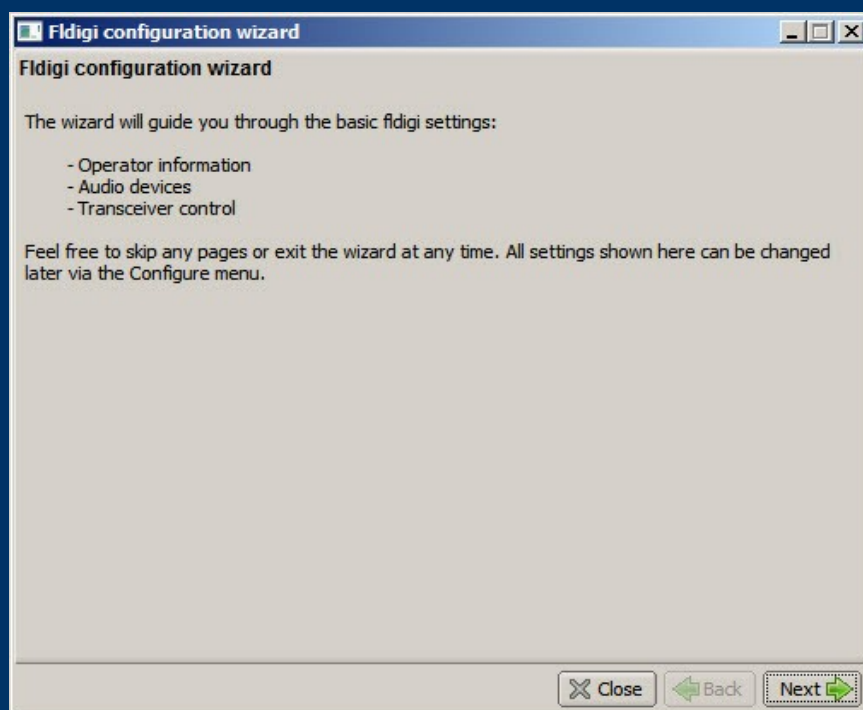
Soundcard Calibration

- If possible, calibrate your soundcard.
- Especially necessary for narrowband HF modes.
- Can use fldigi WWV mode or CheckSR.exe.

Modes

- Lots of modes, most popular ones are...
- MT63 (500, 1000, 2000)
- Olivia
- "R" PSK modes...fast with FEC
- Popular PSK31 OK for making non-emcomm contacts, but has no error correction.

MT63 – Most Versatile Mode

- MT63-2000L great choice for FM EmComm.
- Fast – less than 2 min to send 2kb text file.
- Data redundancy in time and in frequency.
- Very resistant to noise – can lose up to 25% of signal and still copy.
- Be sure to use L version...long interleave
- Long interleave provides better error correction
- Works well with holding mike up to speaker.
- Used in WPA ARES SET and Red Cross drills.

MT63-2000L Waterfall
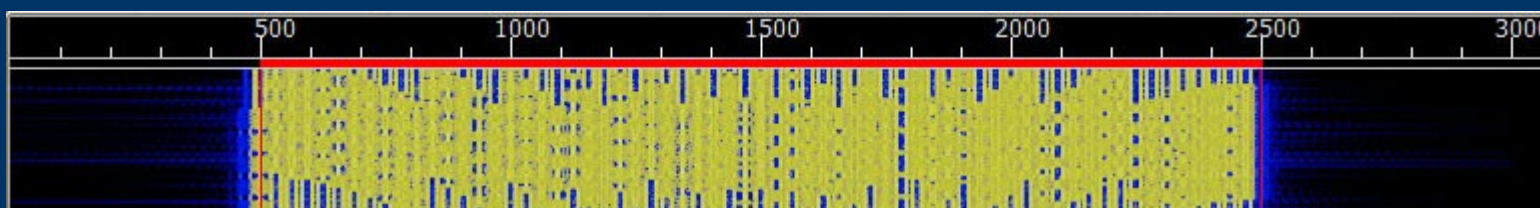
- 64 tones sent at same time.
- Signal width is 2000 Hz.
- Offset frequency is always fixed at 1500 Hz.
- Fixed low frequency eliminates tuning errors.
- Sounds like a giant buzzsaw.

Important MT63 configuration
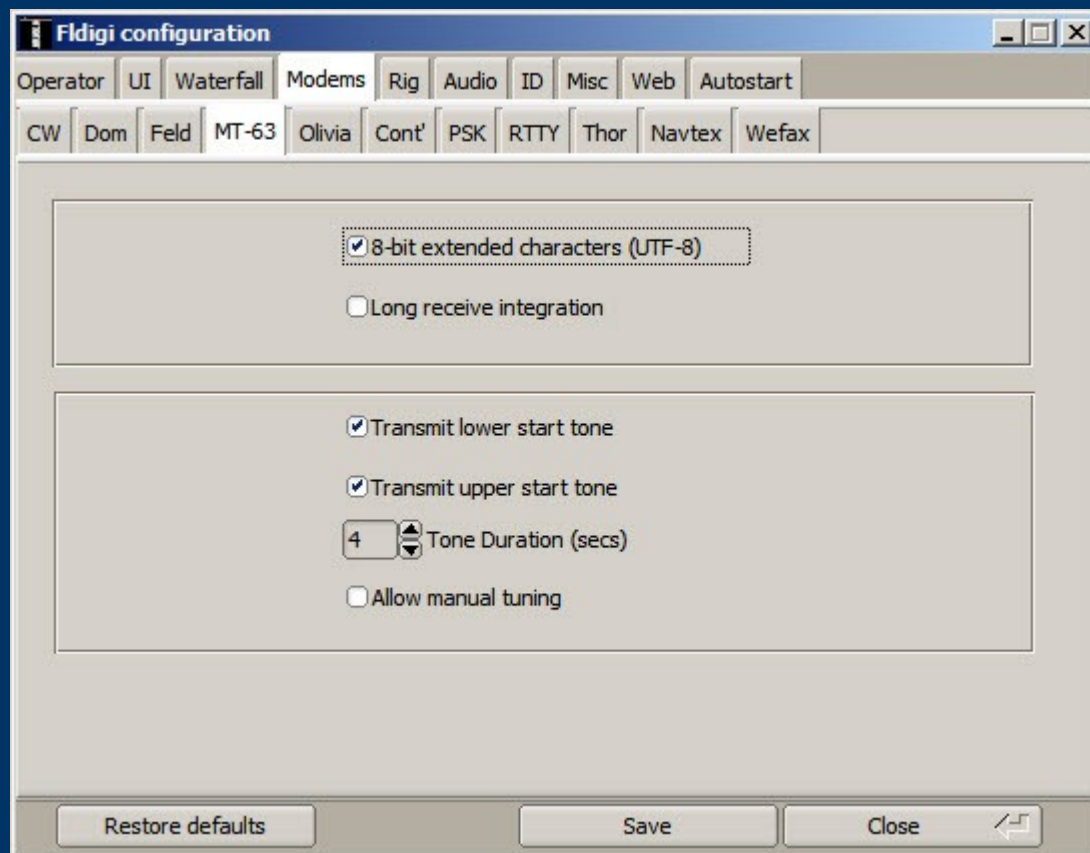
- Check use of 8-bit extended characters
- Uncheck manual tuning for VHF/UHF.
- Check manual tuning for HF...important!

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HF modes

- Preferred HF mode is Olivia.
- Olivia is great for poor HF conditions.
- Will get through when no other mode will.
- Can make contacts below noise floor!
- Does not require precise tuning.
- We use 8/500 when possible – 8 tones in a 500 Hz bandwidth.
- When conditions are poor, we go to 16/500 – 16 tones in a 500 Hz bandwidth.
- 16/500 is slower, but will get through.
- Fine article in Dec 2008 QST by WB8ROL.

Olivia waterfall

- Screenshot of Olivia 16/500 signal in waterfall
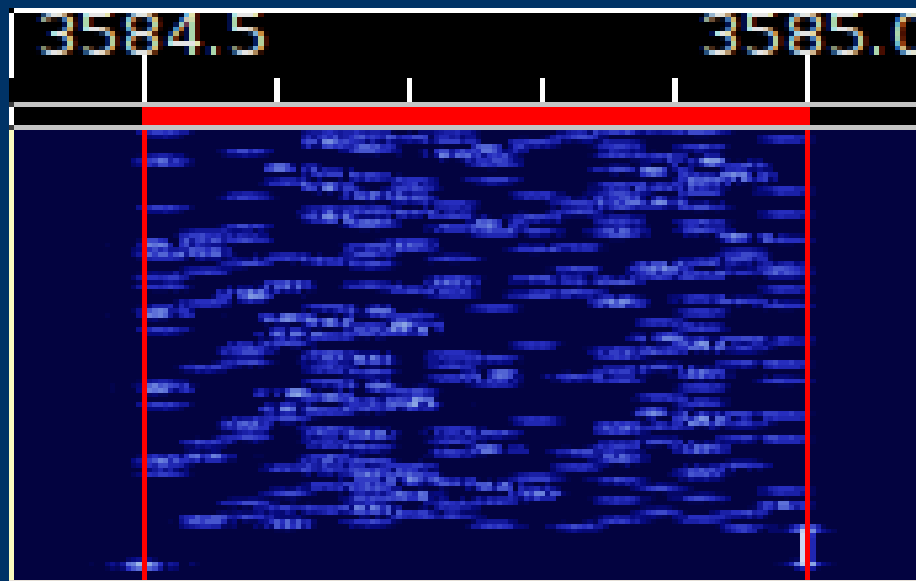
- Unmistakable sound...like a flute!

HF Tips

- A few things to remember for HF operation.
- Always use upper sideband (USB), even on 40M and 80M.
- Don't overdrive your audio.
- Disable speech compressor, noise blanker, and all other audio processing.
- Adjust mike gain so that ALC just moves a little.
- Digital modes are 100% duty cycle so...
- 50 watts is plenty!
- RF kills touchpads...use an external mouse!
- Don't need high power for digital modes anyway.

Data Verification with Checksums

- Checksums allow you to be 100% sure your message was received accurately.
- Checksum is inserted into a file by Flmsg.
- Receiving station computes the checksum on the incoming file and...
- If the two checksums are identical, the file was received without error.
- Allows multiple stations to receive and confirm data 100%.
- Great for bulletins like situation updates, weather reports, road closures, lists of contact info.

Example

This is an example of a file with a checksum:

```
[WRAP:beg][WRAP:crlf][WRAP:fn example.txt]This is an example of a wrapped file.
    Here's what happens when we wrap something.[WRAP:chksum B71E][WRAP:end]
```

- Note the WRAP beg and end delimiters.
- Also note the checksum, it's B71E.
- Flmsg automatically generate checksums.
- Flmsg also computes checksums on incoming messages.

Flmsg – send/receive messages
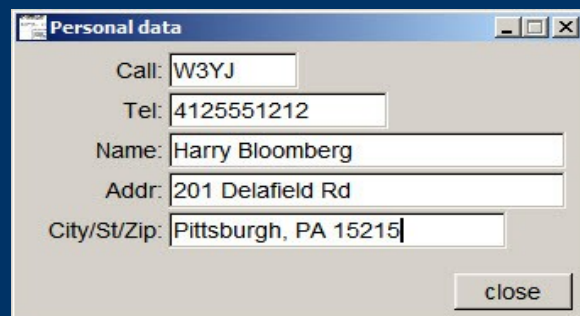
- Flmsg used to send formatted messages:
  - ICS forms like ICS-213
  - ARRL Radiograms
  - Blank text
- Easy workflow for CSV spreadsheets.
- No need for use of text editor like Notepad.
- Starts transmission automatically.
- Eases importing and checksum verification of incoming message.
- Can have incoming messages automatically opened!

Flmsg screenshot

Flmsg - configuration

- Click on Config menu.
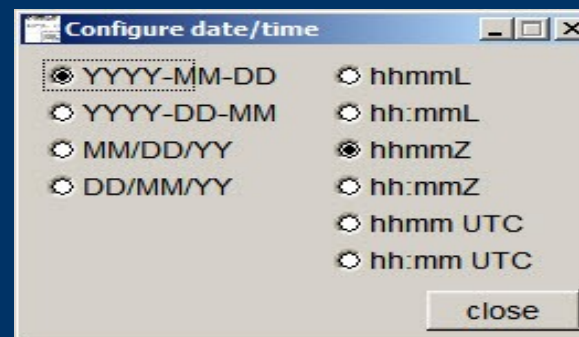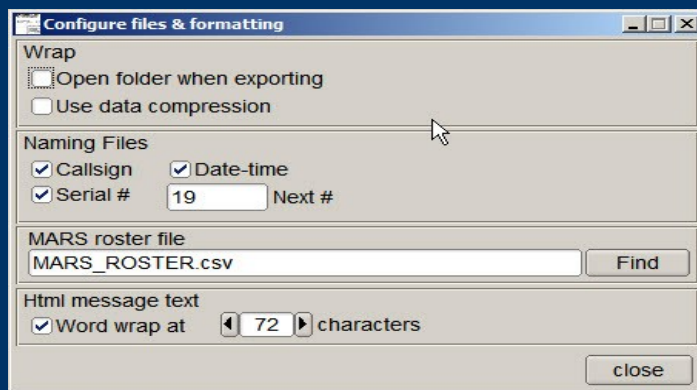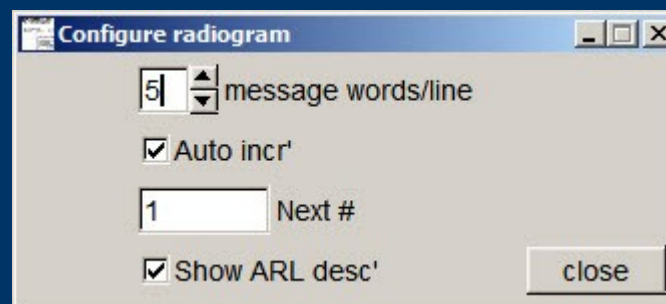
Flmsg – Autosend workflow

- One click sending!
- Enter text directly into large empty box.
- Can also drag-and-drop text file into box.
- Push the AutoSend menu at top.
- Will be prompted to save file with automatically assigned unique filename.
- Flmsg will cause Fldigi to automatically send message.

Flmsg – Autosend Blank Text
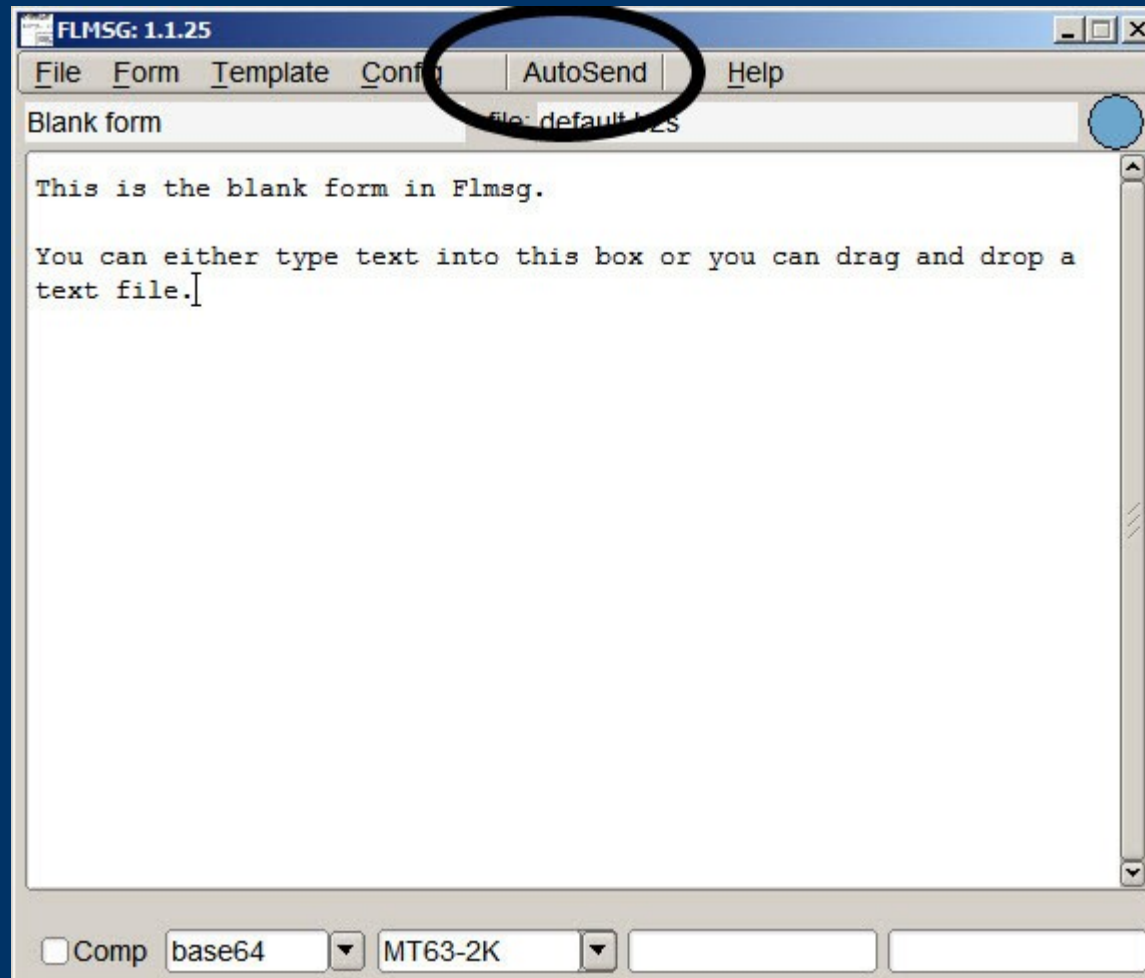
Flmsg Auto Display of Messages

- Incoming messages can be automatically opened in Flmsg.
- Can also auto open messages in browsers.
- Can walk away and come back to see messages displayed.
- Display in browser great for EOC or Served Agency facility.
- In Flmsg, Config->Misc, hit NBEMS tab.
- Check appropriate boxes.
- Must check box for Enable NBEMS data interface.
- Important: must enter complete path to flmsg.exe.

Configure Fldigi for Incoming Data
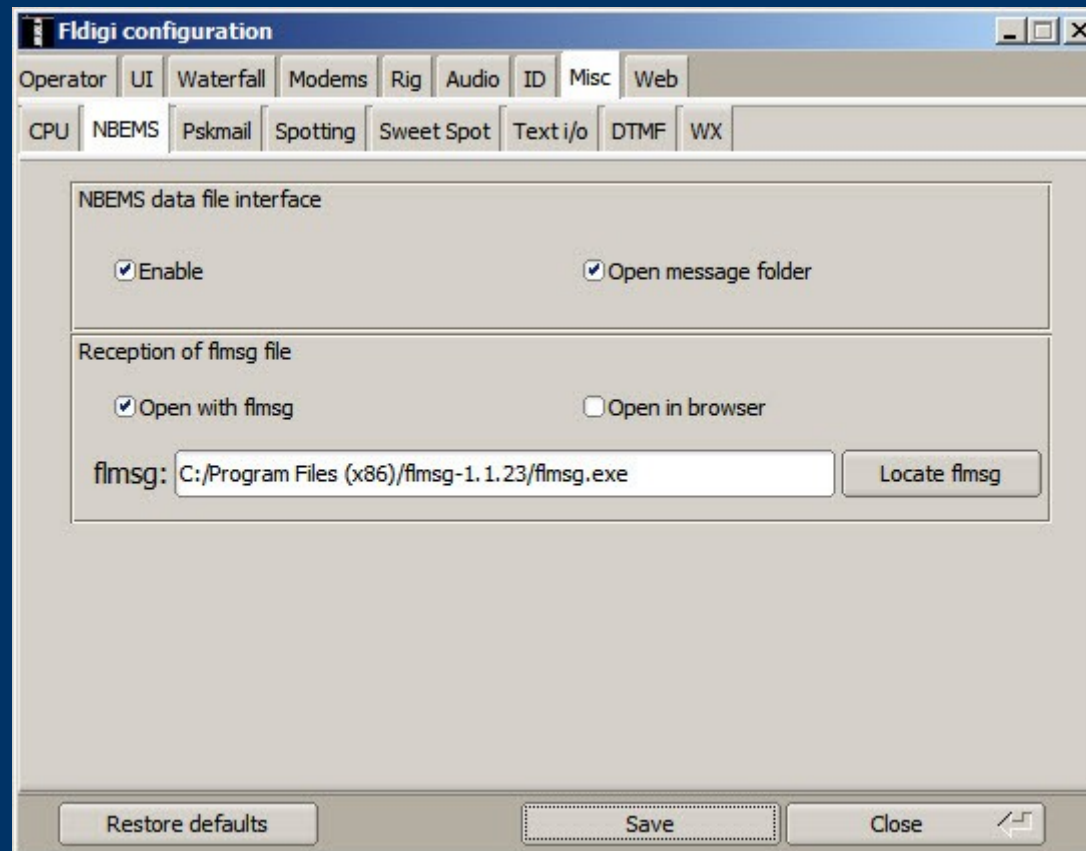
CSV Files for Spreadsheets

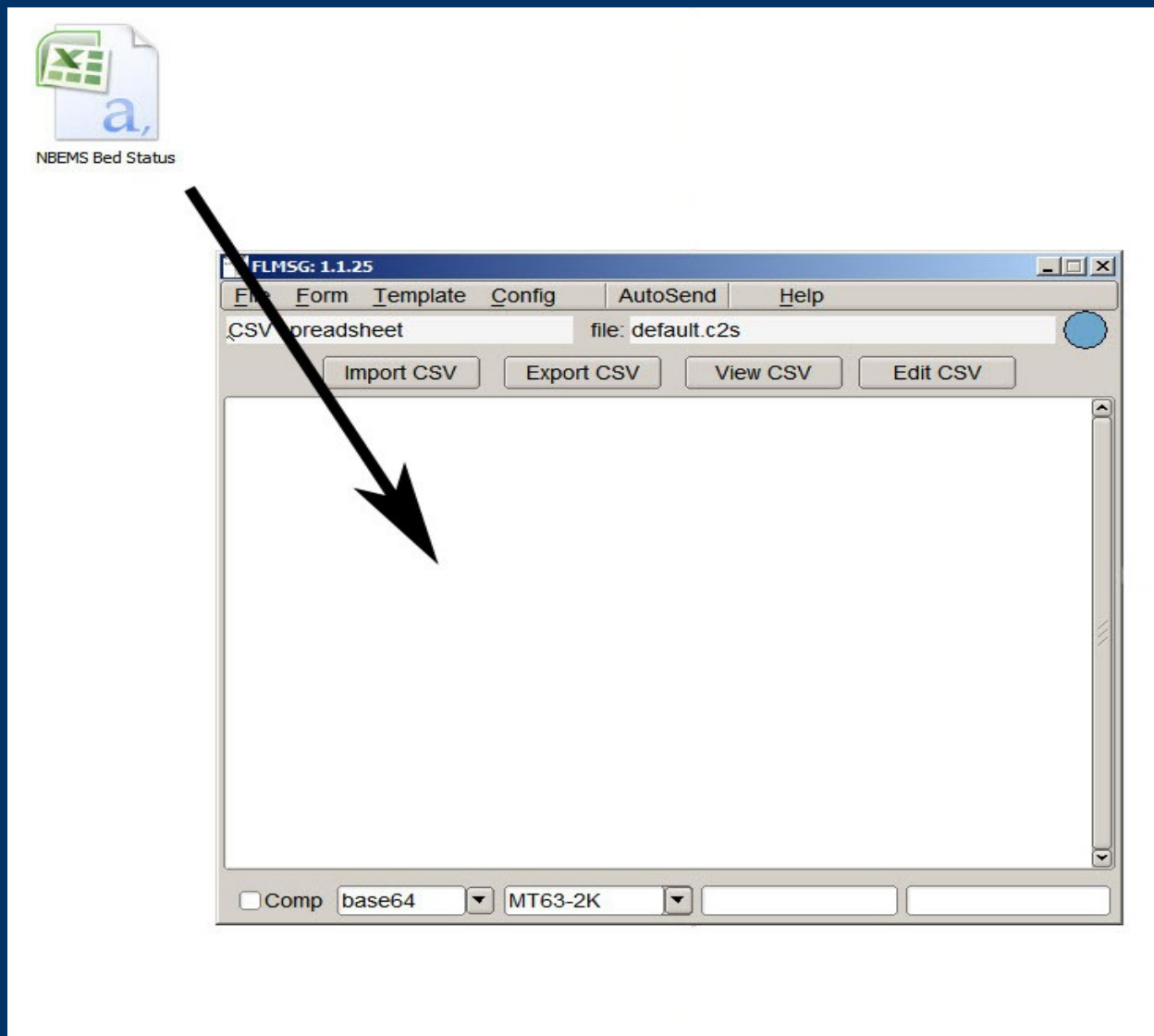- Flmsg simplifies sending and receiving Comma Separated Value (CSV) spreadsheets

  To Send:
- Form->CSV menu
- Drag-and-drop CSV file into the large text box.
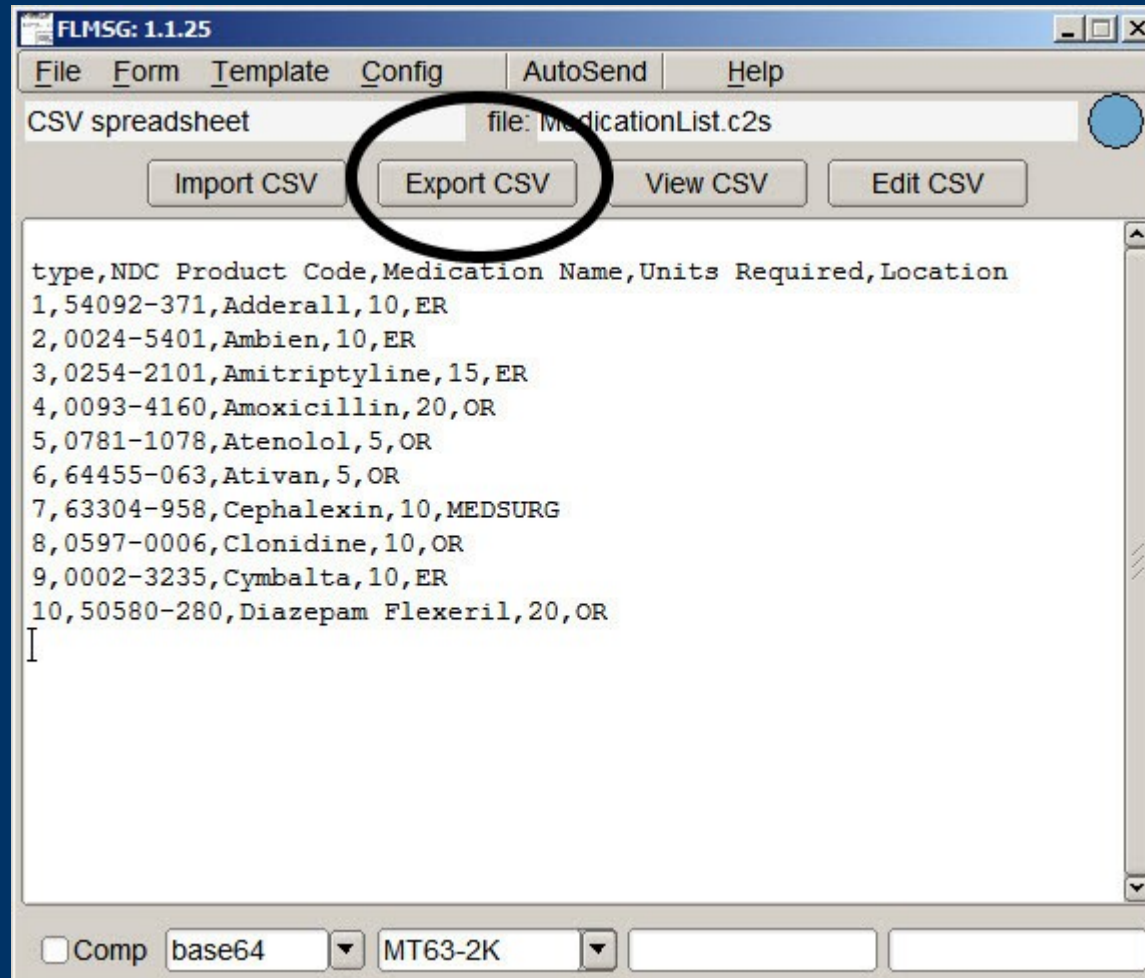- Push Auto Send.

  To Receive:
- Incoming CSV file will auto open in Flmsg.
- Push Export CSV button.
- Save to Desktop or USB drive.

Drag-and-Drop to Import CSV File

Extract Incoming CSV File

NBEMS Data Guidelines

- We send only text files, no binary files.
- We do not send Word Documents, save as text.
- Excel spreadsheets must be exported as CSV.
- We do not send images.
- Limit file size to 3KB to avoid repeater timeouts.
- CRITICAL: Meet with Served Agency beforehand to set expectations.
- Encourage Served Agency to give us data electronically.
- Remember, we have limited bandwidth.

The Need for Speed

- NBEMS is a great suite for sending data but...
- It is slow...MT63-2000L is only 1 kb per sec
- 3 min to send a modest 3000 byte file
- Can send only text
- Even low res photos are impractical to send
- Forget about sending video
- Would like to send rich multimedia data
- Live streaming video
- Large spreadsheets and documents

The Solution: Broadband Hamnet

- One solution is Broadband Hamnet (BBHN)
- Was known as High Speed Multimedia (HSMM)
- Take an inexpensive off-the-shelf wi-fi device...
- Install ham-developed firmware and...
- We can easily create high-speed networks
- Networks are self-discovering and self-configuring
- Hams don't need to be IT personnel to create networks
- Limitation...line of sight range
- But, in the clear and with high-gain antennas, range of miles

BBHN Integration with NBEMS

- Goal: Send data from an aid station to an NBEMS station for long-haul relay
- Set up an anon FTP server and attach to the mesh
- Use Flmsg to write and read forms
- Will send Flmsg messages to our NBEMS station using the mesh and the FTP server
- Frees up NBEMS station for communication with outside the scene
- Can setup Windows or Linux FTP server
- Good Windows FTP server is FileZilla: https://filezilla-project.org/

Advertising an FTP Service

FTP to NBEMS Workflow

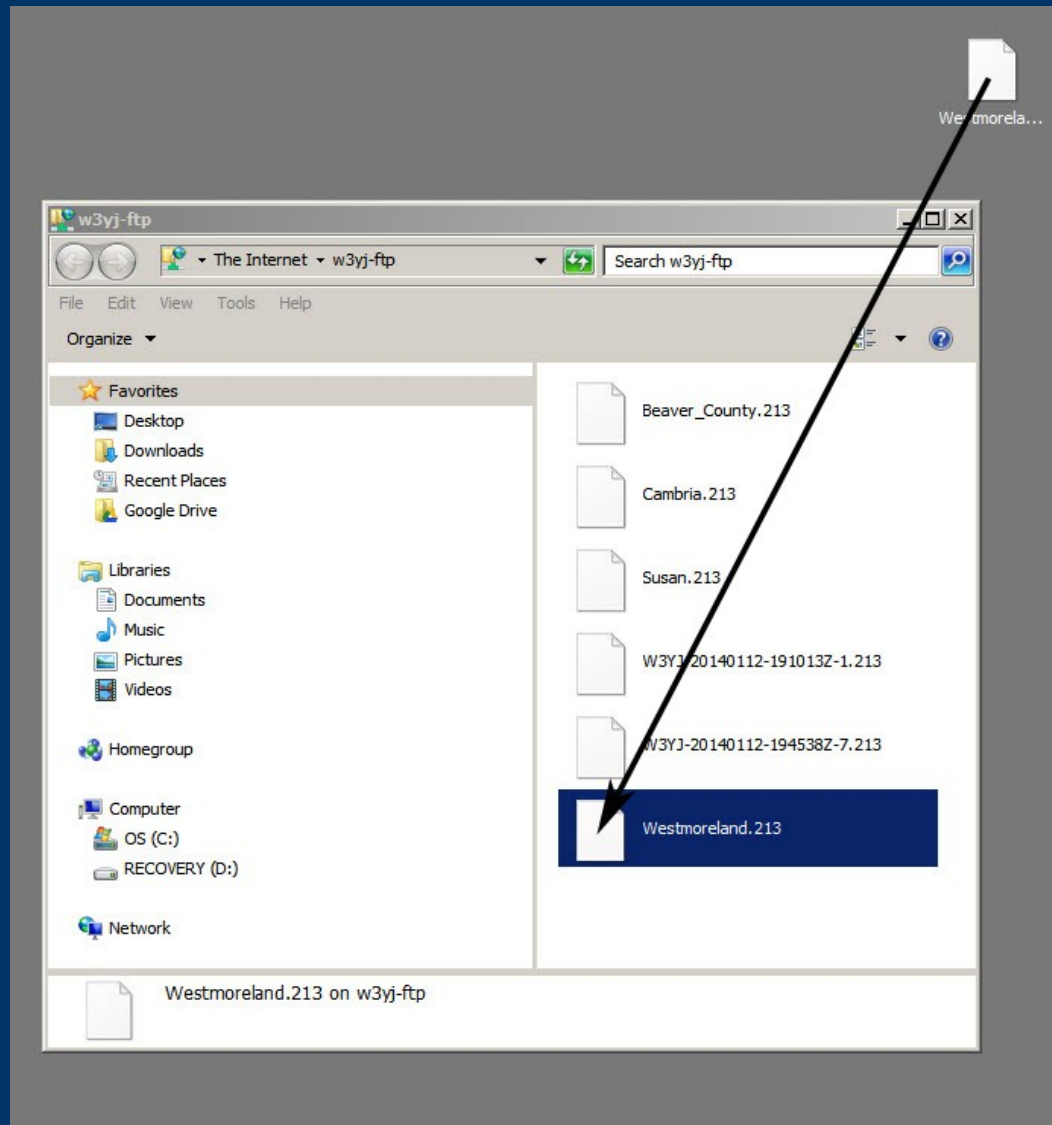- Entire workflow uses point-and-click, drag-and-drop from end-to-end
- For the ham at an aid station...
- Create message with Flmsg
- Save file to desktop
- Open IE
- Go to advertised FTP service on mesh
- Click on link
- In IE, View-> Open FTP Site in IE
- Drag file from desktop into FTP window

FTP to NBEMS Workflow
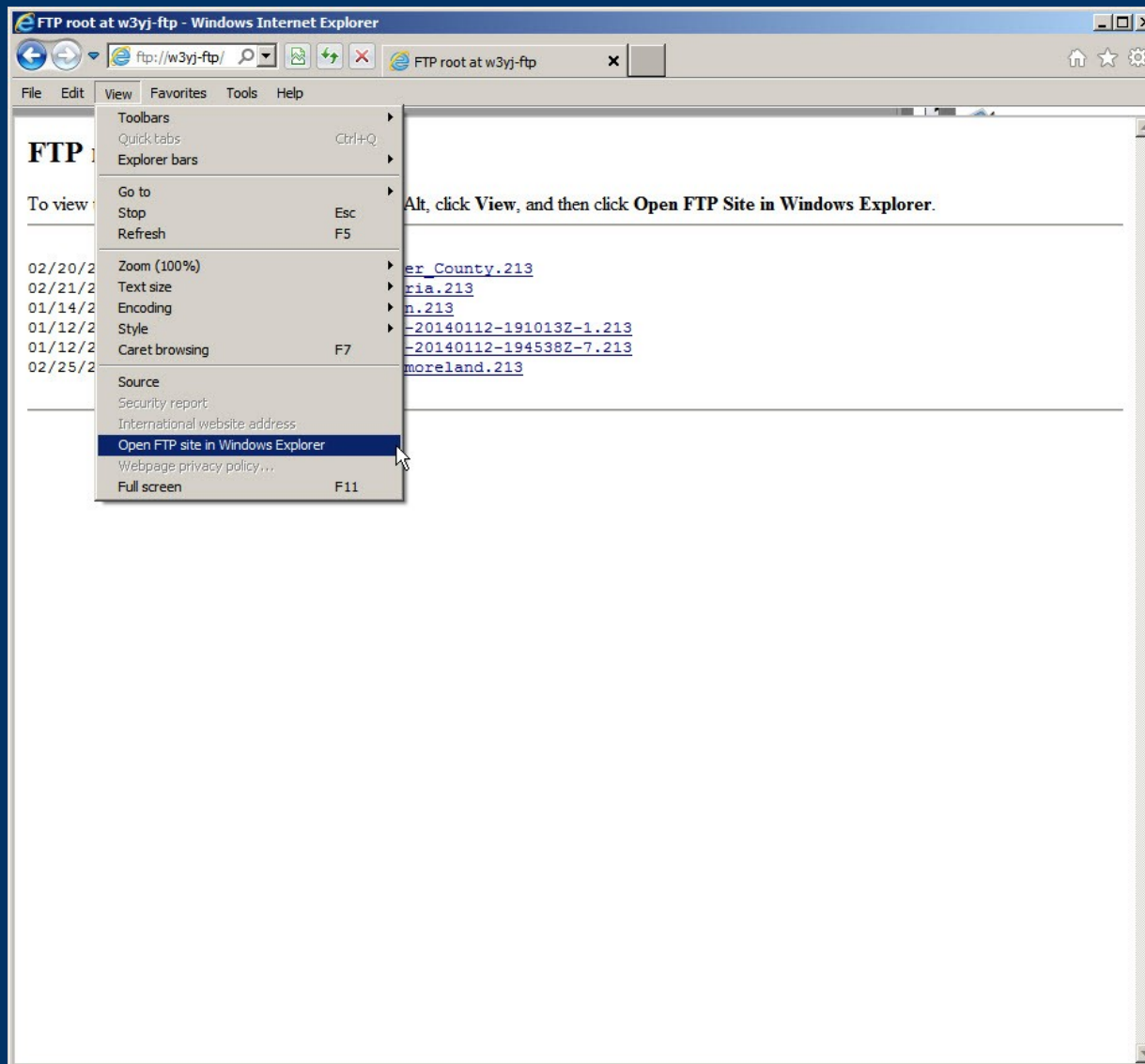
Drop Flmsg file into FTP window

FTP to NBEMS Workflow Cont...

- To retrieve Flmsg file from FTP server for NBEMS transmission...
- Go to advertised FTP server, open FTP window as before
- Drag file from FTP window onto Desktop
- Open Flmsg
- Drag file into little blue circle at top right of Flmsg
- Save file, hit AutoSend
- The file is on the way!

# *Obtain Flmsg file from FTP Server*
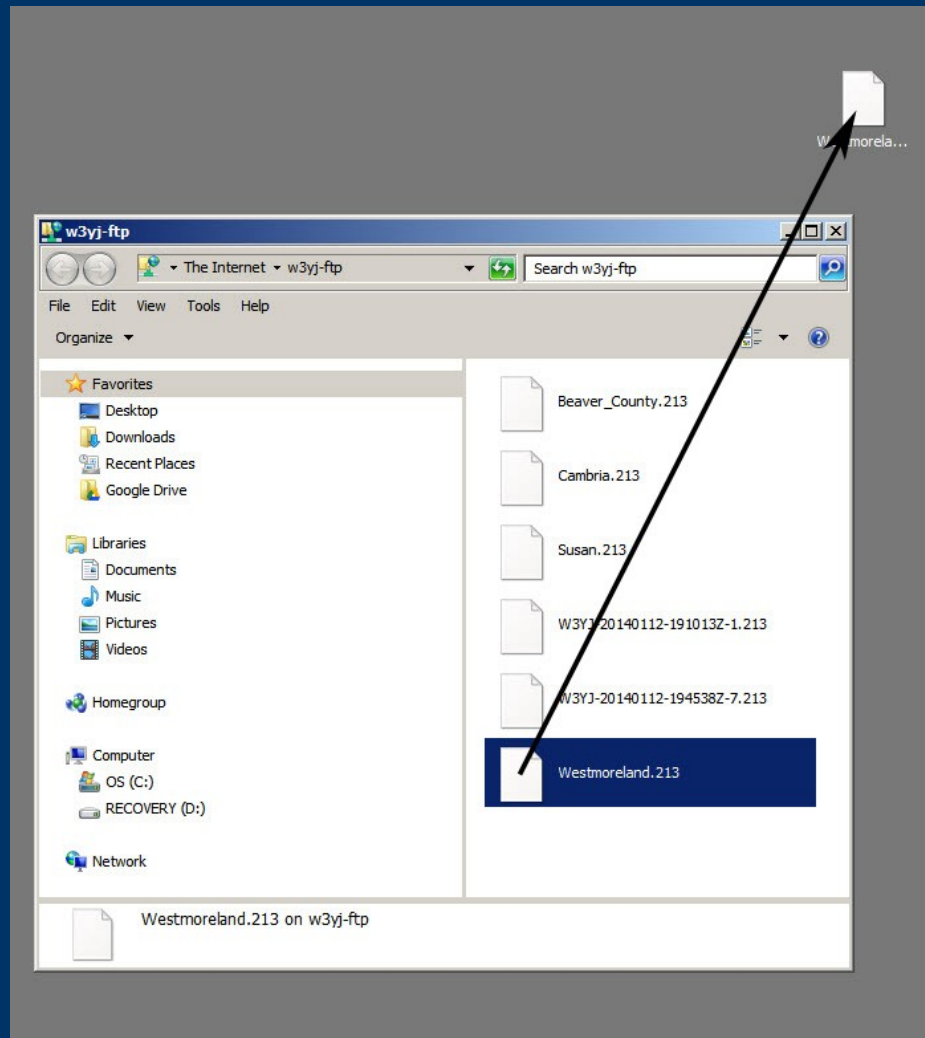
Drop file into Flmsg
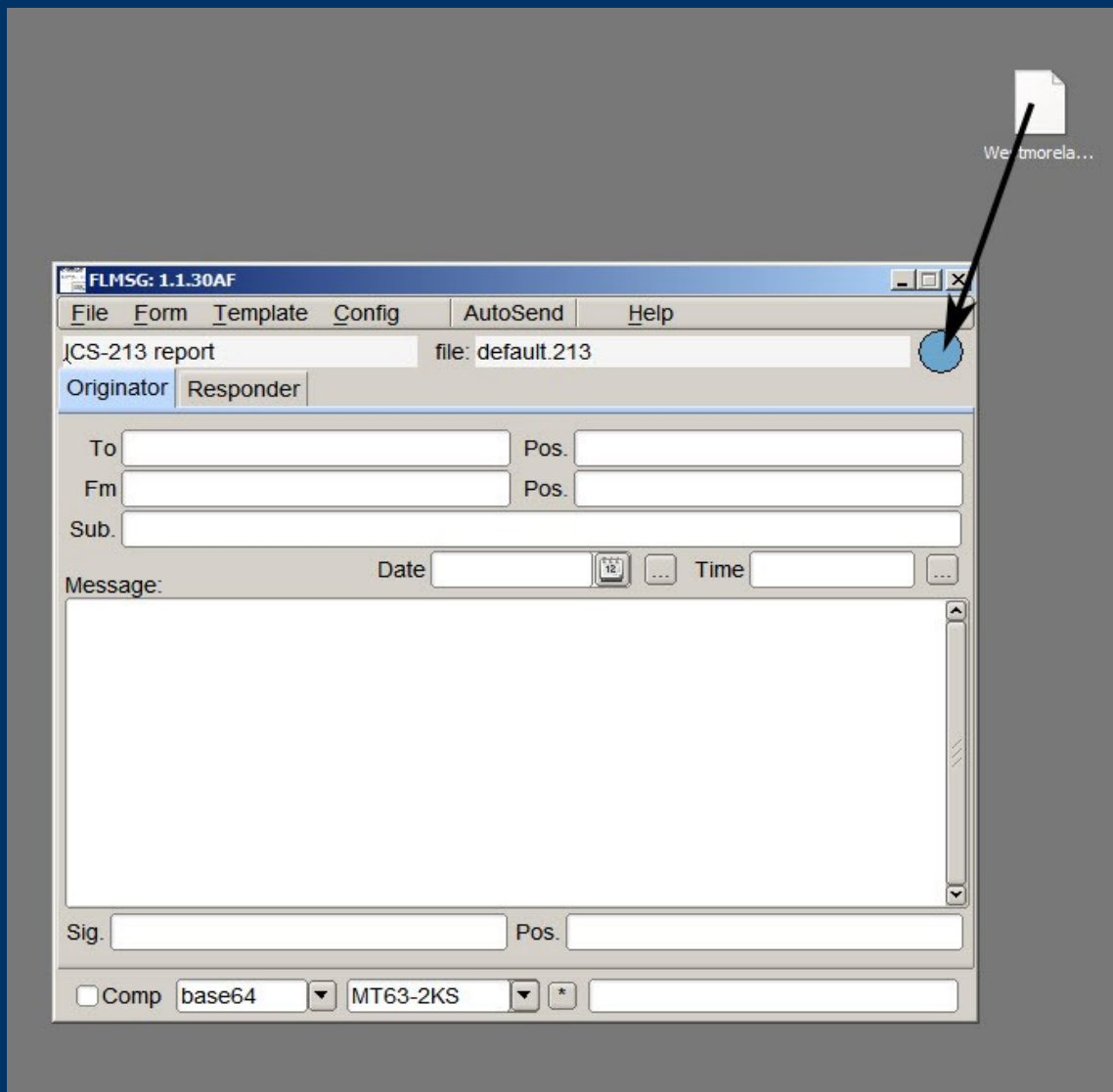
Next steps

- Our strength is the ability to turn fun amateur activities into powerful emcomm tools.
- So, download NBEMS, and make lots of contacts!
- If you're ready for your daily hamming, you're more prepared for emergency than you think.
- Be active, and on the day you're needed, you'll feel right at home.

Resources

- Western PA ARES Website: http://wpaares.org
- Docs available as well as membership sign up page
- wpaares-digital Yahoo group for WPA hams only
- NBEMSham Yahoo group
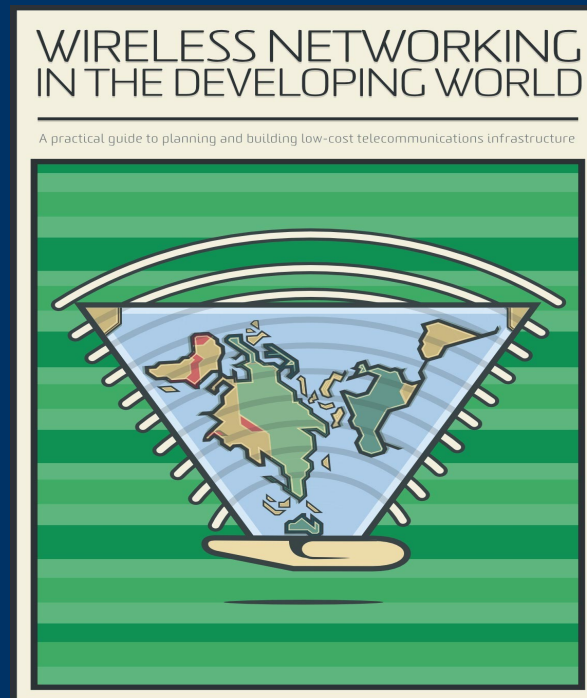- ARRL's Public Service Handbook
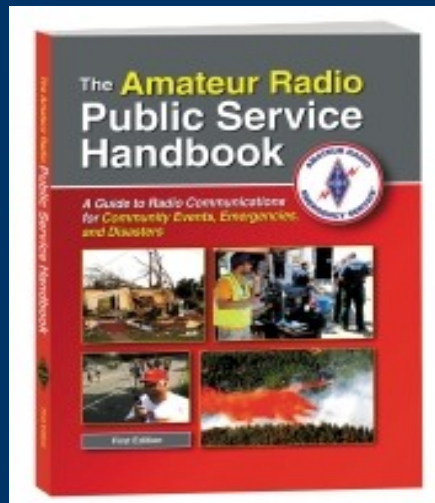
Resources

- W1HKJ (author of Fldigi)
  http://www.w1hkj.com
- MT63 Wikipedia page
  http://en.wikipedia.org/wiki/MT63
- Aug 2009 QST
- June 2010 QST
- Sept 2012 QST
- ARRL NBEMS Page
  http://www.arrl.org/nbems

References

- BBHN website
  http://broadband-hamnet.org
- Wireless Networking in the Developing World
  http://wndw.net
  Free book!

WIRELESS NETWORKING
IN THE DEVELOPING WORLD

A practical guide to planning and building low-cost telecommunications infrastructure

Acknowledgments

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- N3MSE, John Rodgers, Western PA SM
- AB3ER, Larry Keller, Former Western PA SEC
- N3SPW, John Szwarc, former Western PA SEC