

NBEMS Suite

- Narrow Band Emergency Messaging System
- A suite of programs including:
Fldigi, Flarq, Flwrap and now Flmsg
- Designed for sending digital information over amateur radio.

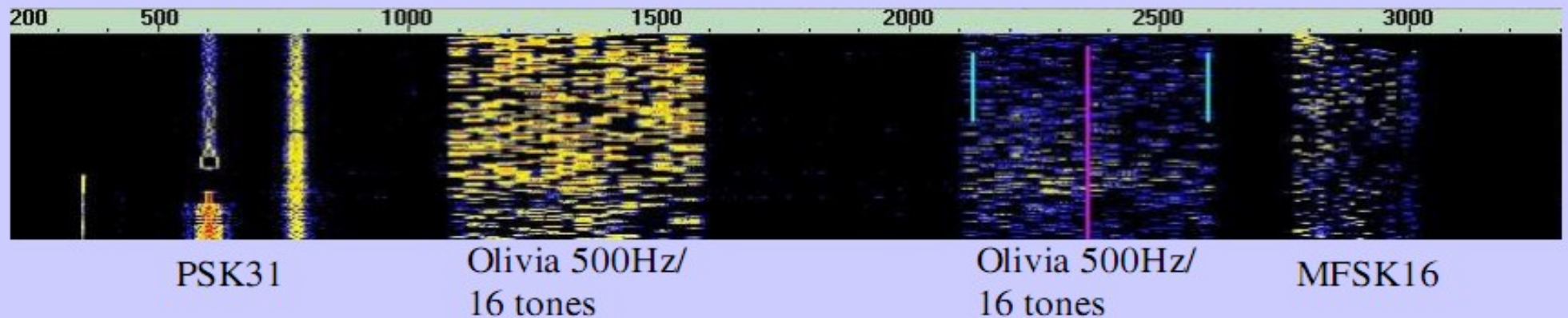
Install Fldigi - Flwrap - Flmsg

- Available for Windows, Mac and Linux
- CD – Handed out
- Pre-installed
- Wireless Download
 - NHARES Access point
 - <http://192.168.1.2>
 - Follow the nhares directory structure

NH-ARES Digital Primer

- What is "Digital Communications" in amateur radio?
- What is the best mode?
- How do you interface the radio and computer?
- What information can be sent over digital?
- What information should be sent over digital?
- HF vs. VHF/UHF
- Use on simplex or repeaters?

Advantages of Digital Modes:



- **Low Power - never need to run over 50 watts, 5 -30 watts is almost always sufficient**
- **Software is FREE**
- **Spectrum efficiency**
- **Great for reliable rag-chew**
- **Many modes - choose your mode depending on conditions**
- **Bottom of the solar cycle - works well, even under very poor conditions where phone QSO's would be impossible!**
- **Emergency Communications**
- **It's FUN**



Digital Communications:

- ANY information that can be digitized can be sent via a digital mode.
- Some data is just too big to reasonably send via sound card digital modes (Video, MP3, big pictures) etc.
- We will be focusing on smaller file types: text, spreadsheets in .csv format, small pictures.

Information that SHOULD be sent via digital:

- Any "sensitive" information such as phone numbers, names, etc.
- Specific directions / instructions.
- Long lists of information.
- Difficult to spell names.
- Prescriptions.
- Others?????

Information that SHOULD NOT be Sent via Digital Modes:

- Quick exchanges of simple information.
- Simple status updates.
- Station call-ups – basic Net operation.
- Others?

Digital Communications Using FLDIGI

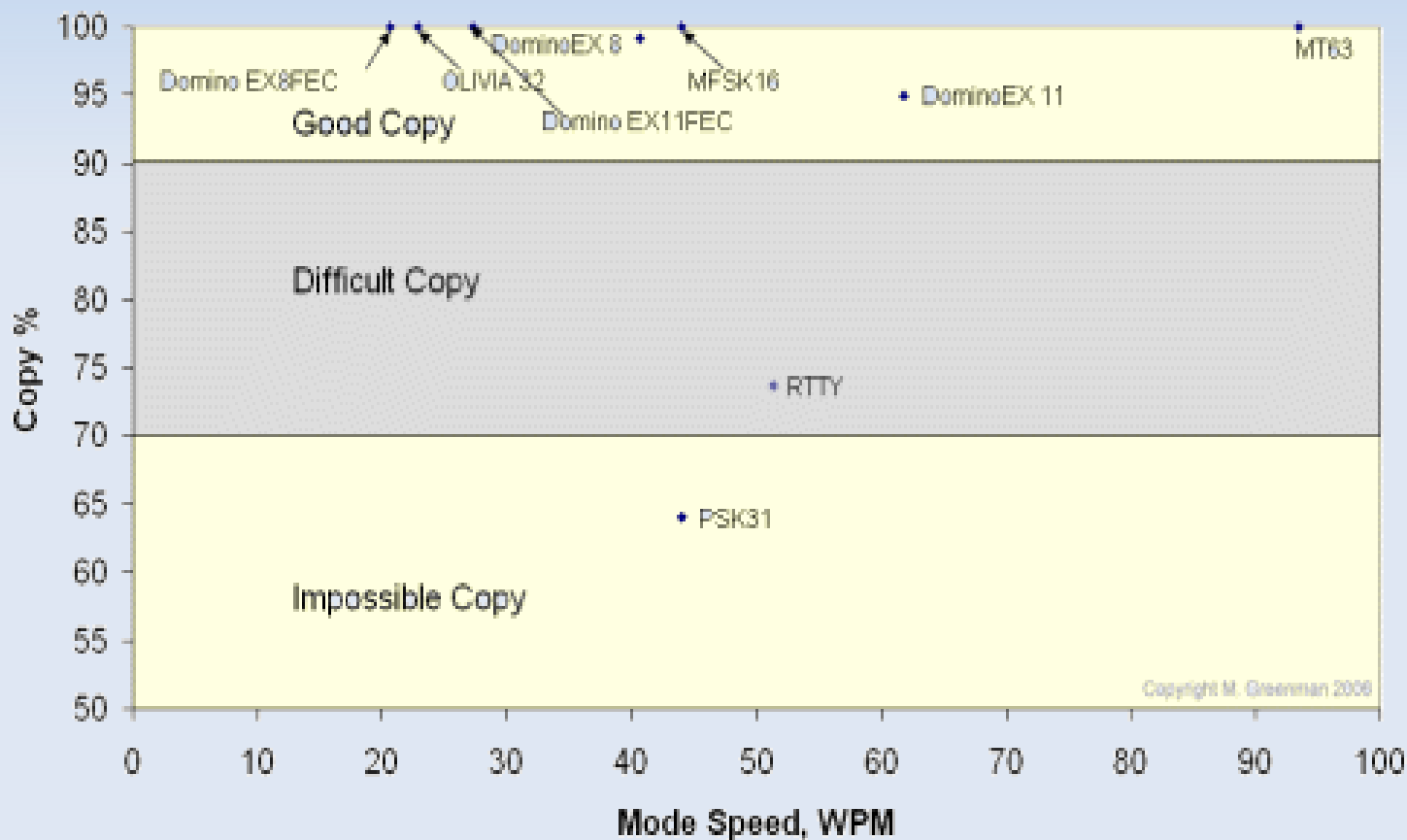
- What is fldigi??
- Available for Windows, Mac and Linux
- Can be used as a "live cd/USB" with the Puppy Linux version, Ubuntu and others

Sound Card Modes

- Which mode to choose?
- Contestia, DominoEX, Hell, MFSK, MT63, Olivia, Psk, RTTY, Thor, Throb
- There are many different variation of these modes:
- Example PSK31, PSK31R, PSK63, PSK125, PSK250, PSK500

Which Mode?

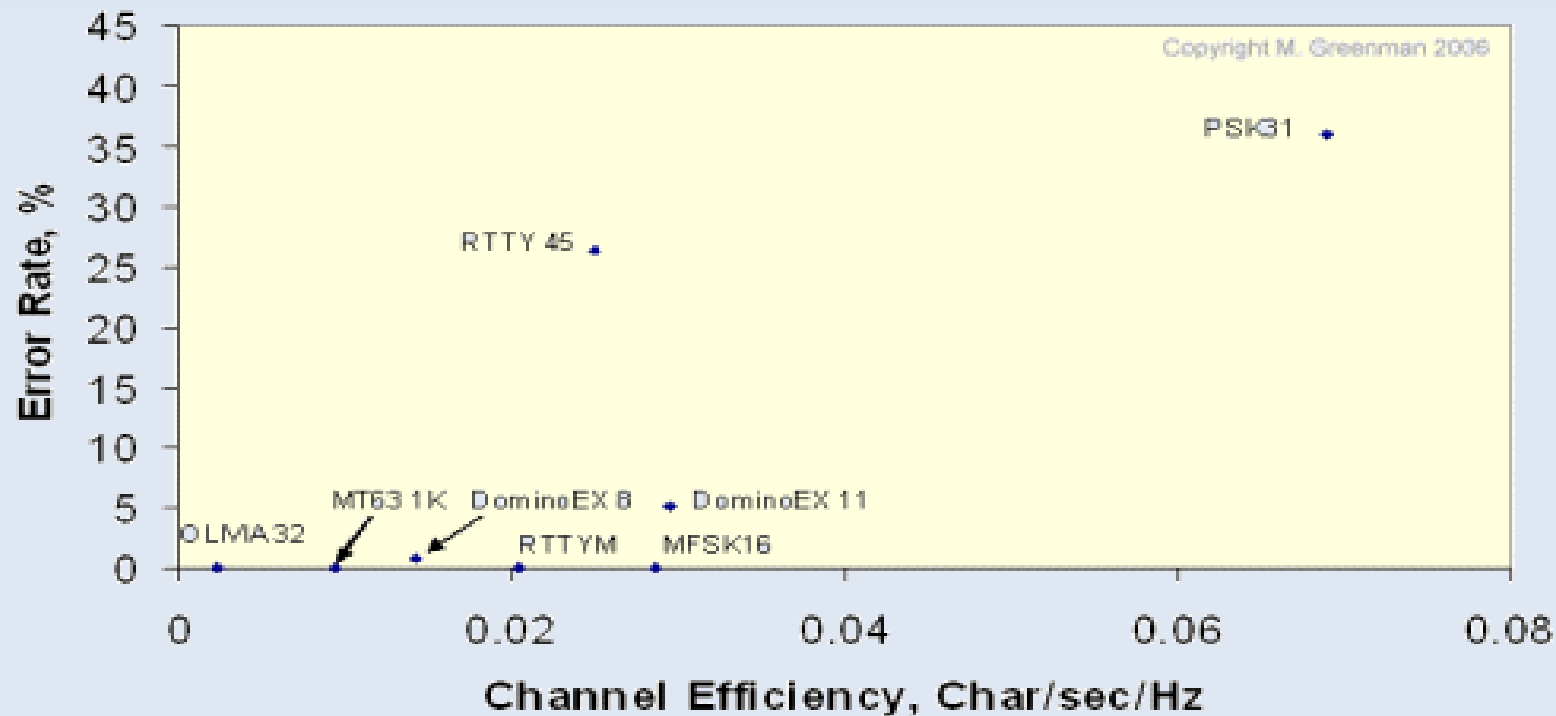
Error Rate vs Mode Speed
Mid-Latitude Disturbed NVIS 0dB S/N



Which Mode?

Mode Error Rate vs Channel Efficiency,

Mid-Latitude Disturbed NVIS 0dB S/N



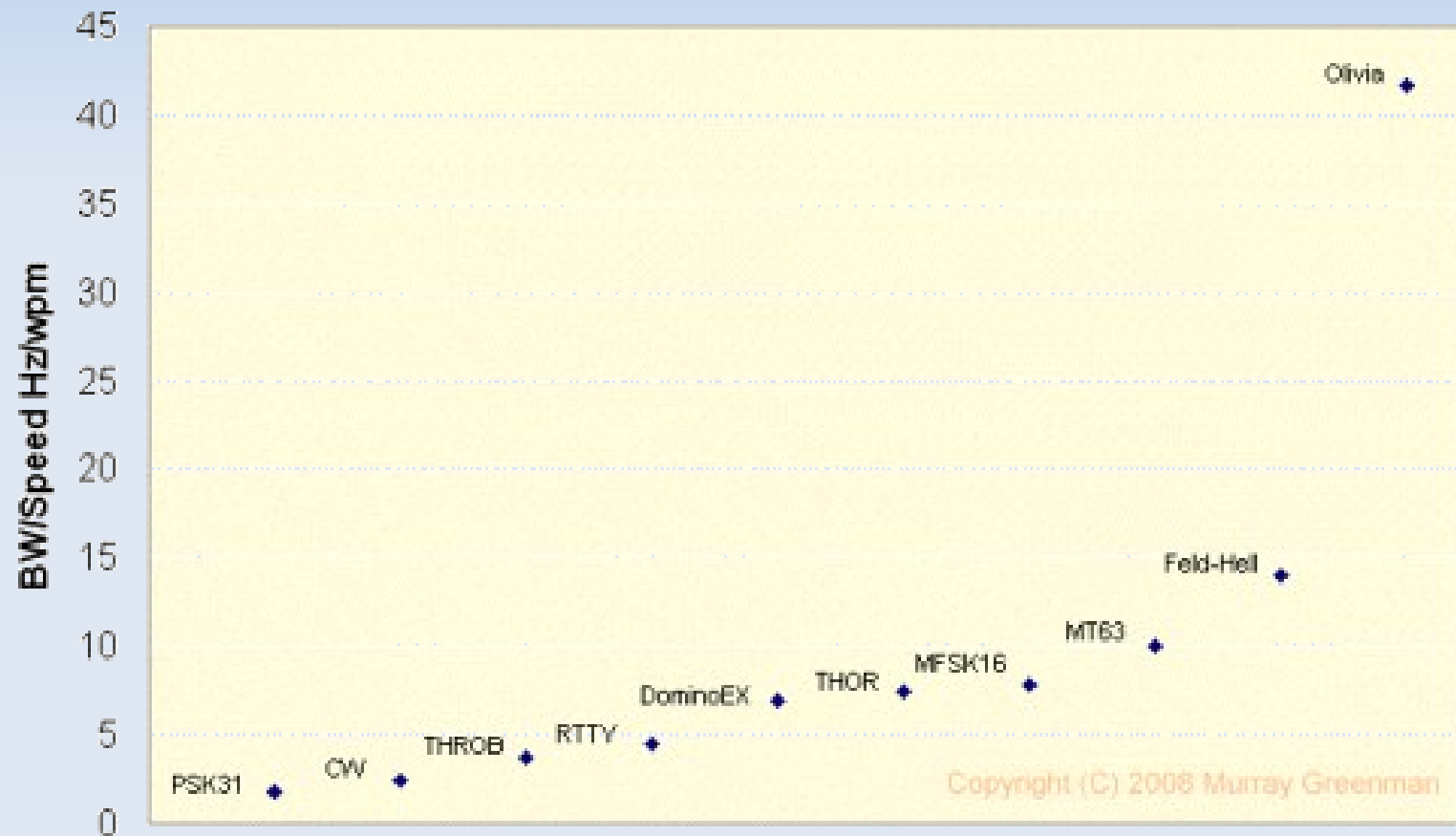
Which Mode?

Digital Mode Bandwidth Comparison



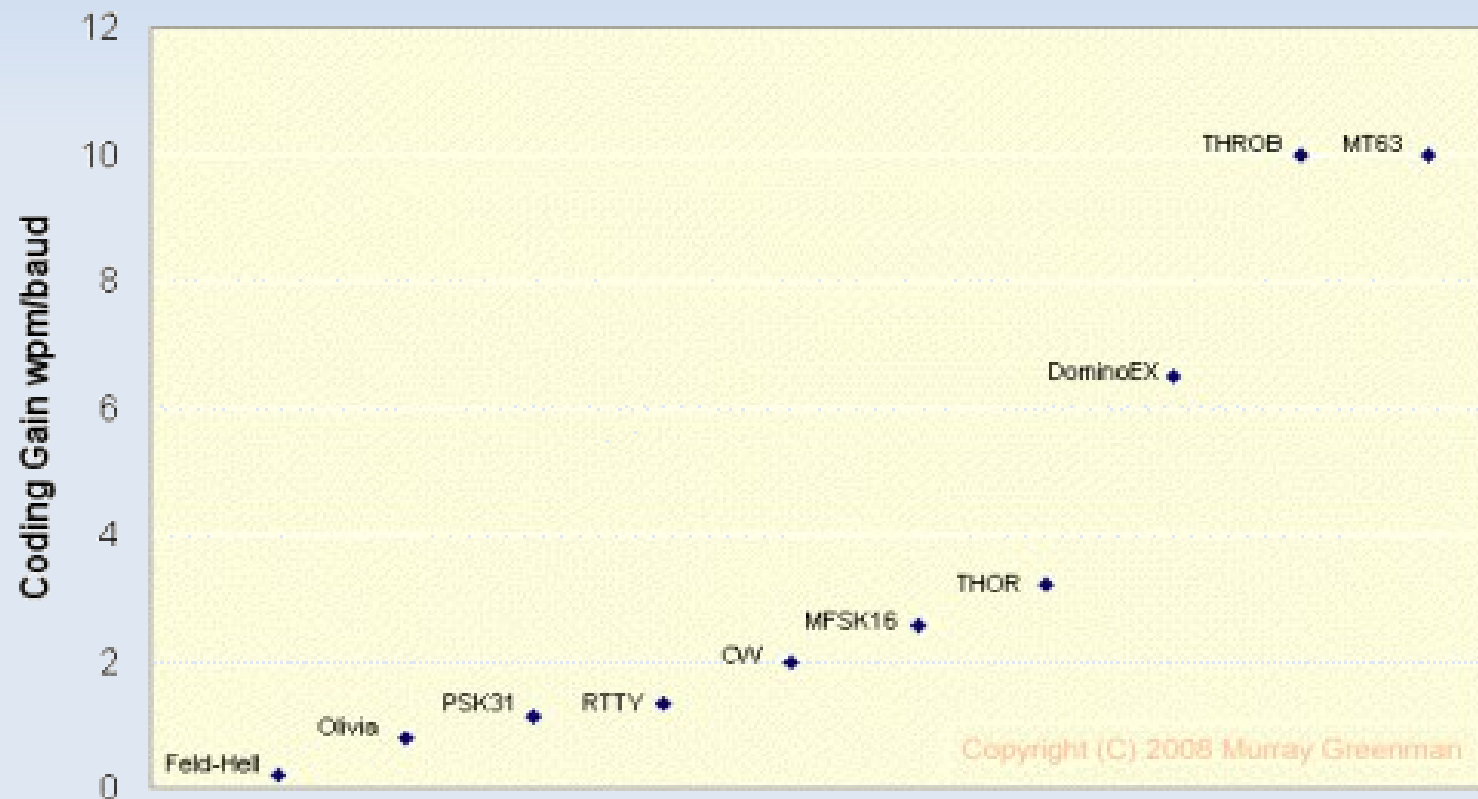
Which Mode?

Digital Mode Bandwidth Budget



Which Mode?

Digital Mode Coding Gain



NBEMS/flidigi - Available Modes

Name	WPM	BW	NBEMS Mode	flarq Compat	Error Corr.	Duty Cycle	Linear Path	Recommended for:				NOTES
								HF	VHF FM	VHF SSB	Weak Sgnl	
Contestia 4-250	40	250Hz			None	100%	X	X			X	Contestia is derived from Olivia, faster but not as robust
Contestia 8-250	30	250Hz			None	100%	X	X			X	Contestia is only upper case - not good for traffic handling
Contestia 4-500	78	500Hz			None	100%	X	X			X	
Contestia 8-500	60	500Hz			None	100%	X	X			X	
Contestia 16-500	30	500Hz			None	100%	X	X			X	
Contestia 8-1000	117	1kHz			None	100%	X	X			X	
Contestia 16-1000	78	1kHz			None	100%	X	X			X	
Contestia 32-1000	48	1kHz			None	100%	X	X			X	
Domino EX-4	29	170Hz			FEC1	100%		X				Domino modes work well with drifty radios
Domino EX-8	58	348Hz			FEC1	100%		X				Domino is an improved version of MFSK for HF
Domino EX-11	80	262Hz	X	X2	FEC1	100%		X			X	FEC only needed under worst conditions
Domino EX-16	115	360Hz		X2	FEC1	100%		X		X		
Domino EX-22	160	525Hz	X	X2	FEC1	100%		X		X		NBEMS recommended as MFSK alternative
Feld Hell	25	350Hz			None	22%	X	X			X	Hellschreiber uses facsimile technology
Slow Hell	2.8	40Hz			None	22%	X	X			X	
Feld Hell X5	125	1750Hz			None	22%	X	X				
Feld Hell X9	225	3150Hz			None	22%	X	X				
FSK Hell	25	490Hz			None	80%	X	X				
FSK Hell-105	25	210Hz			None	80%	X	X				
Hell 80	50	800Hz			None	100%	X	X				
MFSK-4	18	154		X	FEC	100%		X				Faster MFSK modes can handle picture files
MFSK-8	36	316		X	FEC	100%		X				MFSK modes require precise tuning and stability
MFSK-16	58	218	X	X	FEC	100%		X		X	X	NBEMS recommended for HF NVIS ops
MFSK-22	80	316		X	FEC	100%		X				
MFSK-31	55	330		X	FEC	100%		X				
MFSK-32	120	630	X	X	FEC	100%		X		X		NBEMS recommended for HF NVIS ops
MFSK-64	240	1260		X	FEC	100%		X	X			
MFSK images		316		X	FEC	100%		X				128x128 B/W in 16 seconds
MT63-500	50	500Hz		X	FEC	80%	X	X	X			
MT63-1000	100	1kHz		X	FEC	80%	X	X	X			
MT63-2000	200	2 kHz		X	FEC	80%	X	X	X			
OLIVIA 8/250	14.6	250Hz			FEC	100%	X	X				
OLIVIA 8/500	29.2	500Hz			FEC	100%	X	X				
OLIVIA 16/500	19.5	500Hz			FEC	100%	X	X			X	
OLIVIA 8/1000		1kHz			FEC	100%	X	X				
OLIVIA 32/1000	24.4	1kHz			FEC	100%	X	X				

Recommended for:

Name	WPM	BW	NBEMS Mode	flarq Compat	Error Corr.	Duty Cycle	Linear Path	Recommended for:				NOTES
								HF	VHF FM	VHF SSB	Weak Sgnl	
BPSK-31	50	62.5Hz		X	flarq	80%	X	X				
QPSK-31	50	62.5Hz		X	flarq	80%	X	X				FEC does poorly under burst noise conditions
BPSK-63	100	125Hz		X	flarq	80%	X	X				
QPSK-63	100	125Hz		X	flarq	80%	X	X		X		FEC does poorly under burst noise conditions
BPSK-125	200	250Hz	X	X	flarq	80%	X	X				
QPSK-125	200	250Hz		X	flarq	80%	X	X				FEC does poorly under burst noise conditions
BPSK-250	400	500Hz	X	X	flarq	80%	X	X				
QPSK-250	400	500Hz		X	flarq	80%	X	X				FEC does poorly under burst noise conditions
BPSK-500	800	1kHz		X	flarq	80%	X	X				
QPSK-500	800	1kHz		X	flarq	80%	X	X				FEC does poorly under burst noise conditions
PSK63FEC	55	125hZ		X	FEC	80%	X	X				
PSK125R	110	250hZ		X	FEC	80%	X	X				FEC plus interleaving
PSK250R	220	500hZ		X	FEC	80%	X	X				FEC plus interleaving
PSK500R	440	1kHz		X	FEC	80%	X	X				FEC plus interleaving
RTTY 45	60	270Hz			None	100%		X				US standard
RTTY 50	66	270Hz			None	100%		X				European standard
RTTY 70	100	370Hz			None	100%		X				
THOR 4	14	173Hz		X	FEC	100%		X		X		Thor is good for noisy conditions, but slow
THOR 5	22	244Hz		X	FEC	100%		X		X		
THOR 8	28	346Hz		X	FEC	100%		X		X		
THOR 11	40	262Hz		X	FEC	100%		X				
THOR 16	58	355Hz		X	FEC	100%		X				
THOR 22	78	524Hz		X	FEC	100%		X				
THROB 1	10	72Hz			None			X		X		THROB is very slow, good for very poor conditions
THROB 2	20	72Hz			None			X		X		THROB is very difficult to tune
THROB 4	40	144Hz			None			X		X		
THROB X1	10	94Hz			None			X		X		
THROB X2	20	94Hz			None			X		X		
THROB X4	40	188Hz			None			X		X		

Notes:

- 1 Switchable FEC
- 2 Do not use with FEC

NBEMS modes

Author's Note: Much of the information contained in this chart came from the fldigi online help pages. The rest was found on a number of different web sites and its accuracy isn't known.

Old School Digital Operating

- Required a sound card interface.
- You have to all be on the agreed upon mode.
- A lot of modes to choose from.
- Very tough to tune in to modes.
- No guarantee of 100% copy of sent message.
- Easy for many stations to try to communicate at the same time – interfering with each other.
- Many more issues.

Enter NBEMS :

Fldigi has added some very useful features:

- RSID
- TXID
- RXID
- Notifications
- Some add on programs with more to follow:
- Flarq, flwrap, pskmail, flrig, fllog

• MT63 2k Long - Local FM Comms

- - Can be used very effectively without a sound card interface (audio coupling)
- - Extremely effective under poor RF conditions
- - Extremely accurate decoding (major duplication of data and forward error corrected)
- - Very forgiving on sound card tuning and calibration when used on FM
- - Excellent for sending larger situation reports or databases

FLDIGI:

The screenshot displays the FLDIGI software interface. At the top, the menu bar includes File, Op Mode, Configure, View, and Help. Below the menu bar, there are several status indicators: Spot, RxID, TxID, and TUNE. The main interface is divided into several sections:

- QSO Log:** A table with columns for Enter Xcvr Freq, QSO Freq, On, Off, Call, Name, In, Out, and Notes. The first entry shows a frequency of 14070.000, QSO Freq of 14070.421, and an Off time of 1842.
- Message Window:** A large yellow area containing the text:
iCQ s
CQ DE @e ILC RZ3i C RZ3Lr
CQ 2Q CQ Dm Rprg
p
- Waterfall Display:** A blue area showing a frequency spectrum. The x-axis is labeled with 500, 1000, 1500, 2000, and 2500. A red vertical line is positioned at approximately 14070.421 kHz.
- Control Panel:** A bottom section with various controls and buttons. It includes buttons for CQ, ANS, QSO, KN, SK, Me/Qth, Brag, ICS-213, T/R, Tx, Rx, and TX. Below these are buttons for WF, -20, 70, x1, NORM, 421, QSY, Store, Lk, Rv, and T/R. At the very bottom, there are fields for BPSK31, s/n 5 dB, imd -30 dB, and checkboxes for AFC and SQL.

Fldigi Basics:

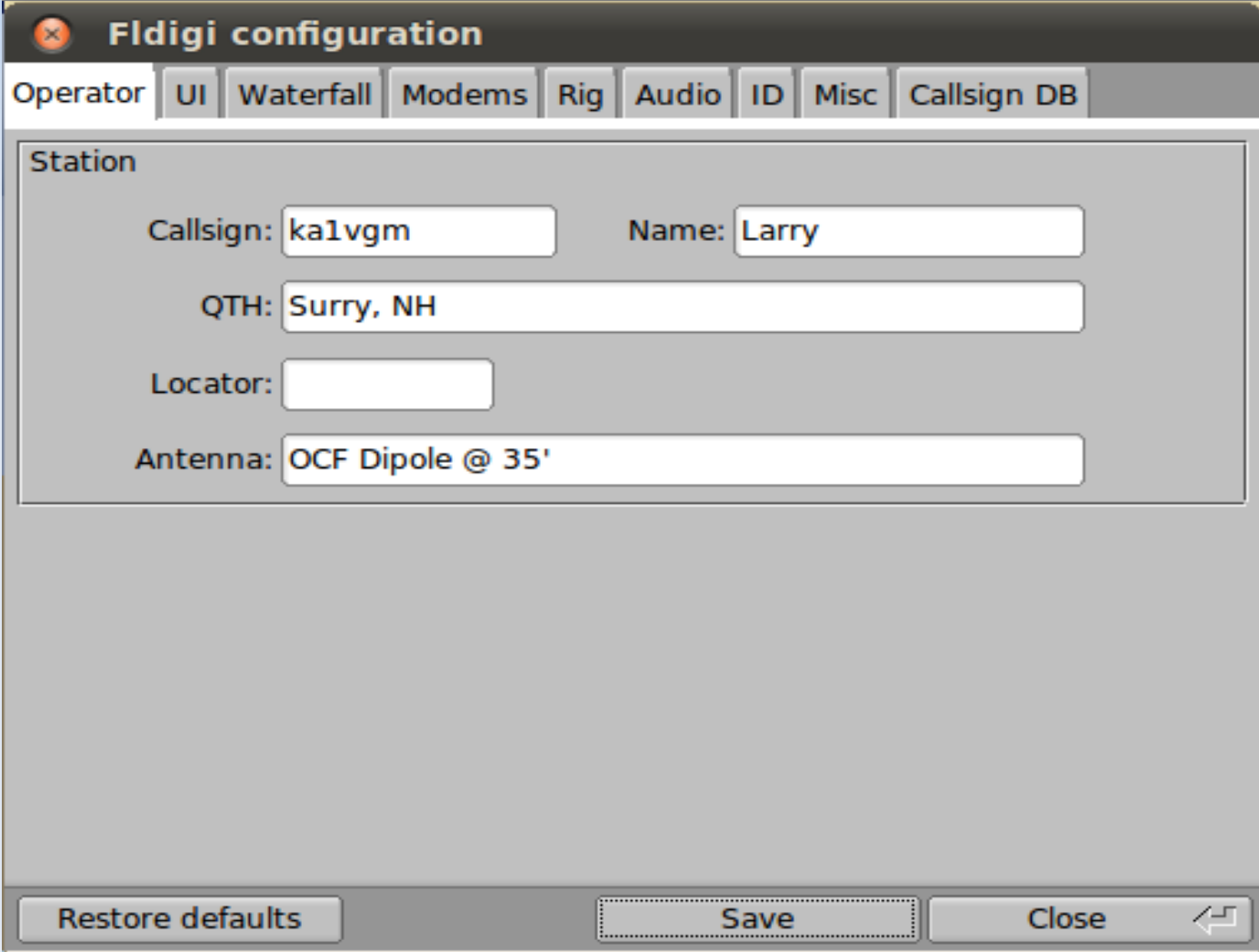
- Fldigi is a sound card digital mode software.
- It takes computer data and converts it to audio out of the sound card.
- It also take sound it receives and converts it back to data.
- It requires a CPU of ~500MHz (min) but works much better with a CPU over 1GHz.

Fldigi Basics

- Fldigi has many options and features.
- We will not even begin to touch on all of them today.
- Our focus will be to configure Fldigi for NHARES digital use over HF and VHF/UHF frequencies.
- We will focus on acoustic sound card coupling for this instruction.

Fldigi – Configuration

- From the "Configure" menu – choose "Operator"



The screenshot shows the "Fldigi configuration" dialog box with the "Operator" tab selected. The "Station" section contains the following fields:

Field	Value
Callsign	ka1vgm
Name	Larry
QTH	Surry, NH
Locator	
Antenna	OCF Dipole @ 35'


At the bottom of the dialog, there are three buttons: "Restore defaults", "Save", and "Close".

Monitor Transmitted Signal


Operator | UI | **Waterfall** | Modems | Rig | Audio | ID | Misc | Callsign DB

Display | FFT Processing | Mouse

Colors and cursors
default.pal






Load...



Save...

Bandwidth cursor Cursor center line Bandwidth tracks

 Cursor color  Center line color  Tracks color

Frequency scale

Always show audio frequencies Font...

Transmit signal

Monitor transmitted signal 0.50 Signal level

Restore defaults Save Close

RSID Settings

Fldigi configuration

Operator | UI | Waterfall | Modems | Rig | Audio | **ID** | Misc | Callsign DB

Video Preamble ID

Transmit mode ID Video ID modes

Transmit video text : 500 Hz limit

Use small font Chars/Row: Mode width limit

CW Postamble ID

Transmit callsign Speed (WPM): CW ID modes

Reed-Solomon ID (Rx)

Receive modes

Detector searches entire passband

Mark previous frequency and mode

Reception disables detector

Notifications only

Squelch open (sec)

Reed-Solomon ID (Tx)

Transmit modes

Restore defaults Save Close

Basic Acoustical Coupling

- Place your computer microphone about 3-12 inches away from radio speaker.
- Turn up volume on radio to a comfortable listening level.
- Turn up computer speakers to a comfortable listening level.
- When transmitting, place radio microphone about 3-6 inches away from the radio speaker.

Acoustic Coupling

- It is very important to key up the microphone at least $\frac{1}{2}$ -1 full second before hitting the TX button
- A better solution is to re-program another macro button to pause for 1 second before starting TX.
- This allows for the transmitter to reach full power and the noise from you hand keying the microphone to diminish.

Going Beyond Acoustic Coupling

- If the room is too noisy or you can afford it, please use a sound card interface.
- You can build your own for ~ \$12.00
- This will make for a much cleaner signal that can be fine tuned.

Keyboard to Keyboard Chatting:

- Push the TX button on the screen (or it's keyboard equal) to start transmitting.
- Type the text you want to send and then push the RX button to switch to receive.
- Don't forget to add your callsign to the end of your transmission.

Sending "Canned" Messages

- This is where we can "shine".
- Have a message already composed and ready to go.
- Paste it into the transmit buffer.
- Add your call sign to the end.
- Push TX and then RX
- Watch it go!!

Sending Image Files

- Some digital modes are already designed for sending pictures.
- MFSK is one such mode.
- Be careful of the file size though.
- It has to transmit in under 10 minutes or you violate FCC rules!!
- You must ID at the end of the transmission and every 10 minutes.

Sending Spreadsheets

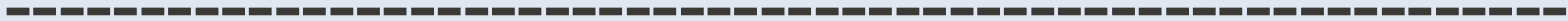
- Convert the spreadsheet to .CSV format
- Add to the transmit buffer.
- Add your call sign to the end.
- Hit the TX and then the RX button.
- Be aware of the 10 minute rule!

Sending Other/Binary Files

- Sending other format and binary files requires a bit of conversion first.
- You need to convert the file to "Base64" format before sending it.
- This makes the file a "text" file.
- Paste it to the transmit buffer and send like a text file.

What is Missing.

- Does anyone know what is missing from the previous examples of sent messages/files?



- Error Correction!!!
- How do you verify that the message/file was received exactly as it was sent.

Error Correction - flarq

- Flarq – which ships with Fldigi is an "Automatic Repeat Request/Query" or ARQ program.
- This adds a layer of error correction to Fldigi
- This allows a message to be received exactly as it was sent.
- The receiving program automatically requests the transmitting program to re-send any data that was corrupt.

Flarq's Failings

- Flarq is great if all you have to do is send a message or file to one other station.
- Since it uses a "connected mode" of transmission you can only send to one station at a time.
- It adds some overhead to each transmission in the way of a checksum.
- This can be slower than voice for sending to multiple stations!
- You must have a sound card interface with TX control to use Flarq!

Flwrap to the Rescue!

- Flwrap take the entire file and "wraps" it with a checksum.
- You can then send this out to as many stations as you want.
- Once they receive it, they "un-wrap" the file to verify they received it 100% error free.
- If anyone needs it to be re-sent, the entire file has to be re-sent.

Sending Messages in ARES

- From the previous descriptions – you should be able to figure out the best method for error correction for general ARES use.
- Flwrap makes the most sense when sending a small to medium sized message to multiple recipients.
- Flwrap can be used with "acoustic coupling" - this means you don't need a sound card interface with TX control to use it.

Flmsg

- A program designed to make it easy to pass messages over digital.
- Works with Flwrap and Fldigi.
- Currently supports: ICS-213 and ARRL Radiogram.

Fmsg - ICS-213

FLMSG: 1.0.3 — □ ×

File Template Config Help filename: MedEm_001.f2s

ICS213 | Radiogram

Originator | Responder

To: Pos.

Fm: Pos.

Sub.

Date ... Time ...

Message:

1. # injured 4 at O'Hara Township
2. # casualties 2 & "4" unknown
3. # displaced 30
4. Available doctors 1
5. Available nurses 2
6. Request:
a. shelter 30
b. morgue transport 2
c. ambulance transport 4, from Hazel Green UMC to City Hosp.

Sig. Pos.

Flmsg – ARRL Radiogram

FLMSG: 1.0.3 filename: rg0001.m2s

File Template Config Help

ICS213 Radiogram

Message Records

SVC *NR 1 *PREC ROUTINE HX_ HXA50 HXG hx *STN ORIG KOTER CK 15 ck

PLACE OF ORIG COLO SPRINGS CO TIME FILED 0408Z *MON DY MAR 27

*TO
K0HBZ
WES WILSON
765 COUNTY ROAD
WOODLAND PARK CO 80963

TEL: 719 687 8758

OP NOTE: NBR 1

ARL MSG

TXT:
HI WES X THIS IS
AN EXAMPLE OF AN ARRL
FORMATTED RADIOGRAM X 3R14159 73

SIG: DAVE W1HKJ OP NOTE: NBR 2

Fmsg - Configure

fmsg configure [-] [X]

Date <input checked="" type="radio"/> YYYY-DD-MM <input type="radio"/> MM/DD/YY <input type="radio"/> DD/MM/YY	Radiogram format Call: <input type="text" value="W1HKJ"/> Tel: <input type="text" value="25828-3105"/> Name: <input type="text" value="Dave Freese"/> Addr: <input type="text" value="106 Whitfield Dr"/> City/St/Zip: <input type="text" value="Toney, AL 35773"/> <input type="text" value="4"/> <input type="button" value="↑"/> <input type="button" value="↓"/> message words/line	Naming Files <input type="checkbox"/> Callsign <input checked="" type="checkbox"/> Date-time <input type="checkbox"/> Serial # Next # <input type="text" value="2"/>
Time <input type="radio"/> hhmmL <input type="radio"/> hh:mmL <input checked="" type="radio"/> hhmmZ <input type="radio"/> hh:mmZ <input type="radio"/> hhmm UTC <input type="radio"/> hh:mm UTC	Wrap <input type="checkbox"/> Use compression	<input type="button" value="close"/>

Acoustic Coupling-Audio Levels

- When using acoustic coupling, there are some modes that work better than others.
- Sound card levels are also fairly important.
- Microphones should be adjusted for a desired distance away from speaker preference.
- It is best to experiment **BEFORE** you need to use fldigi in an actual event!

HF Operation

- Longer Distances?!
- Lower power?!
- More Frequencies?!
- Less Bandwidth?!

VHF/UHF Operation

- More operators!
- Less frequencies?!
- Simplex vs. Repeaters.
- FM takes a preset bandwidth vs. SSB
- Repeaters – infrastructure already in place.
- Flarq vs. flwrap on repeaters.

How about VHF/UHF

- We will use FM for our communications on VHF/UHF.
- FM is the most available mode for all Amateurs on these bands.
- We have a pretty wide signal using FM.
~2.8kHz
- PSK31 and all of the narrower modes "might" be considered a waste of bandwidth.
- Why not use all of the bandwidth to the maximum?

Sound Card Interface

- You can buy a pre-made sound card interface from ~\$40-\$200.
- You can make your own for about \$12-\$30
 - An Opto-isolator or reed relay
 - 2 transformers
 - a couple of diodes and resistors
 - some wire, solder, a pc board, some connectors and an enclosure

Simple Sound Card Circuit

PSK Interface

