CCARC - BPRA
Ham Basics 2010

Welcome!

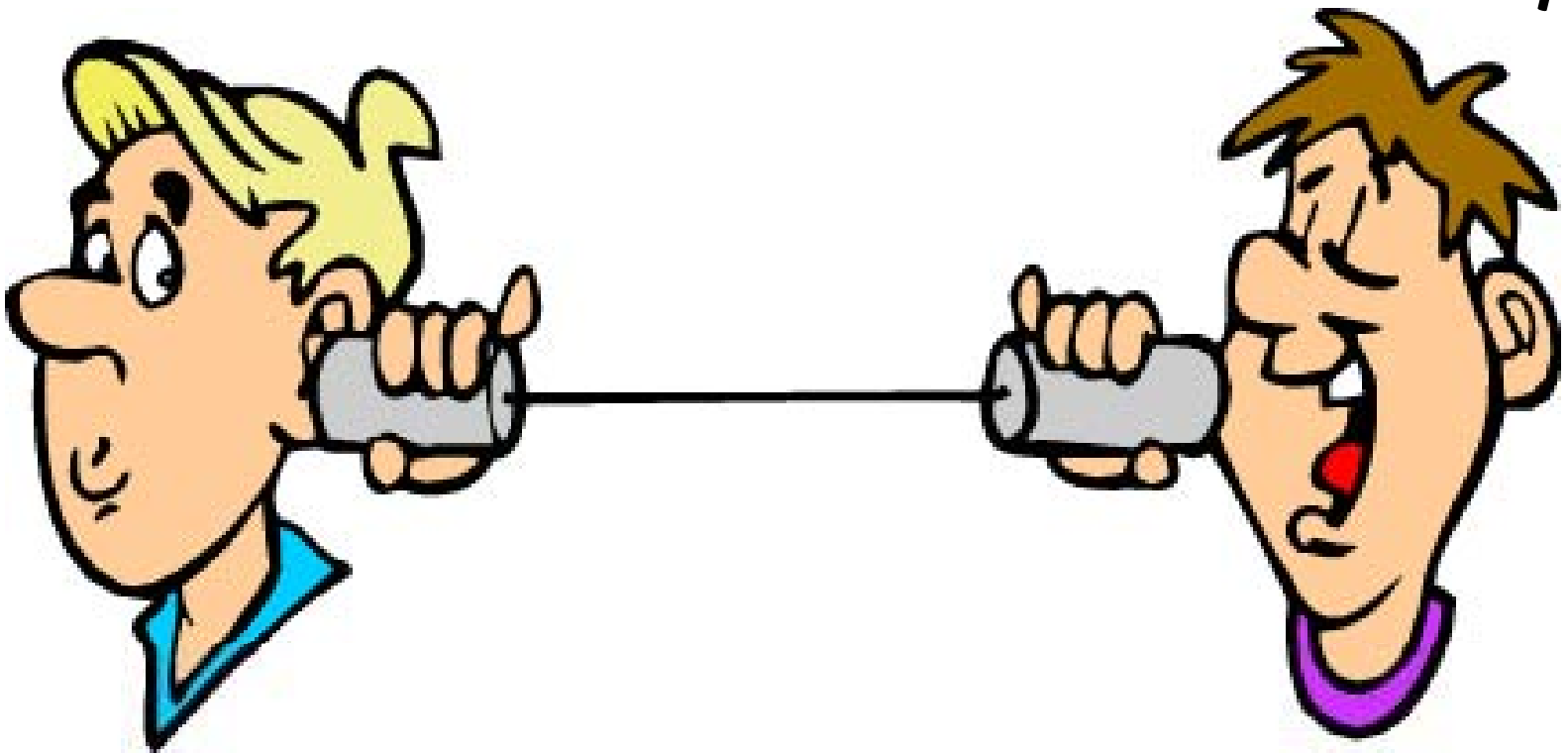
Digital Communications

"AMATEUR RADIO IS THE HOBBY…

EMERGENCY COMMUNICATIONS IS A COMMITMENT…"

What is digital messaging?

How do we do it?



Subjects to cover

- Amateur Radio Digital Mode History
- Two Basic Digital Technologies
- TNC Technology, Modes & Software
- Soundcard Technology, Modes & Software
- Accuracy
- Making the connection without wires
- Making the connection with wires
- Digital Messaging Systems
- Making the “over-the-air” connection with radio

Amateur Radio Digital Mode History

- The '**Original Digital**' mode
  - Presence or absence of carrier (1, 0, 1, 0, 1, etc.)
  - **CW**!

Amateur Radio Digital Mode History

- Started as Mechanical Hardware Specific
  - 1849 Landline based teleprinter operations began
  - 1920 Rudolf Hell invented Hellschreiber
  - 1930's RTTY (**R**adio **T**ele**TY**pe) [Military RATT/SCRT]
- 1980's started computerizing the RTTY signals
- Prior to 1995 the only 'legal' HF digital mode that was authorized by the FCC were those that used the standard Baudot codes; e.g. RTTY

Amateur Radio Digital Mode History

- In 1995, the FCC opened to door to other modes (ASCII based) and declared that any new mode coding were legal as long as they were published in the public domain.

- And the “Barn Door” opened!

Amateur Radio Digital Modes

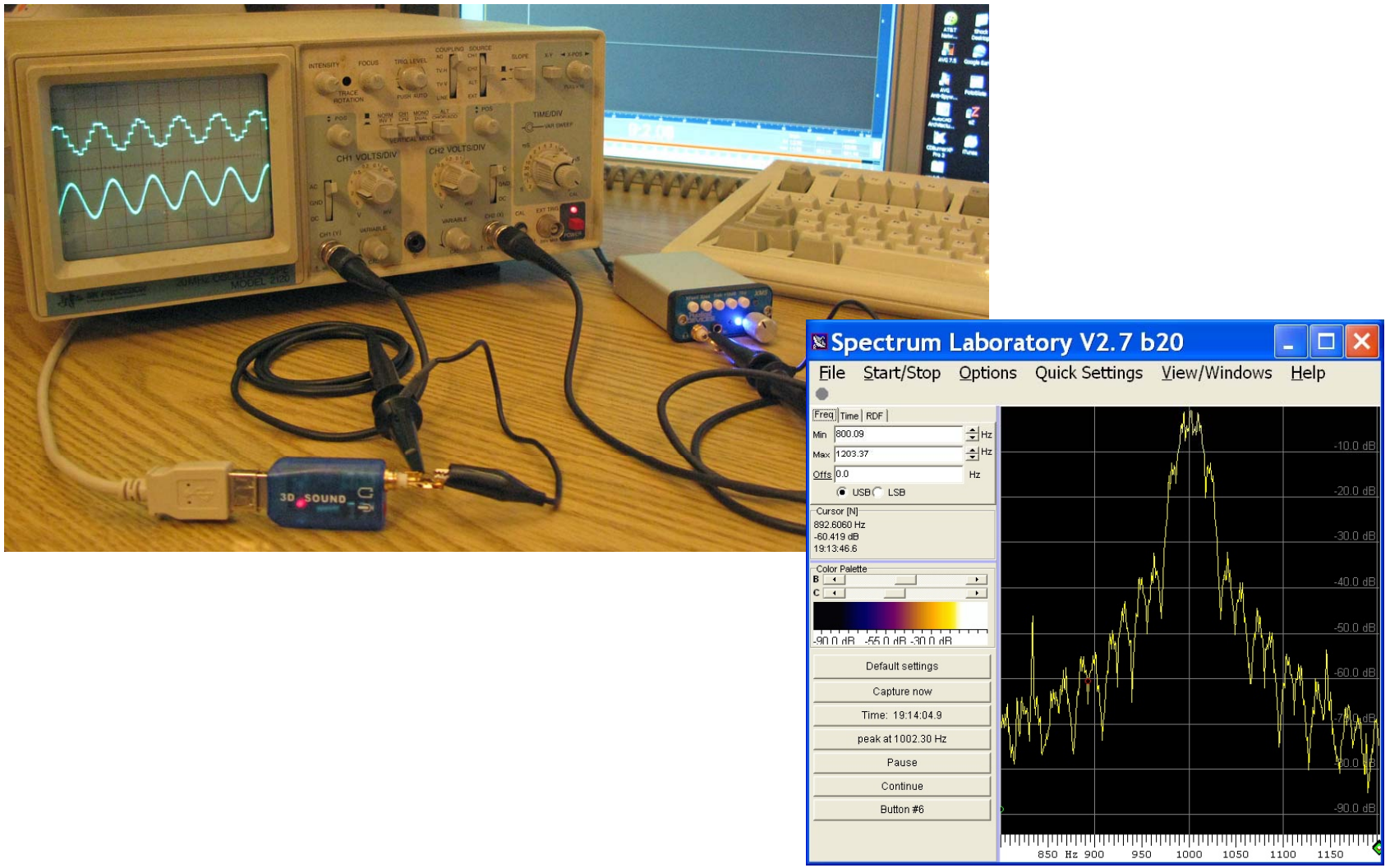
Mode	Year	Author
AMTOR	1983	G3PLX
APRS		
ASCII		
BAUDOT		
BPSK31/63/125		
CHIP 64/128		
CLOVER	1993	HAL Corp
CLOVER 2000		
CONTESTIA		
CW (Morse)		
CW CCW (OOK-FSK)		
DIGISSTV		
DOMINO	2004	VK2ZTO
DOMINOF/EX		
FAX		
FSK31		
FSK441		
G-TOR		Kantronics
HELLSCHREIBER	1920's	Rudolf Hell
C/MT HELL		
DUPLO HELL		IZ8BLY
FELD HELL		
FM HELL 105/245		
FSK HELL		
GL HELL		
HELL 80		
PC HELL		
PSK HELL 105/245	1999	ZL1BPU & IZ8BLY
S/MT HELL		
HF FAX		
HF DIGITAL RADIO MONDIALE		
JT44		

Mode	Year	Author
MFSK16/8		ZL1BPU & IZ8BLY
PICCOLO		
COQUELET		
MT63 (all sub-modes)		SP9VRC
NAVTEX		
OLIVIA		
PACKET, HF	Early 70's	
PACTOR I	1991	DL6MDA & DF4KV
PACTOR II	Mid 90'S	
PACTOR III	2002	
PACTOR 4	On the way!	
PAKAM10		
PAX		
PAX2		
PSK10		
PSK31	1999	G3PLX
PSK63F/125F/220F	2003	
Q15X25		
QPSK31/63/125		
RTTY		
RTTY 50+SUNOP		
RTTYM		
SITOR A		
SLOW FELD		
SSTV		
TDM		
THROB		G3PTT
THROBX		
WEFAX		
WINMOR		

Two Basic Digital Technologies

- Objective is “Tones-to-Digits-to-Tones”
- Terminal Node Controller (Hardware based)
  - External ‘smart box’ converter for digits-to-tones-to-digits
  - Not inexpensive
- Soundcard (Software based)
  - External or Internal PC microprocessor converter for digits-to-tones-to-digits

Digits-to-Tones-to-Digits



TNC Technology

- TNC (Terminal Node Controller)
  - Typically external to PC
  - Many mfg's (SCS, Kantronics, Timewave/AEA, etc.)
  - Some have Digital Signal Processing (DSP) built-in

TNC Modes

- PACTOR I, II, III
- AMTOR
- RTTY
- PSK31
- CW
- PACKET (HF & U/VHF
- NAVTEX
- TDM

TNC Software

Generic

- Alpha
- PCPakRatt
- Airmail
  - PACKET/PACTOR
- Paclink
  - PACKET/PACTOR
- RMS Express
  - PACKET/PACTOR

SCS Specific

- NCWinPTC
- NCWinPTC Term
- EzTransfer
- SCS Mail

External TNC Devices

Soundcard Technology

- Soundcard
  - Internal to PC
  - External to PC (Tigertronics, WMR, etc.)

Some Acronyms Defined

- AFSK – *Audio Frequency Shift Keying*
- BPSK - *Binary Phase Shift Keying*
- FSK – *Frequency shift Keying*
- MPSK - *Multiple Phase Shift Keying*
- QPSK - *Quadrature Phase Shift Keying*

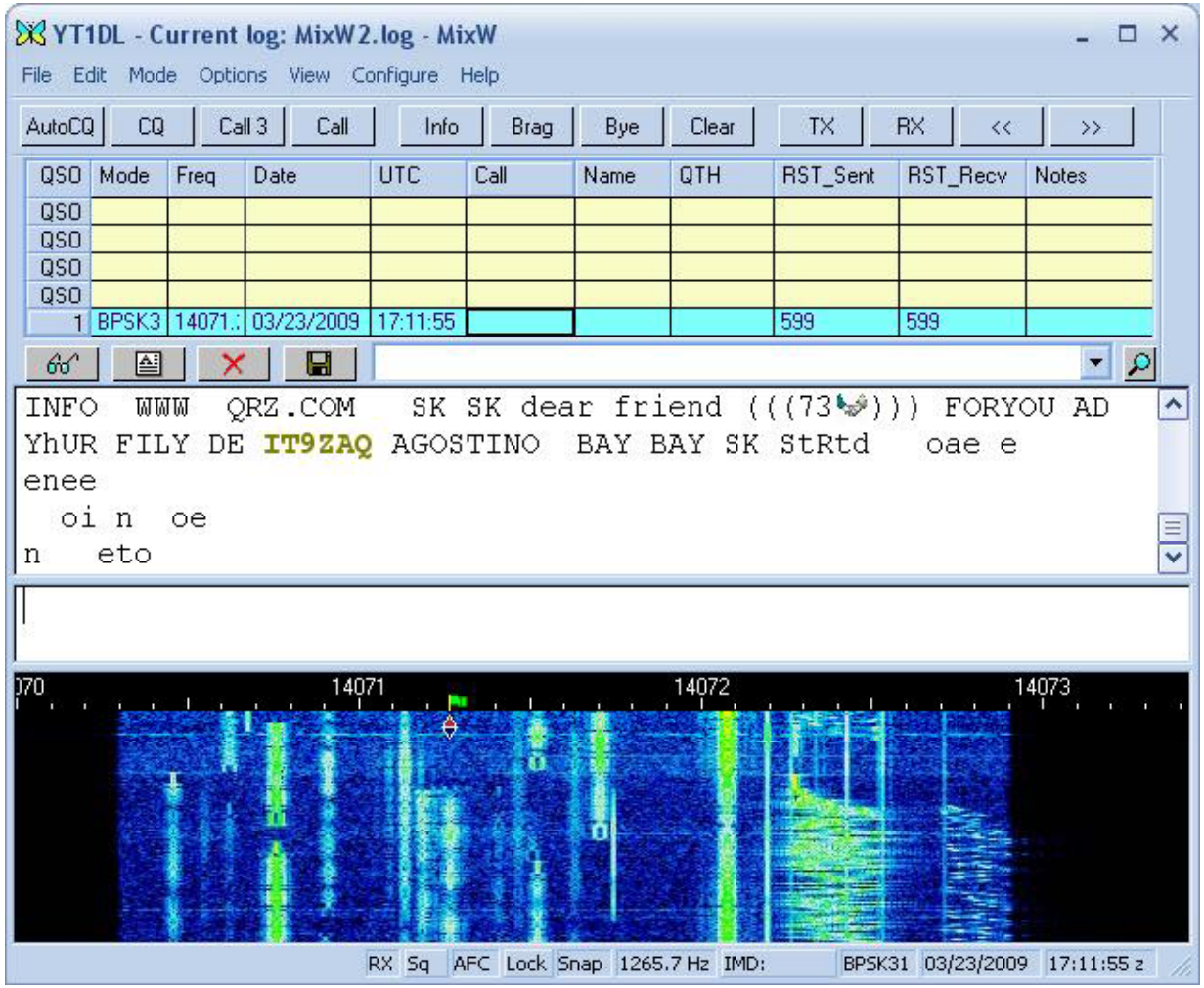
Soundcard Modes

- BPSK 31/63/125
- QPSK 10/31/50
- MPSK
- PACKET
- CCW
- PACTOR 1
- AMTOR FEC
- RTTY
- MFSK 8/16
- OLIVIA
- THROB
- Domino
- PAX
- ALE
- COQUELET
- Hellschreiber
- SSTV
- MT-63
- CHIP
- APRS
- Contestia
- HF FAX
- WIMOR

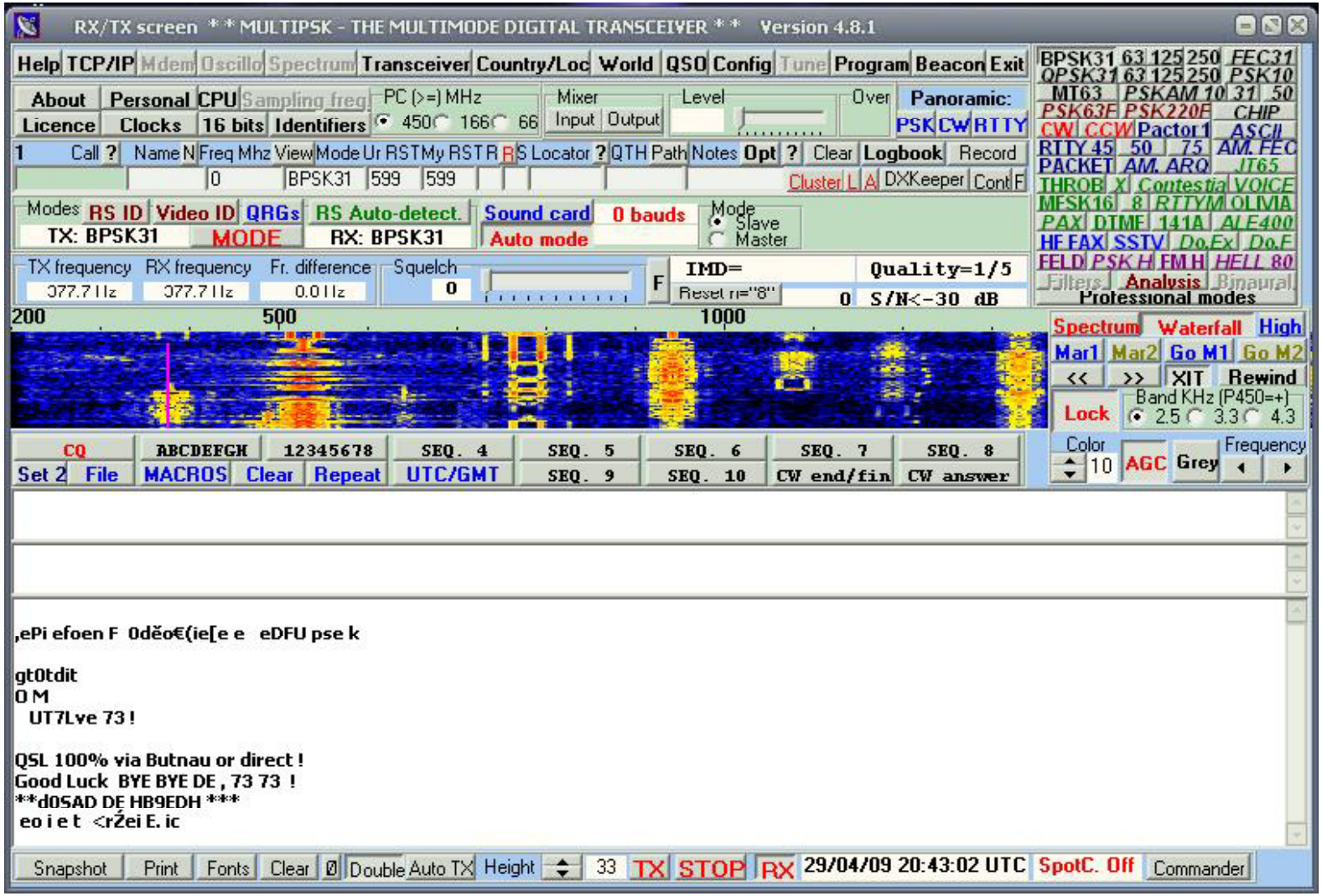
Soundcard Software

- Cwtype
- DIGIPAN
- DigTRX
- Feld Hell
- FTV
- Hamscope
- JVComm32
- MixW
- MMSSTV
- MMRTTY
- MT63
- MultiPSK
- NBF
- PacLink
- Paxon
- PcPakratt
- RDFT
- RMS Express
- Sally
- SCAMP
- SlowFel
- SlowFeld
- Stream
- Throb
- TrueTTY
- W1SQLPSK
- WinDRM
- WinPack
- WinPSKse
- WSJT

MixW


YT1DL - Current log: MixW2.log - MixW
File Edit Mode Options View Configure Help
AutoCQ CQ Call 3 Call Info Brag Bye Clear TX RX << >>
QSO Mode Freq Date UTC Call Name QTH RST_Sent RST_Recv Notes
1 BPSK3 14071.: 03/23/2009 17:11:55 599 599
INFO WWW QRZ.COM SK SK dear friend (((73))) FORYOU AD
YhUR FILY DE IT9ZAQ AGOSTINO BAY BAY SK StRtd oae e
enee
oi n oe
n eto
14071
14072
14073
RX Sq AFC Lock Snap 1265.7 Hz IMD: BPSK31 03/23/2009 17:11:55 z

MultiPSK


RX/TX screen ** MULTIPSK - THE MULTIMODE DIGITAL TRANSCEIVER ** Version 4.8.1
Help TCP/IP Mdem Oscillo Spectrum Transceiver Country/Loc World QSO Config Tune Program Beacon Exit
About Personal CPU Sampling freq PC (>=) MHz 450 166 66 Mixer Input Output Level Over Panoramic:
Licence Clocks 16 bits Identifiers
PSK CW RTTY
1 Call ? Name N Freq Mhz View Mode Ur RST My RST R S Locator ? QTH Path Notes Opt ? Clear Logbook Record
0 BPSK31 599 599 Cluster L A DXKeeper Cont F
Modes RS ID Video ID QRGs RS Auto-detect. Sound card 0 bauds Mode Slave Master
TX: BPSK31 MODE RX: BPSK31 Auto mode
TX frequency RX frequency Fr. difference Squelch F IMD= Quality=1/5
377.7 Hz 377.7 Hz 0.0 Hz 0 Reset n="6" 0 S/N<-30 dB
Filters Analysis Binaural Professional modes
BPSK31 63 125 250 FEC31
QPSK31 63 125 250 PSK10
MT63 PSKAM 10 31 50
PSK63F PSK220F CHIP
CW CCW Pactor1 ASCII
RTTY 45 50 75 AM. FEC
PACKET AM. ARQ JT65
THROB X Contestia VOICE
MFSK16 8 RTTYM OLIVIA
PAX DTMF 141A ALE400
HF FAX SSTV Do.Ex Do.F
FELD PSK H FM H HELL 80
200 500 1000
Spectrum Waterfall High
Mar1 Mar2 Go M1 Go M2
<< >> XIT Rewind
Lock Band KHz (P450=+) 2.5 3.3 4.3
CQ ABCDEFGH 12345678 SEQ. 4 SEQ. 5 SEQ. 6 SEQ. 7 SEQ. 8
Set 2 File MACROS Clear Repeat UTC/GMT SEQ. 9 SEQ. 10 CW end/fin CW answer
Color 10 AGC Grey Frequency
,ePi efoen F 0dëo€(ie[e e eDFU pse k
gt0tdit
0 M
UT7Lve 73 !
QSL 100% via Butnau or direct !
Good Luck BYE BYE DE , 73 73 !
d0SAD DE HB9EDH *
eo i e t <rŻei E. ic
Snapshot Print Fonts Clear Ø Double Auto TX Height 33 TX STOP RX 29/04/09 20:43:02 UTC SpotC. Off Commander

External Soundcard Devices

Accuracy

- Broadcast Mode
  - Character loss is not important
- Error Checking modes
  - ARQ (***A**utomatic **R**epeat-re**Q**uest)*
  - FEC (**F**orward **E**rror **C**orrection)

Accuracy

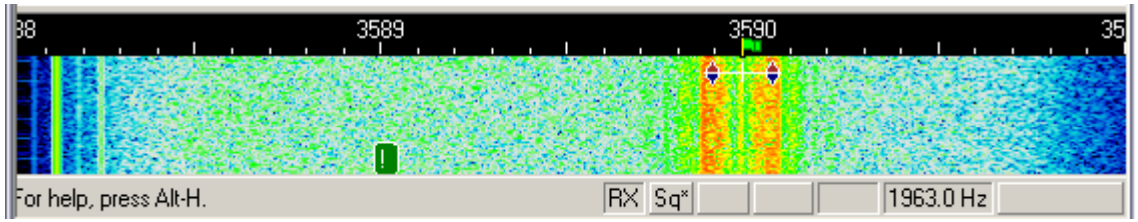
- The **ARQ** mode is used where absolute accuracy is paramount on the exchanged message.
  - It uses a handshaking technique to ensure absolute accuracy in the exchange of data.
  - When a block of the message is not received with 100% accuracy, the receiving station requests the entire block to be resent.

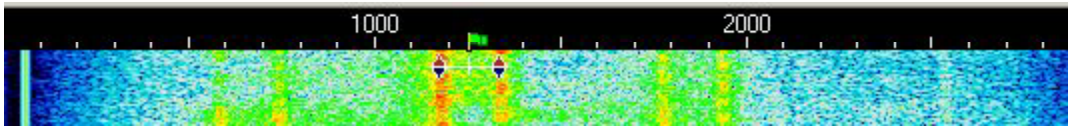
Accuracy

- The **FEC** mode is used where absolute accuracy is not paramount but a higher degree of message exchange reliability is.
  - A redundant data transmission technique that transmits the information using a predetermined algorithm (no handshaking)

Mode Displays

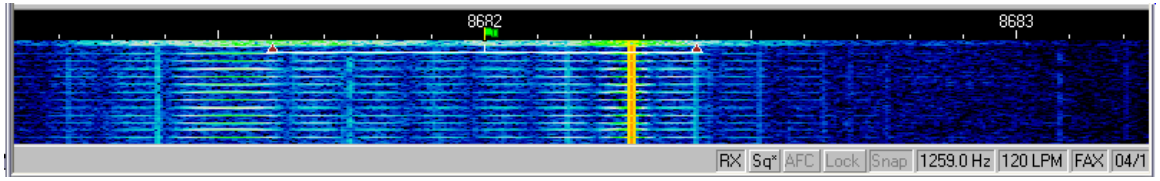
AMTOR

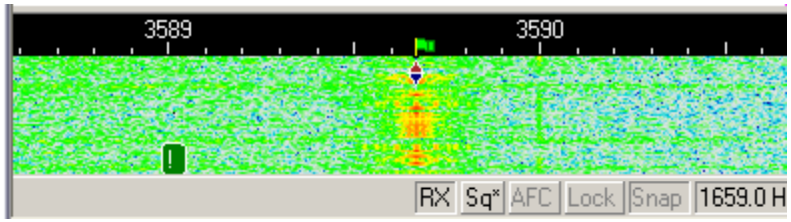




CW

FAX

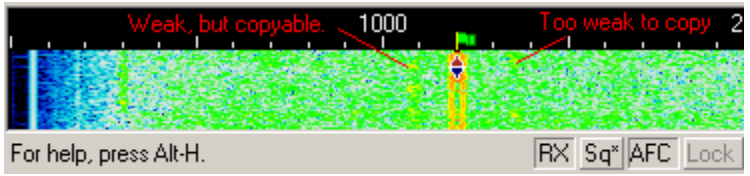


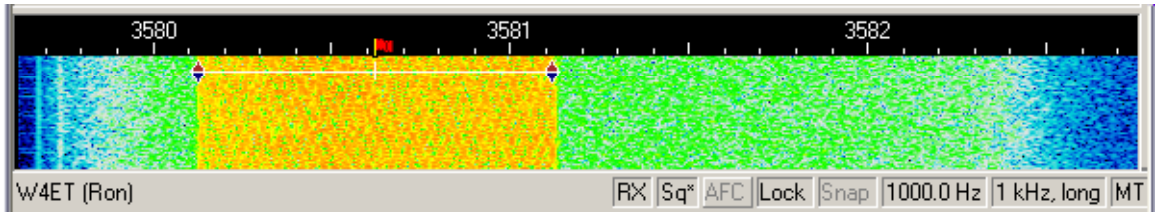


HELLSCREIBER

Mode Displays

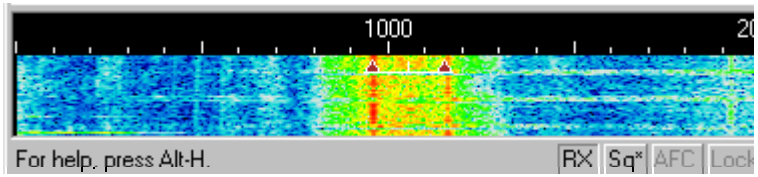
FSK31

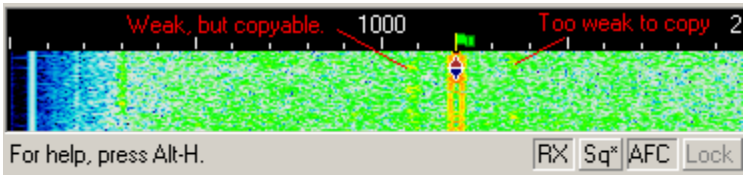




MT-63 (1000HZ)

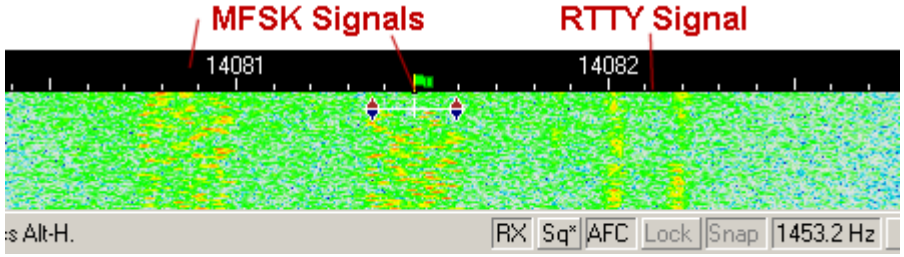
PACTOR 1
PACTOR 2
PACTOR 3



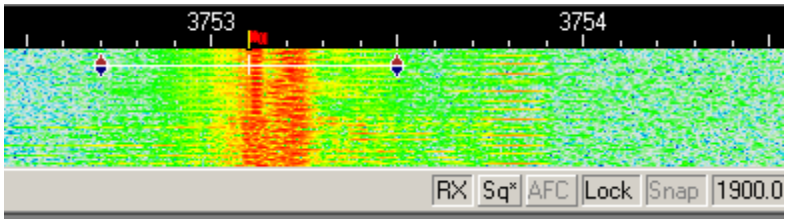


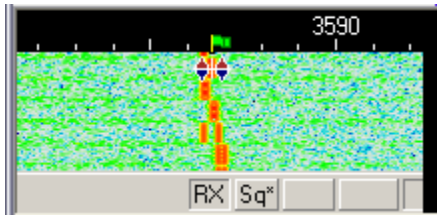
PSK 31/63/125

Mode Displays



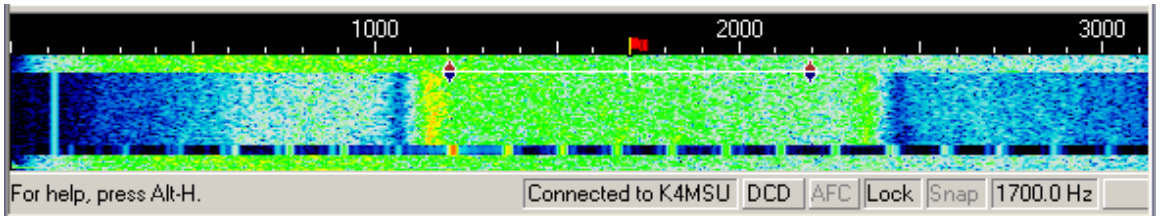
SSTV





THROB

VHF PACKET

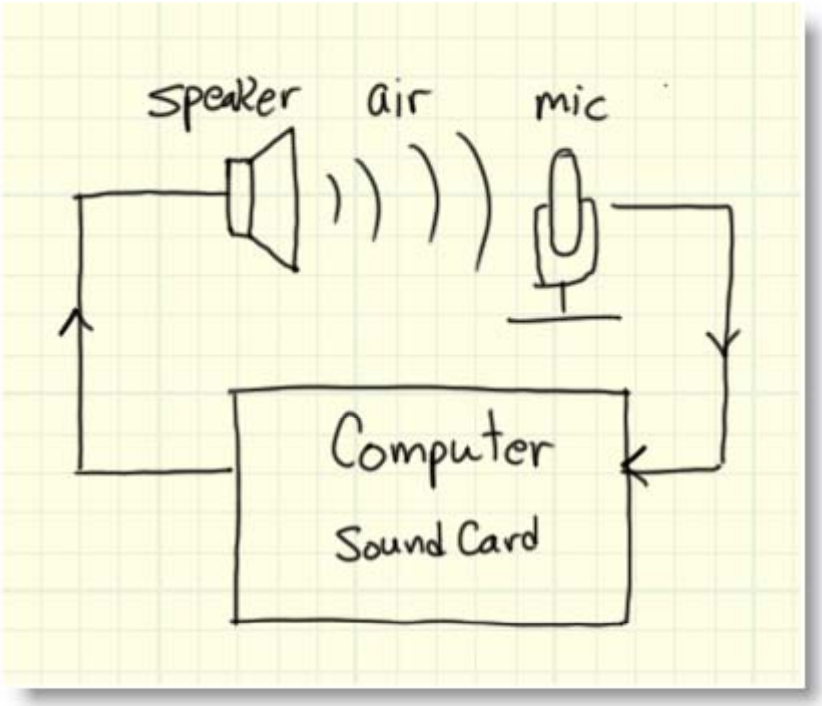


Making the connection without wires

Receive = Radio Speaker - into - Computer Microphone

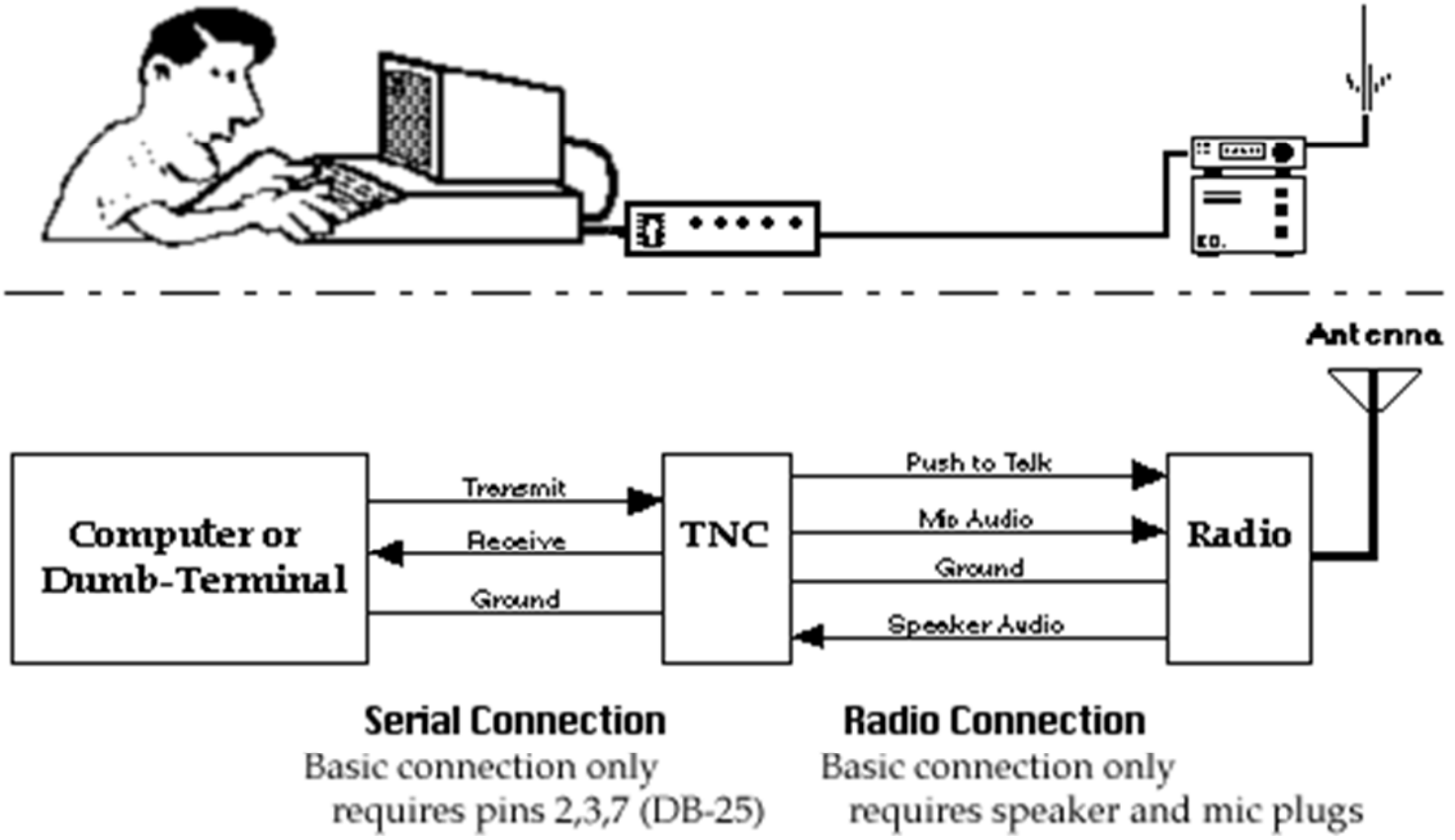
Transmit = Radio Microphone – into – Computer Speaker

It's Free!



What about Transmit PTT?

Making the connection with wires

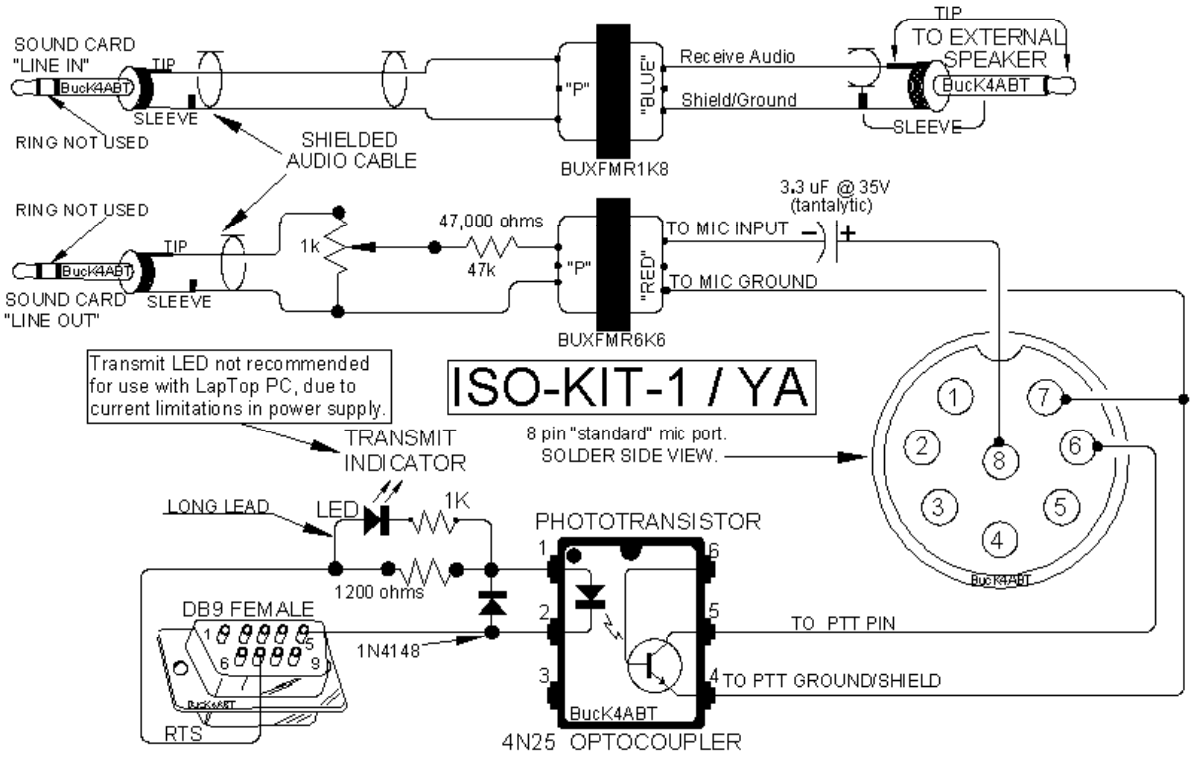


Soundcard Interface - Improved

- Two issues

1. TX & RX Audio isolation

2. PTT control



If serial Comport is DB25, use RTS = 4 & Ground = 7.

YAESU 8 pin microphone HF, VHF, UHF Models; FT-FT-1, 102, 211, 290, 480, 5100, 650, 690, 707, 712, 726, 7200, 727, 736, 747, 757, 767, 77, 790, 840, 890, 912, 980, 990,... etc to PC sound card for PSK31 mode.

Note: Buxcomm Product Shown

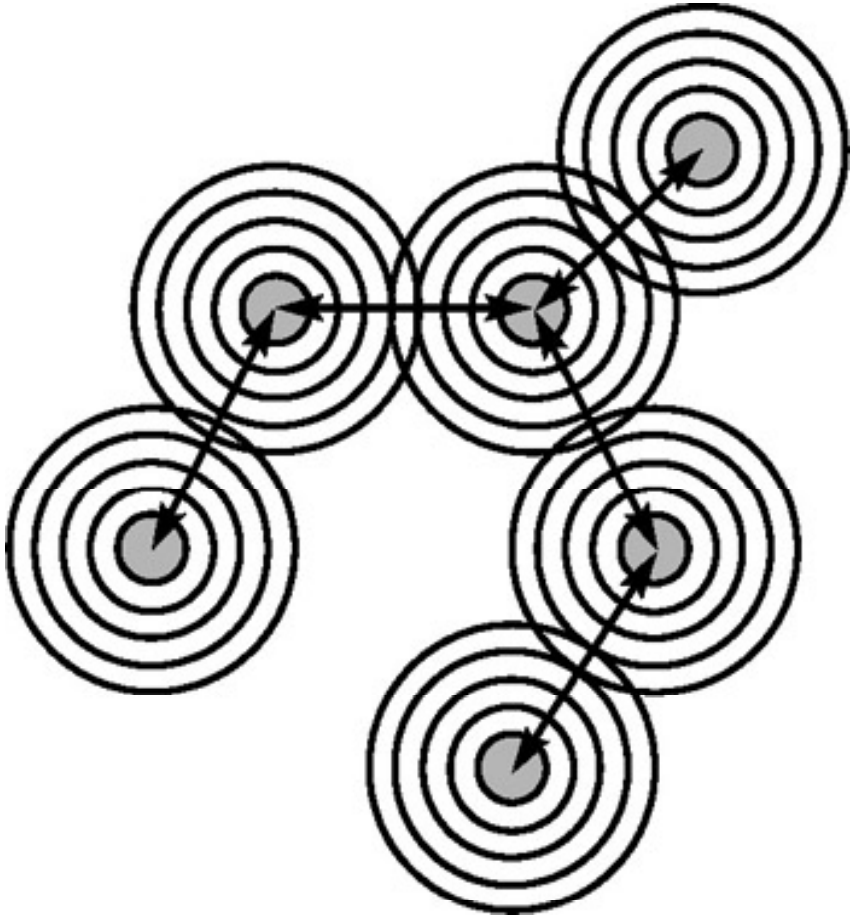
Digital Messaging Schemes

1. Keyboard-to-Keyboard
   – Type message on keyboard
2. Station-to-Station (Point-to-Point)
   – Typed or text file message “Mailboxes” (MBX)
3. Local Message Boards (BBS)
   – Central location for formatted messages
4. Wide Area Systems
   – Winlink 2000 (input/output via a ‘RMS’)

Digital Messaging Systems

- Point-to-Point
- PACKET
  - BBS
- Winlink 2000
  - TELNET
  - PACKET
  - PACTOR
  - WINMOR

PACKET System Topology



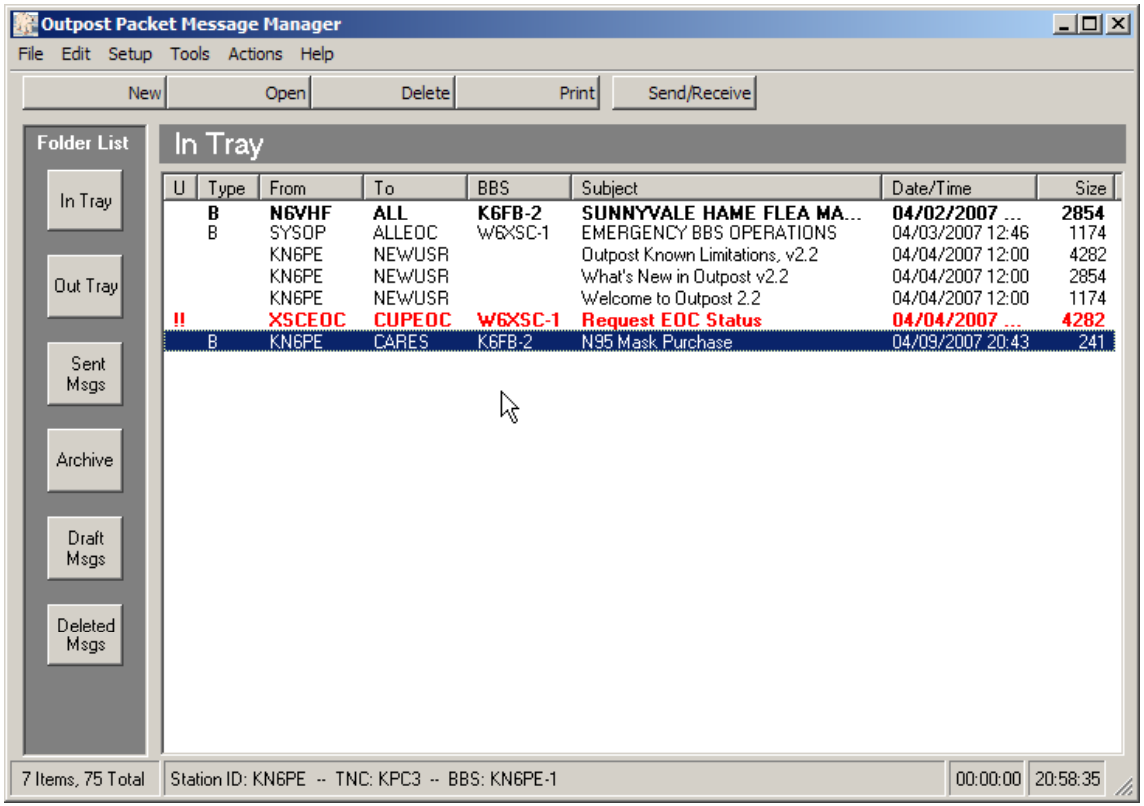
Making the connection with Radio

- Point-to-Point: Any mode, many softwares
- PACKET
  - AX.25 technology
- Winlink 2000
  - TELNET
  - PACKET
  - PACTOR
  - WINMOR (**WIN**link **M**essage **O**ver **R**adio

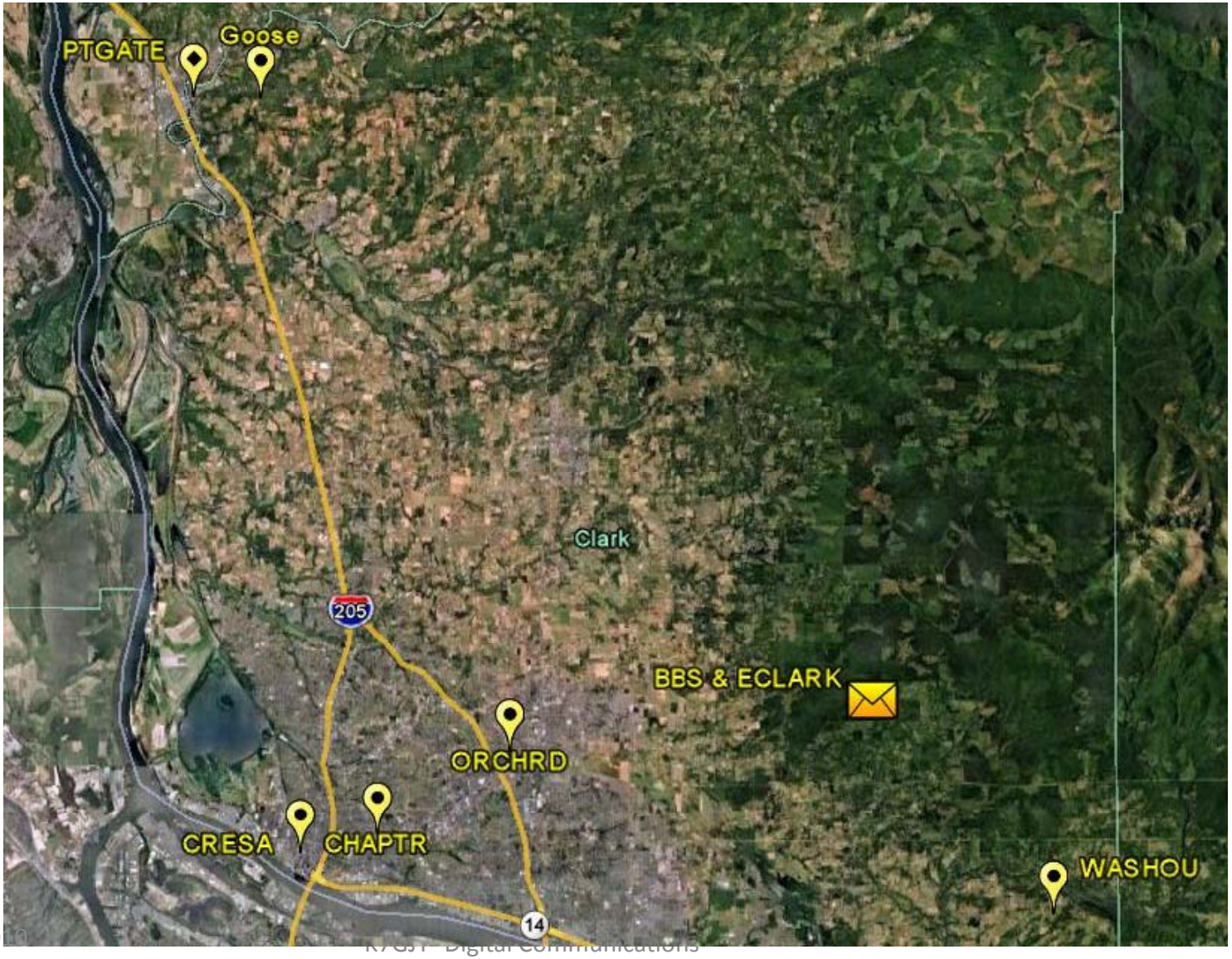
Digital Communication

- **Clark County <u>PACKET</u>**
  - **144.99 [& 441.060]**
  - **Station to Station** (K-K or MBX)
  - **Mt Livingston BBS**
    - Currently W7AIA-8
    - Changing to K7CLL-8

OutpostPM


Outpost Packet Message Manager
File Edit Setup Tools Actions Help
New Open Delete Print Send/Receive
Folder List
In Tray
Out Tray
Sent Msgs
Archive
Draft Msgs
Deleted Msgs
In Tray
U Type From To BBS Subject Date/Time Size
B N6VHF ALL K6FB-2 SUNNYVALE HAME FLEA MA... 04/02/2007 ... 2854
B SYSOP ALLEOC W6XSC-1 EMERGENCY BBS OPERATIONS 04/03/2007 12:46 1174
KN6PE NEWUSR Outpost Known Limitations, v2.2 04/04/2007 12:00 4282
KN6PE NEWUSR What's New in Outpost v2.2 04/04/2007 12:00 2854
KN6PE NEWUSR Welcome to Outpost 2.2 04/04/2007 12:00 1174
!! XSCEOC CUPEOC W6XSC-1 Request EOC Status 04/04/2007 ... 4282
B KN6PE CARES K6FB-2 N95 Mask Purchase 04/09/2007 20:43 241
7 Items, 75 Total
Station ID: KN6PE -- TNC: KPC3 -- BBS: KN6PE-1
00:00:00
20:58:35

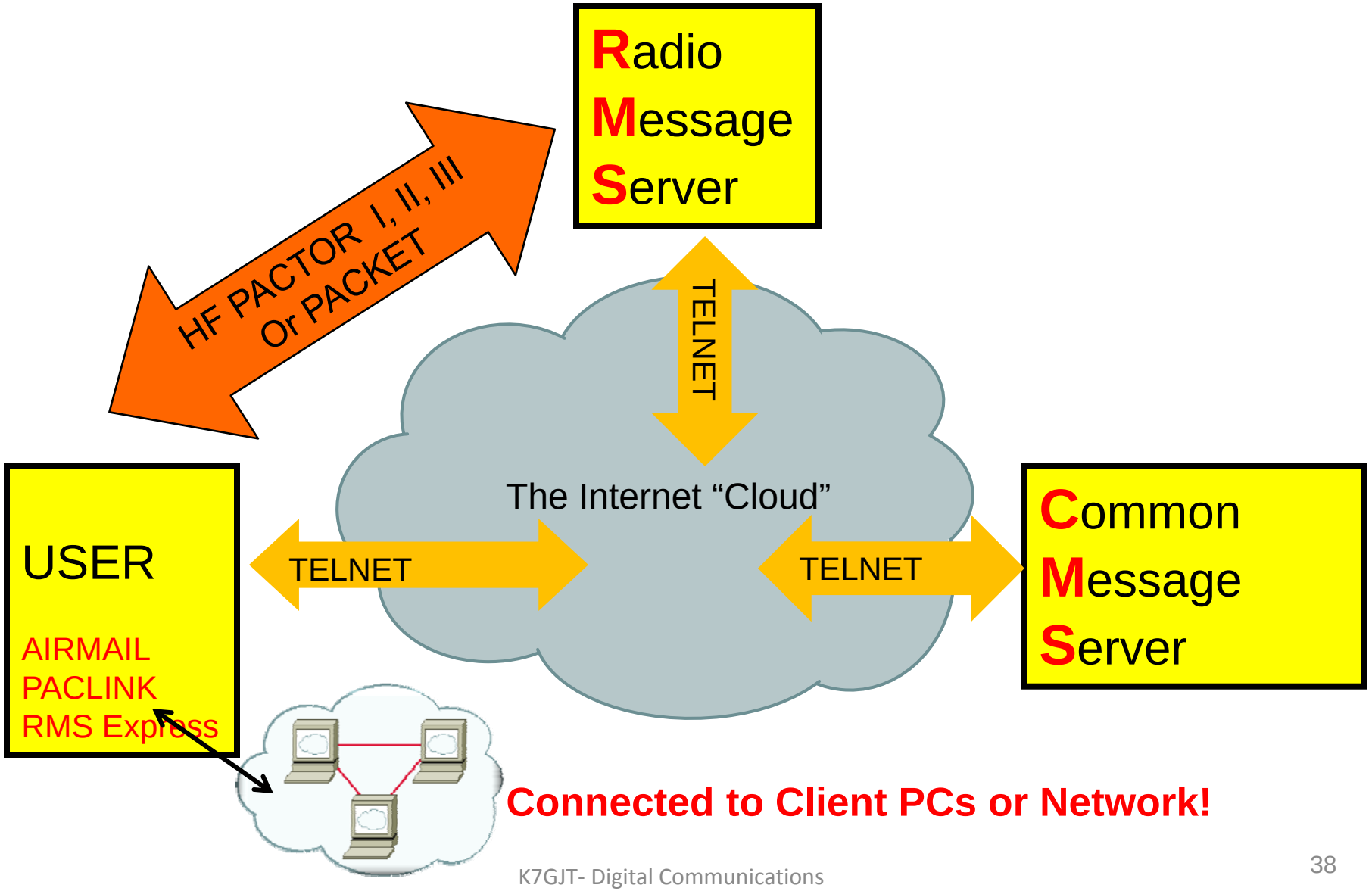
Digital Comms - PACKET



Digital Communication

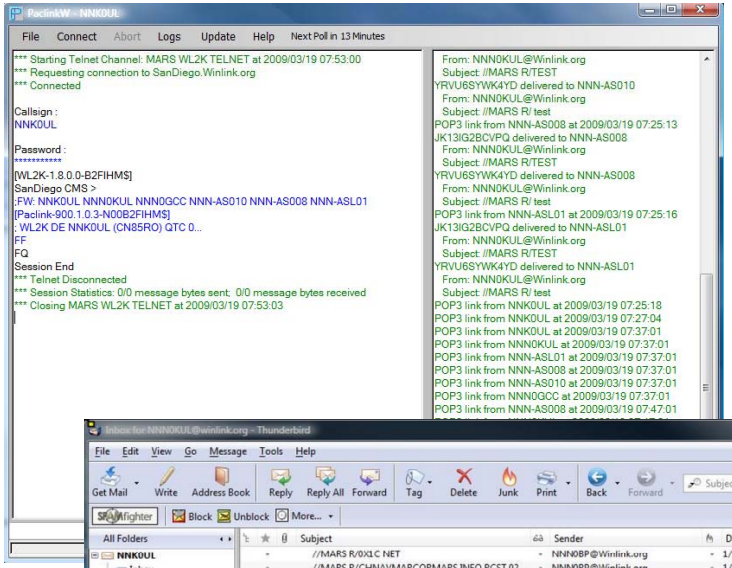
- **Clark County Winlink 2000**
  - **144.920 & 441.525**
  - **VHF: K7YFJ-10 & KA7CTT-10**
  - **UHF: K7YFJ-10 & K7GJT-10**

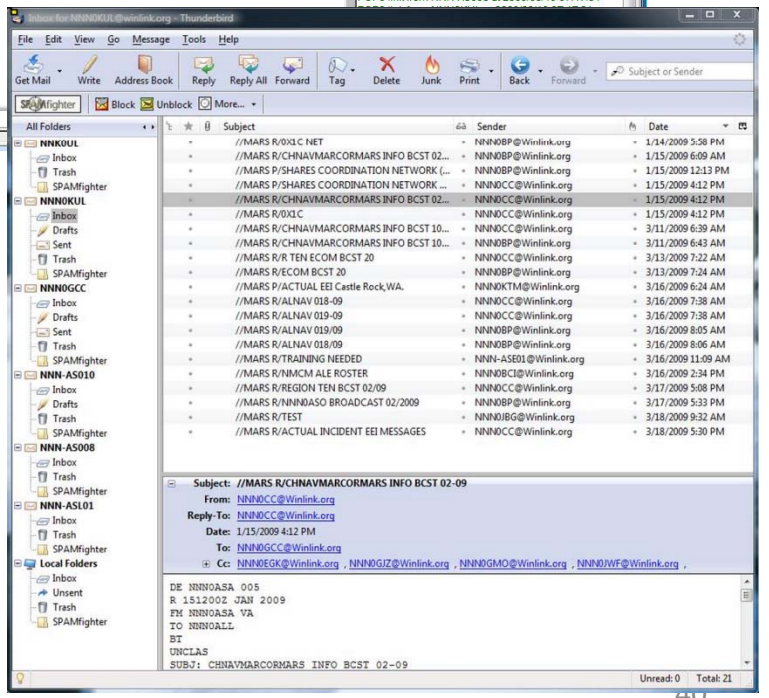
Winlink 2000 Topology

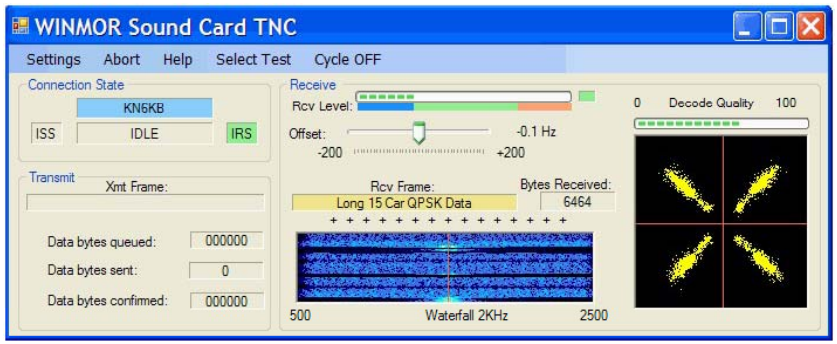


Winlink Station

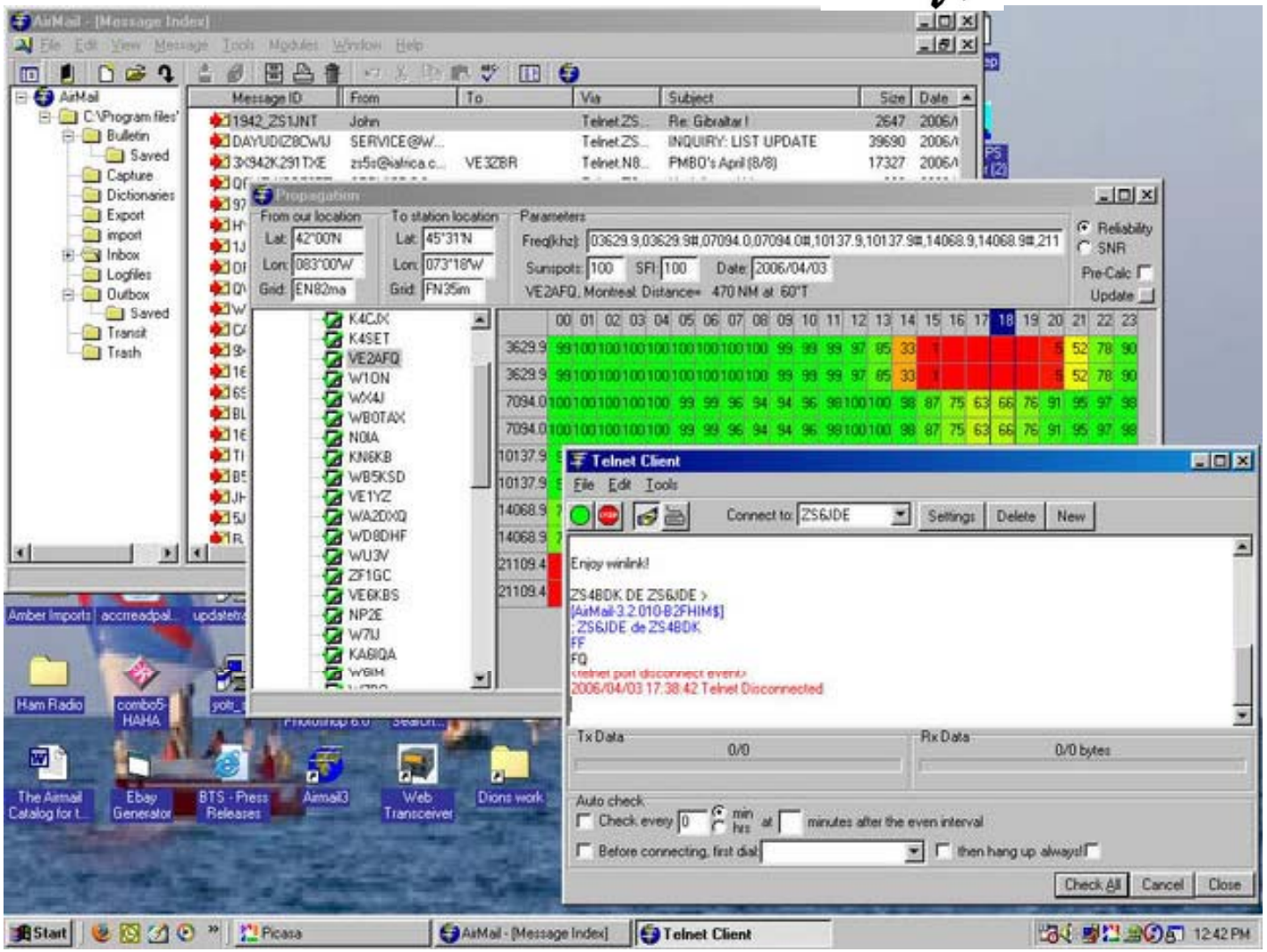
RMS Express & Paclink



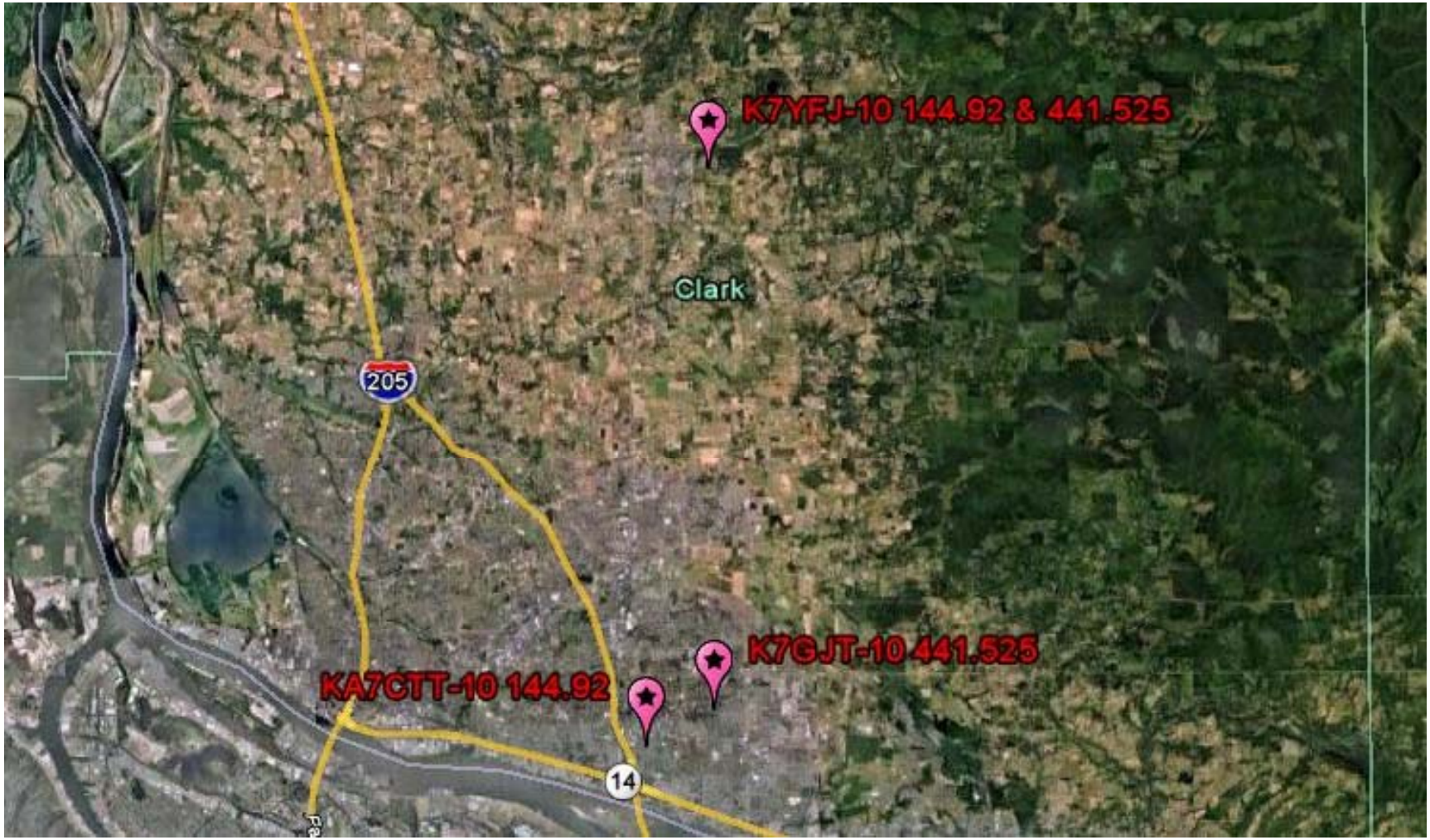




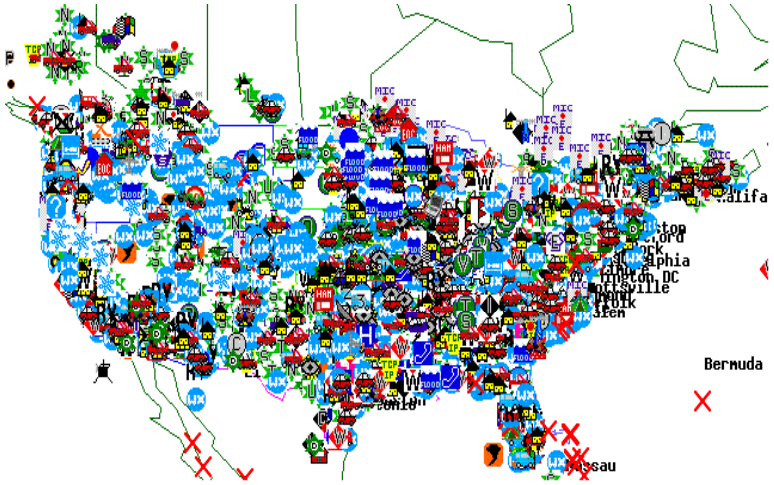
Airmail


AirMail - [Message Index]
Propagation
Telnet Client
Enjoy winlink!
ZS4BDK DE ZS6JDE >
[AirMail-3.2.010-B2FHIM$]
;ZS6JDE de ZS4BDK
FF
FQ
2006/04/03 17:38:42 Telnet Disconnected
Start
12:42 PM

Digital Comms – WL2K RMSs



- Amateur PACKET Reporting System
  - "Maps and Messaging"
  - Over 40,000 users
  - Most common use is position reporting
  - Weather
  - Telemetry



- Covered in next Session

Questions?