

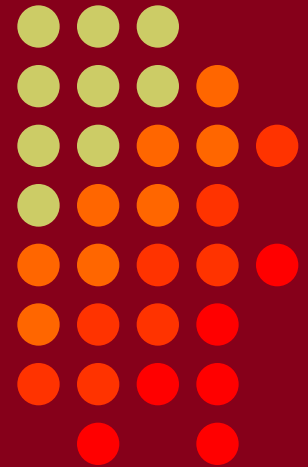
CTU Presents

Techniques to Optimize 6 Meter Contest Performance

Joel Harrison, W5ZN

• CTU •
CONTEST
UNIVERSITY

ICOM®



Techniques to Optimize 6 Meter Contest Performance



- **Antenna Techniques**
- **Station Techniques**
- **Propagation Techniques**
- **Operating Techniques**

Antenna Techniques



- **What Kind of an Antenna?**

- Yagi
 - Horizontal polarization
- ~~Vertical~~
- ~~Dipole / Inverted Vee~~

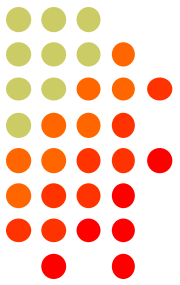
- **How Many Elements?**

- More is better up to a point.
- 7 is good

- **How High Should it Be?**

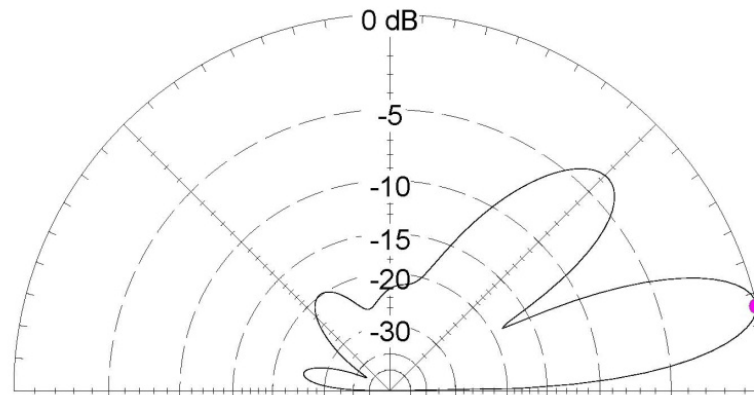
- 30 Ft ?
- Let's look at some plots

Antenna Techniques



Total Field

EZNEC+



50 MHz - Three Element Yagi

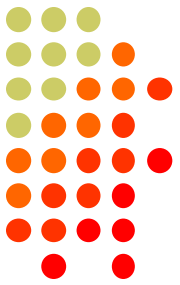
50.1 MHz

Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 13.53 dBi

Cursor Elev 13.0 deg.
Gain 13.53 dBi
0.0 dBmax

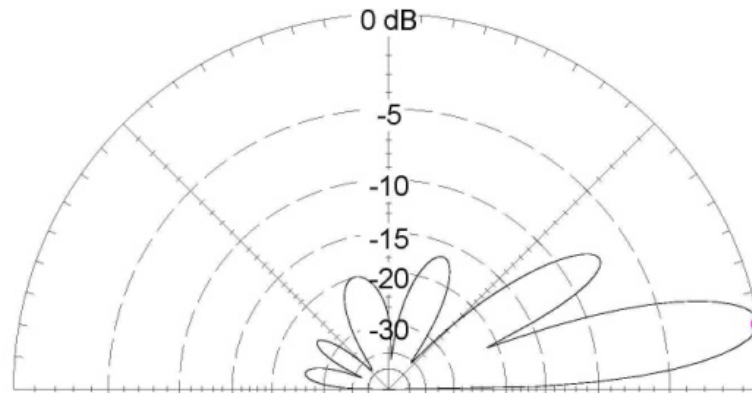
Slice Max Gain 13.53 dBi @ Elev Angle = 13.0 deg.
Beamwidth 14.3 deg.; -3dB @ 6.6, 20.9 deg.
Sidelobe Gain 9.89 dBi @ Elev Angle = 44.0 deg.
Front/Sidelobe 3.64 dB

Antenna Techniques



Total Field

EZNEC+



7 Element Yagi @ 25 FT

50.1 MHz

Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 17.98 dBi

Cursor Elev 10.0 deg.
Gain 17.98 dBi
0.0 dBmax

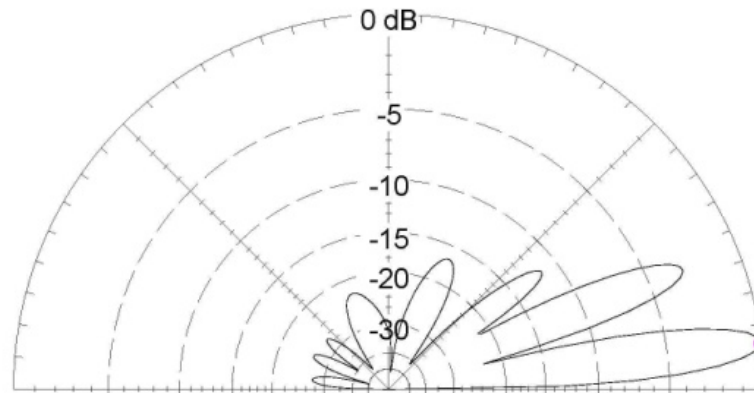
Slice Max Gain 17.98 dBi @ Elev Angle = 10.0 deg.
Beamwidth 11.1 deg.; -3dB @ 5.1, 16.2 deg.
Sidelobe Gain 10.86 dBi @ Elev Angle = 32.0 deg.
Front/Sidelobe 7.12 dB

Antenna Techniques



Total Field

EZNEC+



7 Element Yagi @ 37.5 FT

50.1 MHz

Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 18.42 dBi

Cursor Elev 7.0 deg.
Gain 18.42 dBi
0.0 dBmax

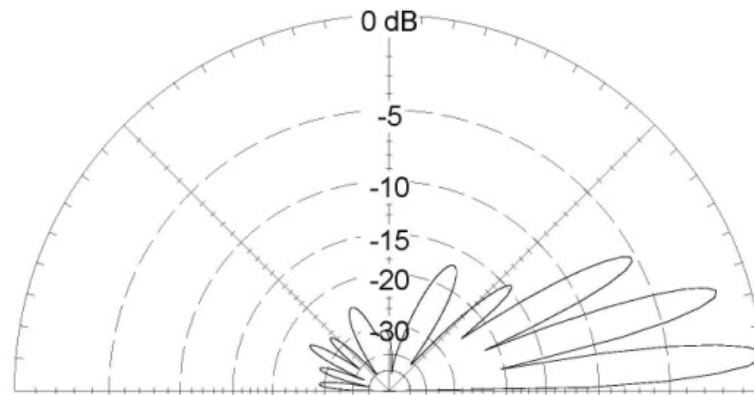
Slice Max Gain 18.42 dBi @ Elev Angle = 7.0 deg.
Beamwidth 7.4 deg.; -3dB @ 3.6, 11.0 deg.
Sidelobe Gain 15.52 dBi @ Elev Angle = 22.0 deg.
Front/Sidelobe 2.9 dB

Antenna Techniques



Total Field

EZNEC+



7 Element Yagi @ 50 FT

50.1 MHz

Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 18.53 dBi

Cursor Elev 5.0 deg.
Gain 18.53 dBi
0.0 dBmax

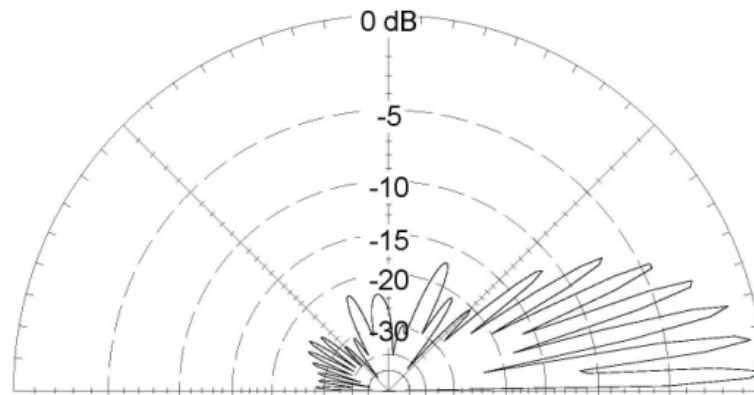
Slice Max Gain 18.53 dBi @ Elev Angle = 5.0 deg.
Beamwidth 5.6 deg.; -3dB @ 2.7, 8.3 deg.
Sidelobe Gain 16.95 dBi @ Elev Angle = 17.0 deg.
Front/Sidelobe 1.58 dB

Antenna Techniques



Total Field

EZNEC+



7 Element Yagi @ 100 FT

50.1 MHz

Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 18.72 dBi

Cursor Elev 3.0 deg.
Gain 18.72 dBi
0.0 dBmax

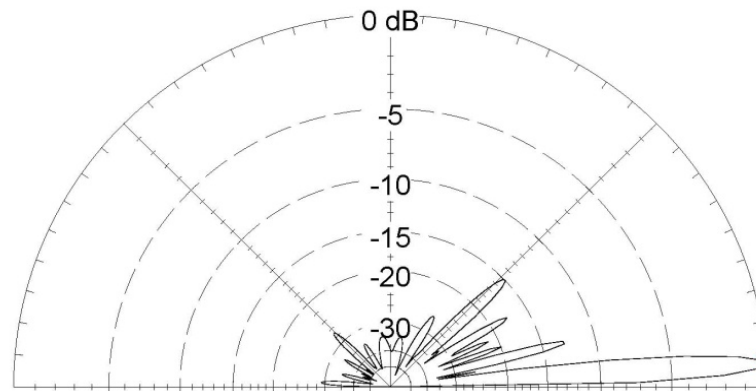
Slice Max Gain 18.72 dBi @ Elev Angle = 3.0 deg.
Beamwidth 2.6 deg.; -3dB @ 1.5, 4.1 deg.
Sidelobe Gain 18.23 dBi @ Elev Angle = 8.0 deg.
Front/Sidelobe 0.49 dB

Antenna Techniques



Total Field

EZNEC+



7x7x7 Array

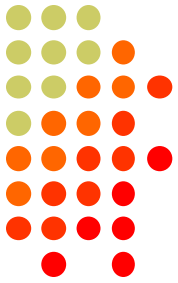
50.1 MHz

Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 22.84 dBi

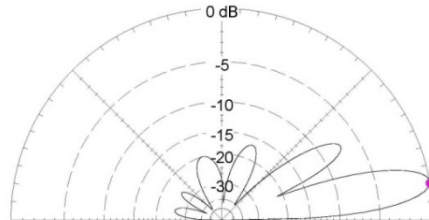
Cursor Elev 4.0 deg.
Gain 22.84 dBi
0.0 dBmax

Slice Max Gain 22.84 dBi @ Elev Angle = 4.0 deg.
Beamwidth 3.8 deg.; -3dB @ 1.8, 5.6 deg.
Sidelobe Gain 10.1 dBi @ Elev Angle = 14.0 deg.
Front/Sidelobe 12.74 dB

Antenna Techniques



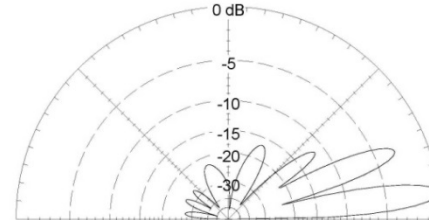
Total Field EZNEC+



7 Element Yagi @ 25 FT 50.1 MHz

| | | |
|---|-------------|-----------|
| Elevation Plot | Cursor Elev | 10.0 deg. |
| Azimuth Angle | Gain | 17.98 dBi |
| Outer Ring | | 0.0 dBmax |
| Slice Max Gain 17.98 dBi @ Elev Angle = 10.0 deg. | | |
| Beamwidth 11.1 deg.; -3dB @ 5.1, 16.2 deg. | | |
| Sidelobe Gain 10.86 dBi @ Elev Angle = 32.0 deg. | | |
| Front/Sidelobe 7.12 dB | | |

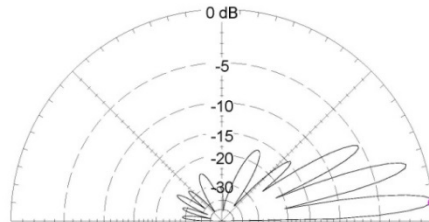
Total Field EZNEC+



7 Element Yagi @ 37.5 FT 50.1 MHz

| | | |
|--|-------------|-----------|
| Elevation Plot | Cursor Elev | 7.0 deg. |
| Azimuth Angle | Gain | 18.42 dBi |
| Outer Ring | | 0.0 dBmax |
| Slice Max Gain 18.42 dBi @ Elev Angle = 7.0 deg. | | |
| Beamwidth 7.4 deg.; -3dB @ 3.6, 11.0 deg. | | |
| Sidelobe Gain 15.52 dBi @ Elev Angle = 22.0 deg. | | |
| Front/Sidelobe 2.9 dB | | |

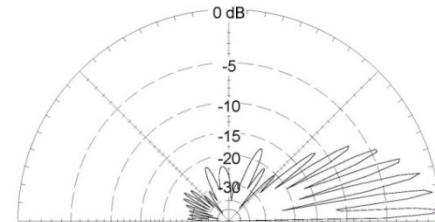
Total Field EZNEC+



7 Element Yagi @ 50 FT 50.1 MHz

| | | |
|--|-------------|-----------|
| Elevation Plot | Cursor Elev | 5.0 deg. |
| Azimuth Angle | Gain | 18.53 dBi |
| Outer Ring | | 0.0 dBmax |
| Slice Max Gain 18.53 dBi @ Elev Angle = 5.0 deg. | | |
| Beamwidth 5.6 deg.; -3dB @ 2.7, 8.3 deg. | | |
| Sidelobe Gain 16.95 dBi @ Elev Angle = 17.0 deg. | | |
| Front/Sidelobe 1.58 dB | | |

Total Field EZNEC+



7 Element Yagi @ 100 FT 50.1 MHz

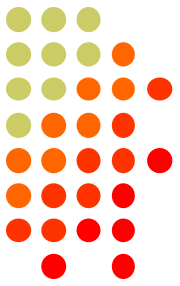
| | | |
|--|-------------|-----------|
| Elevation Plot | Cursor Elev | 3.0 deg. |
| Azimuth Angle | Gain | 18.72 dBi |
| Outer Ring | | 0.0 dBmax |
| Slice Max Gain 18.72 dBi @ Elev Angle = 3.0 deg. | | |
| Beamwidth 2.6 deg.; -3dB @ 1.5, 4.1 deg. | | |
| Sidelobe Gain 18.23 dBi @ Elev Angle = 8.0 deg. | | |
| Front/Sidelobe 0.49 dB | | |

Antenna Techniques

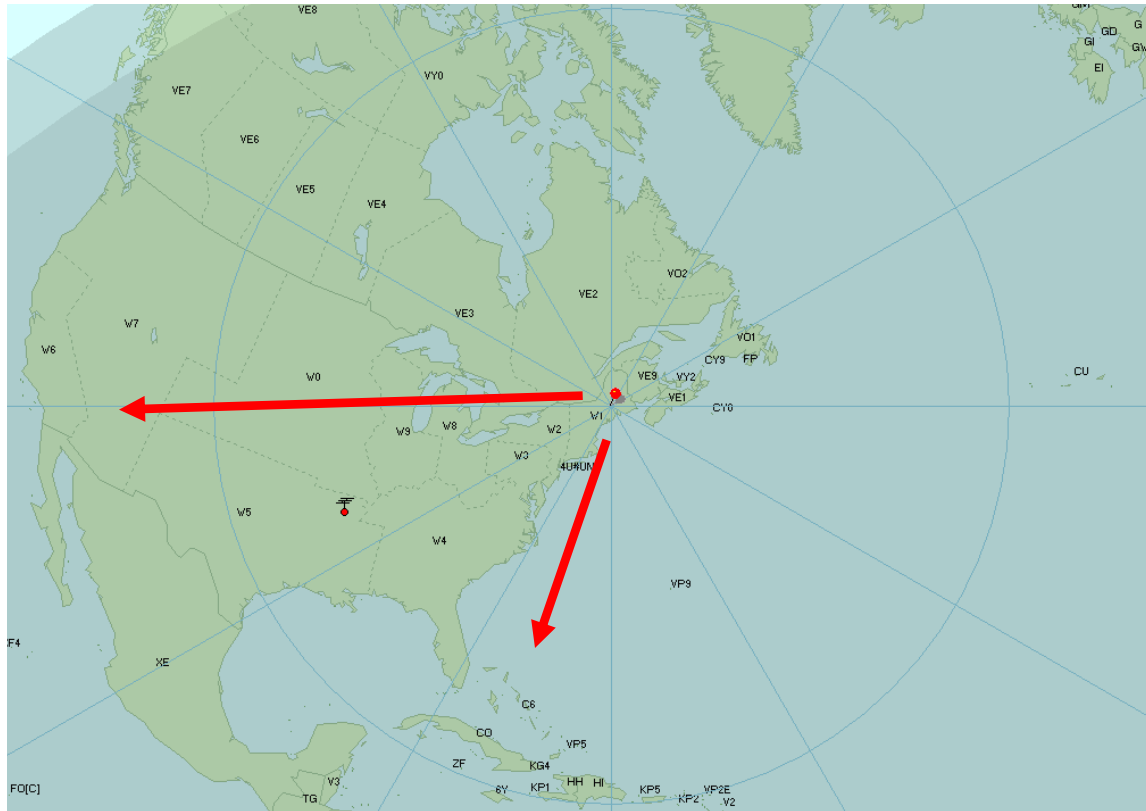


- **What is the best height for my antenna?**
 - You will always have dead zones and nulls regardless of height
 - Get your antennas as high as you reasonable can
- **How Many Antennas do I need?**
 - Really depends on where you live

Antenna Techniques



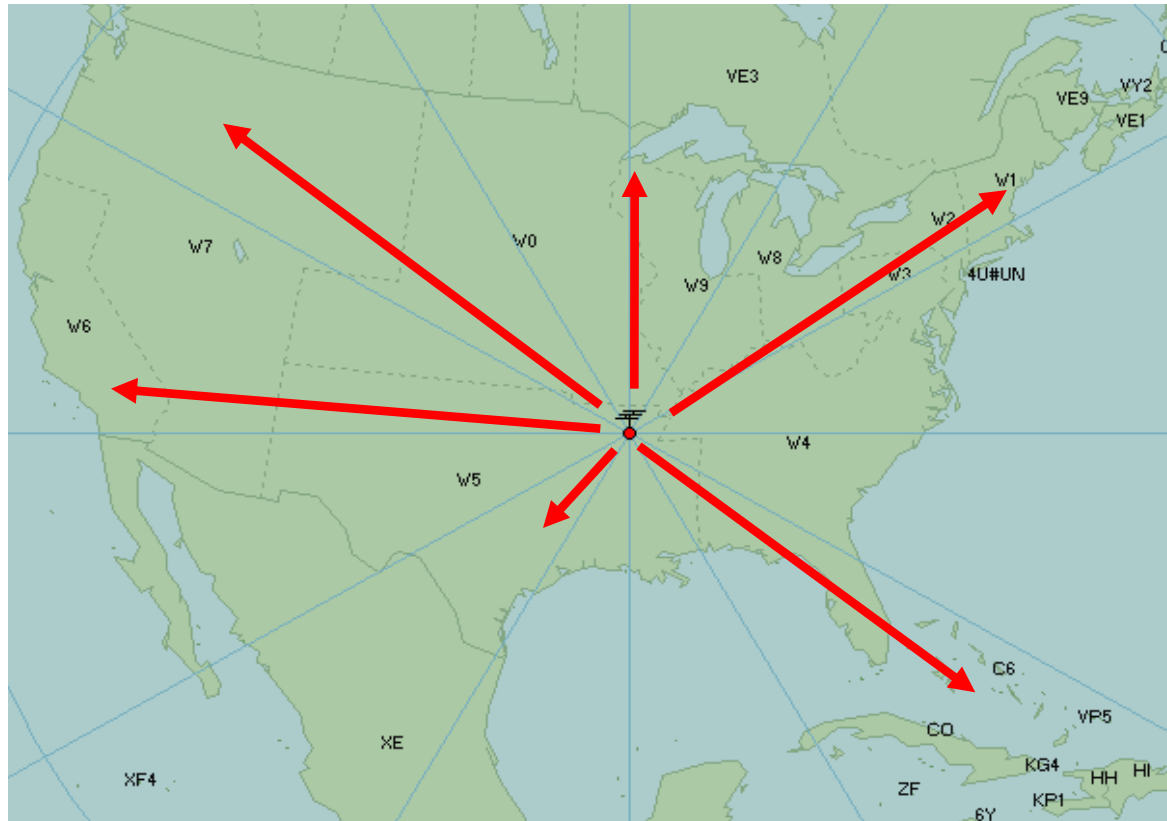
QTH in Maine / Northeast USA



Antenna Techniques



QTH in Mid USA



Antenna Techniques



How can you quickly change antenna direction??

Antenna, or a stack of smaller antennas in a fixed direction allow fast direction change without waiting for a rotor to turn.



Station Techniques



- **Radio**
- **Preamp**
- **Interconnecting cables**
- **Noise**

Station Techniques



- **Radio**
 - All new radios include 6 meters
 - Good dynamic range, roofing filters essential
- **Preamp**
- **Interconnecting cables**
- **Noise**

Station Techniques



Station Techniques



- **Radio**

- All new radios include 6 meters
- Good dynamic range, roofing filters essential

- **Preamp**

- Will improve weak sigs when band is dead but can cause problems in presence of strong stations

- **Interconnecting cables**

- Ensure solid connections
- Avoid cheap phono connectors & cable

- **Noise**

Station Techniques

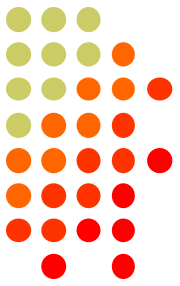


Noise! The Grim Reaper of noise is *not* your friend!!



- Sky Noise
- Atmospheric Noise
- Line Noise
- Other man-made noise

Station Techniques



- Internet Routers can be a significant noise source at 50 MHz that will populate the band, especially the DX Window
 - Multiple carriers of relatively constant amplitude but with modulation (Birdies)
 - 50.044, 50.058, 50.105, 50.120, 50.148, 50.166
 - Broadband trash
- **Get your own station “clean” first!**

Station Techniques



Internet Router noise can be significantly reduced or eliminated.



Also utilize shielded CAT5 cable and connectors

Station Techniques



- **Some Actual Results**

- All “birdies” are gone
- Noise floor dropped 8 dBm !!!

- **More technical info:**

- A Ham’s Guide to RFI, Ferrites, Baluns and Audio Interfacing - Jim Brown, K9YC
 - <http://audiosystemsgroup.com>

Station Techniques



Noise – Recap

- Clean up your own station
- Address line noise issues
- Use Bandpass Filters



Propagation Techniques



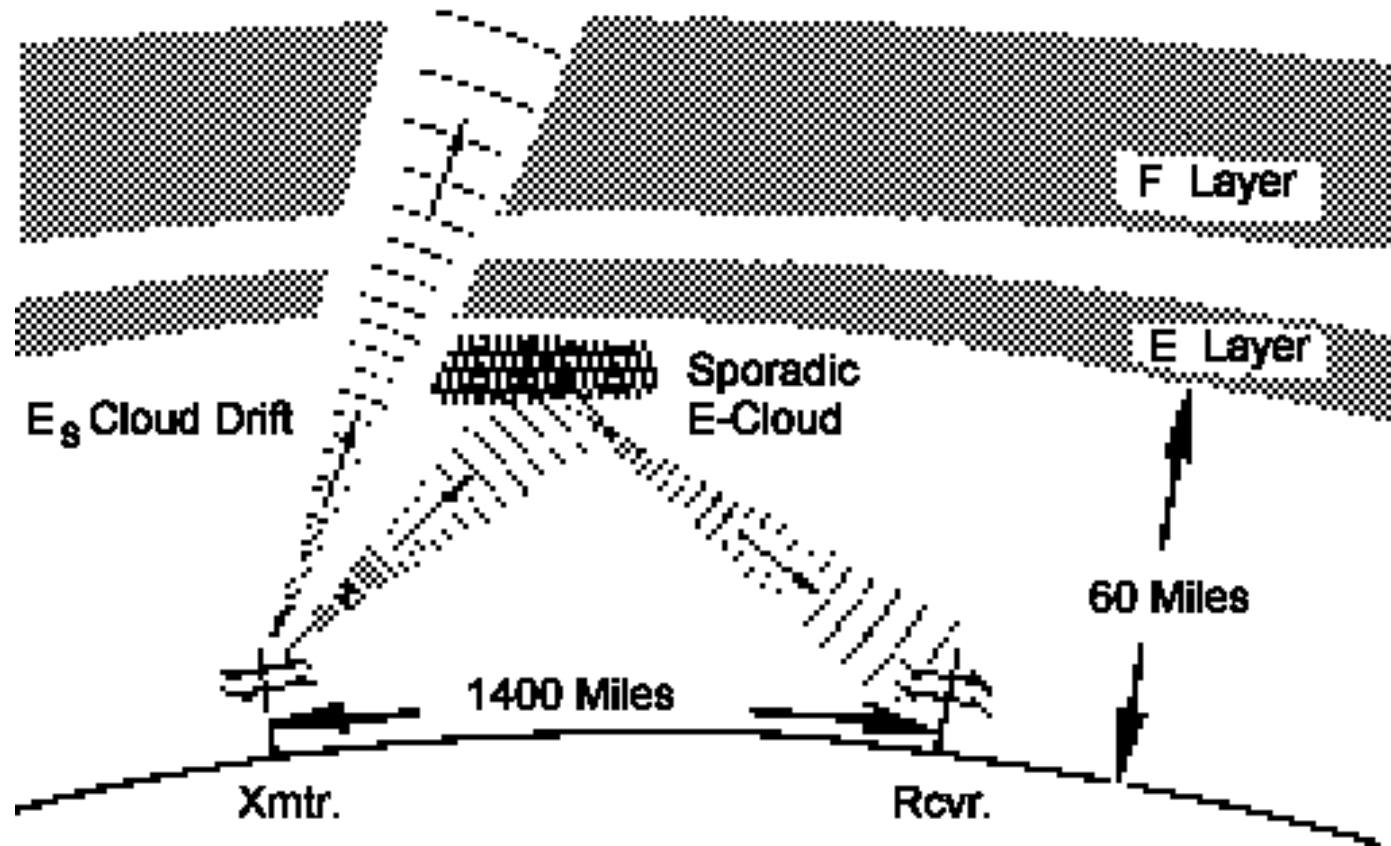
- **Sporadic E – “Es”**
- **Meteor Scatter – “MS”**

Propagation Techniques



- **Sporadic ionization of the E-Layer**
 - Peaks May–July, Possibly generated by lightning
- **50 & 144 MHz, possibly 222 MHz**
 - Single-hop optimum range 900-1300 miles, maximum range 1350-1500 miles
 - Double-hop optimum range 2000-2600 miles, maximum range 2750-3100 miles
- **Peak time during daylight hours & early evening**

Propagation Techniques

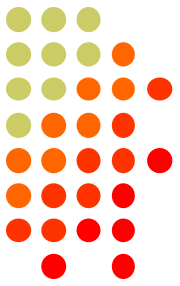


Propagation Techniques

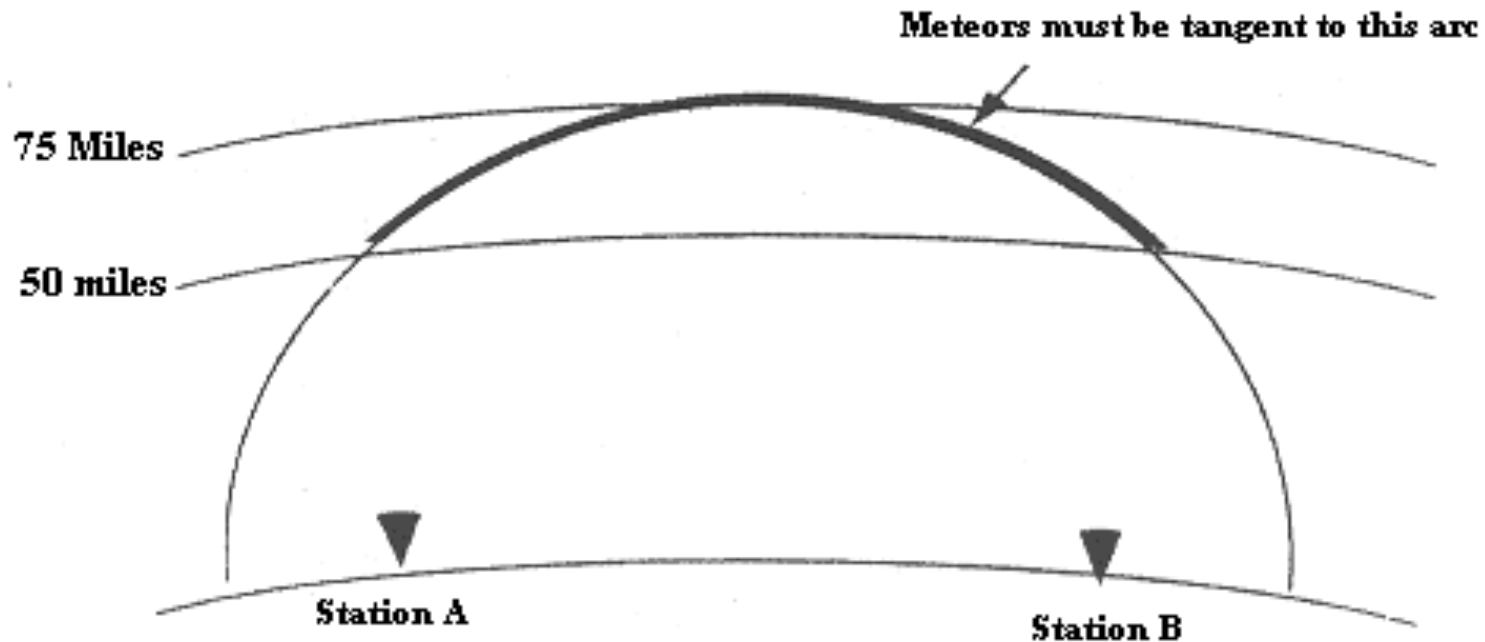


- **Meteor scatter is the reflection of radio waves from the ionized trails from meteors burning up in the upper atmosphere.**
- **Meteors burn up in the upper atmosphere at a height of around 65 miles.**
- **This may be used to make QSOs up to about 1400 miles**

Propagation Techniques



Reflection will occur when the trail is oriented as shown



Propagation Techniques



- **Excellent for 50 MHz**
- **Very Predictable Paths**
 - Best times between midnight & approx 9 AM
 - Peak during “showers” – Anytime with high speed procedures like **WSJT**

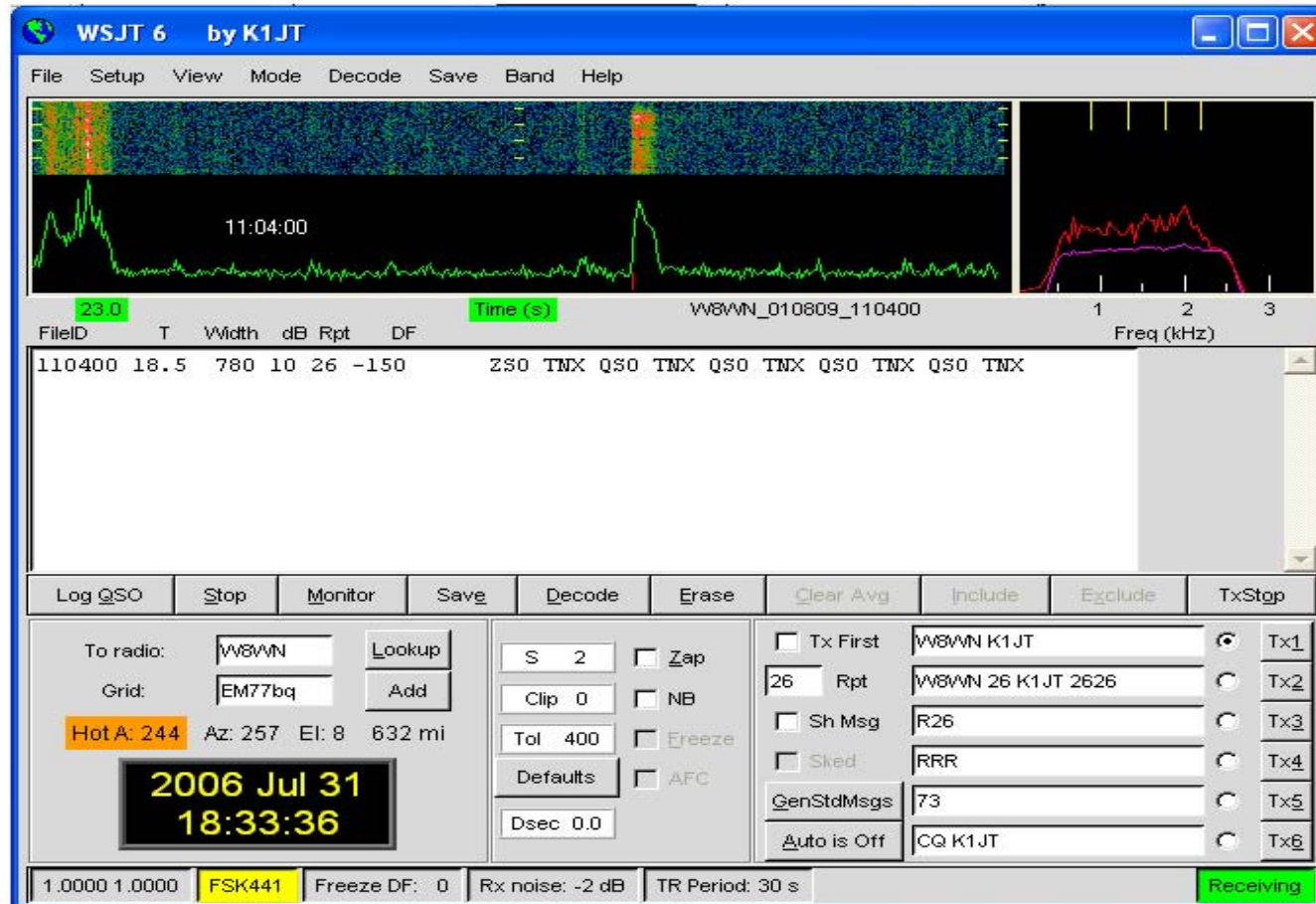
Operating Techniques



K1JT Digital Modes

- **Weak Signal Communication by K1JT (WSJT) offers specific digital protocols optimized for EME and meteor scatter at VHF/UHF**
- **Free open-source programs. Normal usage requires only a standard SSB transceiver and a personal computer with soundcard.**
- **Can Provide Outstanding access to new grid multipliers from moderate stations**

Operating Techniques



Operating Techniques



- **FSK441 Mode**
 - **Calling frequencies 50.260**
 - **Single Antenna & 100 W is outstanding**
 - **Antenna is pointed toward station worked**
 - **Run 30 second sequences**
 - **Normally eastern most station runs 1st 30 second period (0-30) and western station runs 2nd 30 second period (31-00).**

Operating Techniques



- **FSK441 Mode (cont)**
 - **Once calls are received stations start sending report**
 - **Stations will be on after 0500z**
 - **Listen on 50.260 in “Monitor” mode for stations calling CQ**
 - **You may hear “CQ W5ZN EM45 U5” or “D10”**
 - **U5 means the CQ station is listening Up 5 KHz**
 - **Call there. When CQ station hears you he will begin transmitting Up 5 KHz.**

Operating Techniques



- **Download Free Software at:**

<http://physics.princeton.edu/pulsar/K1JT/wsjt.html>

Download User's Guide at:

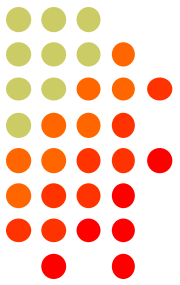
http://physics.princeton.edu/pulsar/K1JT/WSJT_User_600.pdf

Operating Techniques



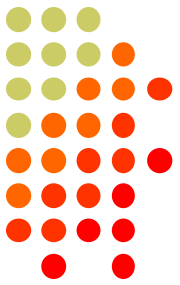
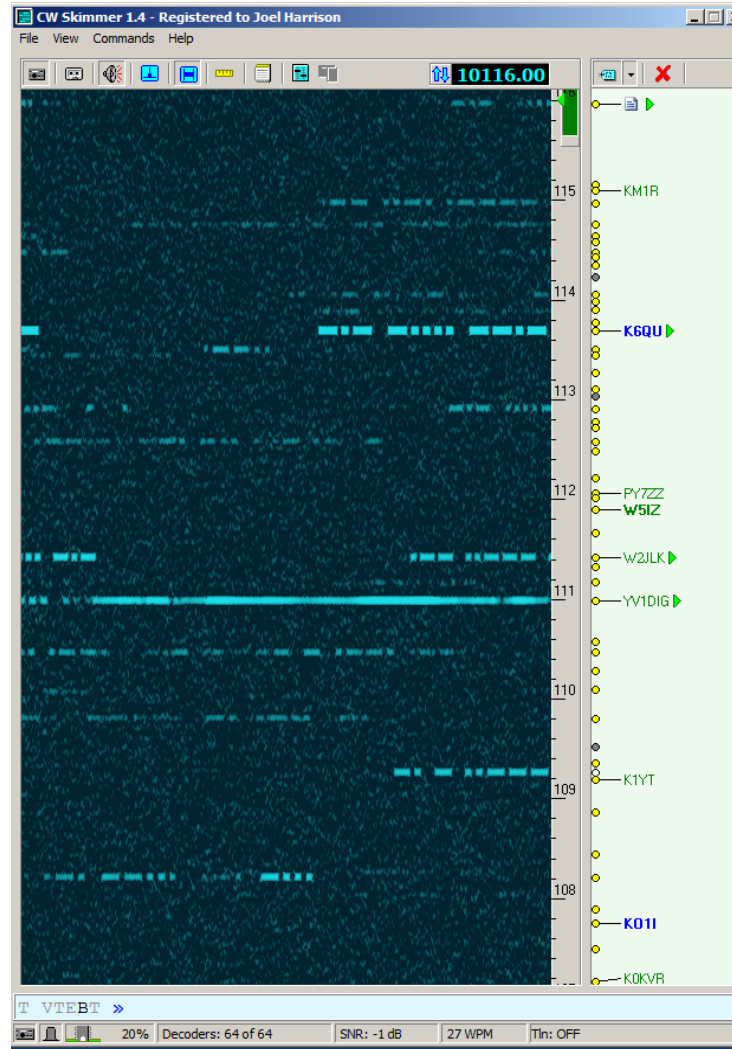
- **How to monitor for an unpredictable band opening:**
 - Radio with Panadapter
 - CW Skimmer
 - ON4KST Region 2 - 50 MHz Chat
 - DX Sherlock
 - Based on Cluster spots & shows paths
 - DX Cluster

Operating Techniques



Operating Techniques

CW Skimmer allows you to see CW stations on the band



Operating Techniques



The screenshot displays a web browser window with multiple tabs. The active tab is 'www.on4kst.org/chat/index.php'. The chat interface shows a list of messages on the left and a list of registered users on the right.

Chat Log:

- 01:20:18 **SERVER** message: The chat is linked to many CLX/WEB DX clusters. Take a look into the **MENU** to discover many functionalities.
- 01:20:18 **SERVER** message: Welcome **W4RXR** tom on this **50 MHz IARU Region 2 amateur chat**. We hope you will enjoy your stay here and visit us again.
- 01:19:26 **KF8MY** Mike LOTW: back to the movie.
- 01:16:09 **KF8MY** Mike LOTW: 73 Boub GN
- 00:56:13 **K1SIX** B'oub 4M Rx: Gotta run GL Bzzzzzzzzzzt!!!
- 00:51:06 **K1SIX** B'oub 4M Rx: crunching. No UL approval anyway so have at it.
- 00:50:14 **K1SIX** B'oub 4M Rx: Sri delay was crunching some numbers. The 240 VAC option cud PROBABLY be rewired to work on 440 3 Phase.
- 00:25:35 **KF8MY** Mike LOTW: industrial strength one? Thats what I need.
- 00:24:06 **KF8MY** Mike LOTW: do they have a 440 3phase version?
- 00:23:35 **KF8MY** Mike LOTW: If we would get some 6m prop I think it would help them...
- 00:23:11 **K1SIX** B'oub 4M Rx: Good Feet sells a 240 vac heater option, Mike.
- 00:22:03 **KF8MY** Mike LOTW: bad feet, mine are cold all the time. I have heater by my feet here to keep them warm.
- 00:20:21 **KF8MY** Mike LOTW: maybe we should sent to Todd??
- 00:19:19 **K1SIX** B'oub 4M Rx: Freezing mist, bad feet with lots o' pain, no DX. BOO-HOO :(((
- 00:18:12 **KF8MY** Mike LOTW: thought you would like that Boub, lol
- 00:17:30 **K1SIX** B'oub 4M Rx: Tnx Mike. Freezing mist moving in here now :-(
- 00:17:28 **KF8MY** Mike LOTW: see ya Terry
- 00:17:11 **KF8MY** Mike LOTW: ya, hopefully it will be back to normal spring by sunday
- 00:16:44 **N8JX** TerryB: Well good luck better go hit the shower well I can 73
- 00:16:13 **KF8MY** Mike LOTW: elements will take it, I made them out of 3/8 solid alum. hehe
- 00:15:27 **N8JX** TerryB: Normal march storm hope its the last one we have this spring but you never can tell
- 00:14:42 **N8JX** TerryB: Not fun rather have the snow than the darn ice
- 00:13:41 **KF8MY** Mike LOTW: elements are about 1 1/2 dia. with the ice lol
- 00:13:08 **KF8MY** Mike LOTW: yep, I dont mind it, just swr a little hi on 6m beams.
- 00:12:16 **N8JX** TerryB: We lose it a lot also but so far lucky, price you pay for livin in the boonies lol
- 00:11:28 **W6TOD** ToddMojaveDesert: Hang in there Mike, pretty radical sounding.
- 00:11:07 **KF8MY** Mike LOTW: good deal, we are use to the power going out here.
- 00:10:04 **N8JX** TerryB: Power
- 00:09:58 **N8JX** TerryB: Had ice earlier but all snow now, no problems with poer as of yet
- 00:08:34 **KF8MY** Mike LOTW: lot of trees down now wind is picking up.
- 00:01:21 **K1SIX** B'oub 4M Rx: (KD2CYU) >>> <https://www.on4kst.org/chat/index.php>
- 23:57:50 **N8JX** TerryB: Still snowin over here Mike so you got more to come
- 23:52:55 **KF8MY** Mike LOTW: GE, well, no power, on generator. Heavy ice and snow, I sent it east.
- 23:32:00 **KD2CYU** Nelson: LOL I think...
- 23:30:19 **K1SIX** B'oub 4M Rx: Hi Nelson. OMG I feel something! It's my feet and I have bad feet and the pain level is 11. BO-HOO. I'm not an actor.
- 23:26:19 **KD2CYU** Nelson: good evening gents
- 23:17:11 **VE3IKV** Pete @ home: 73
- 23:16:51 **K1SIX** B'oub 4M Rx: m factor. CUL
- 23:16:18 **VE3IKV** Pete @ home: I seem to recall the MUF is ~5 x foEs

Registered Users (44 of 7535):

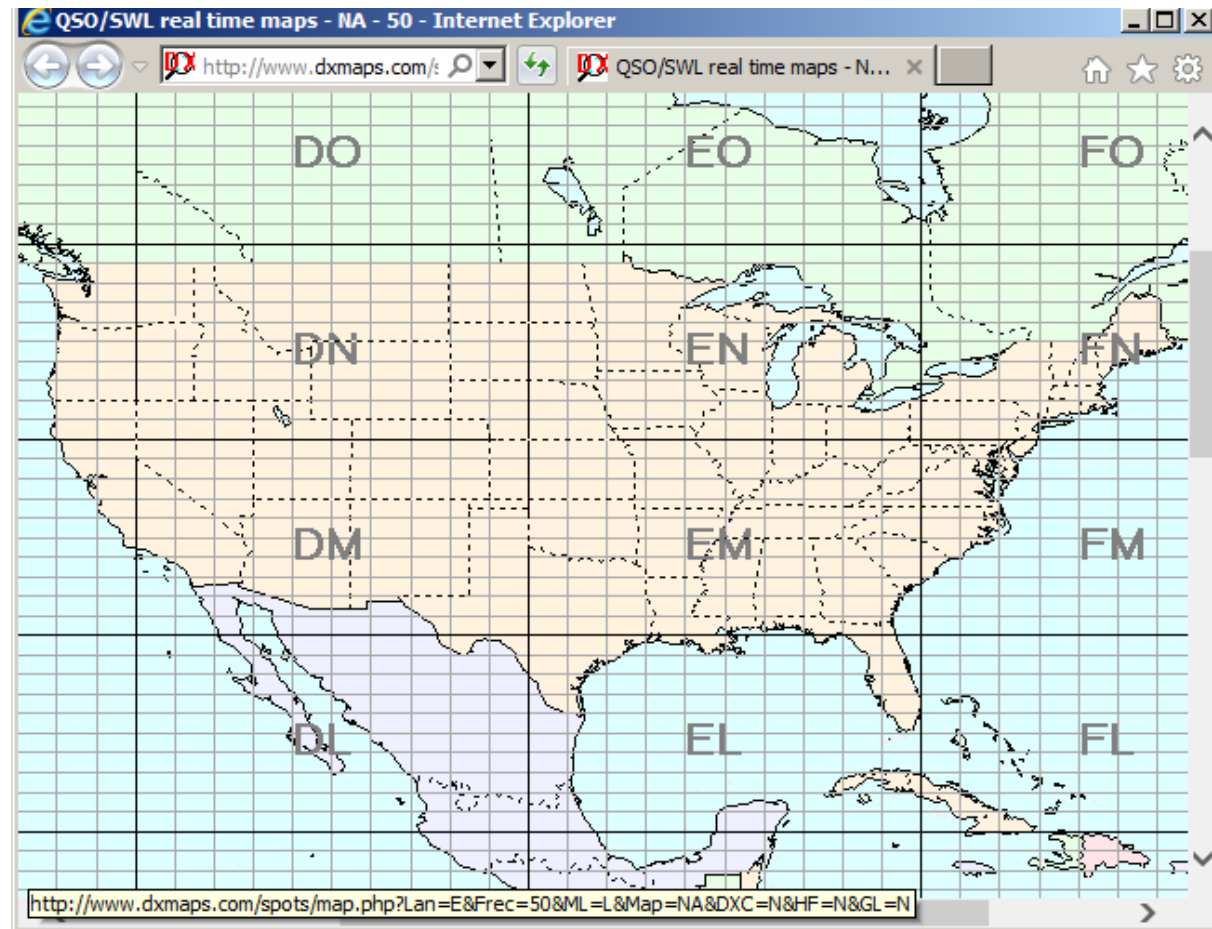
- W5ZN EM45CH Joel
- AB4B EM44HU BubbaT
- AK3C FM19XQ Rick
- CE2AWW FF47FA Dale VE7SV
- FK8CP RG37FR Rémi
- JE1BMJ QM05BR Han - SSSP
- K3SDX EI35DJ Vince
- K1SIX FN43AD B'oub 4M Rx
- K2DRH EN41VR Bob2
- K7TNT DN74FG Richard
- K9ZM EN50JB GregZM
- K41R FN42NE Matt
- K4SCFD EN40QM Jay
- KD2CYU FN20UQ Nelson
- KD5M EM60RS Edd
- KF6A EN73PJ Dan in EN73 MI
- KF8MY EN84CB Mike LOTW
- KR7O DM07BA Robert
- K5TS DM41UN Jim
- KZ4RR EM90GE Lee
- MM0AMW OT5EJ David
- N0LL EM05OS Larry
- N5DQ EM20AB Ed
- N5JEH DM65RD Ed in NM
- N8UP EN62EE Bill Krazy 8
- N4ADK CM97FF Chuck
- NW0W EM47QU Ti-g
- TG3W7R EJ89AU Scott B.
- VA7FC CN79MU Perry
- VE1PZ FN65QR Doug
- VE3MMQ FN149A Bill W4TAA
- VK4CZ Q952LP Scott
- W3UR FM19LG Bernie - LoTW
- W4ABC EL87PT Jon
- W4AS EL95TO Seb EL95
- W4ABD EM44AB Peter LoTW
- W4TAA EL87VA Bill VE3MMQ
- W5ON EM20H JayDn
- W5NZS EM15FM Larry
- W6TOD DM15CO ToddMojaveDesert
- W7T0Z DN15JL Don
- XE2HVB DL44UC Bernardo
- YU6MM KN04HG Mikos
- ZF1EJ EK99IG Eden

<http://www.on4kst.org/chat/index.php>

Operating Techniques



DX
Sherlock
will display
open paths
between
stations



<http://www.dxmaps.com/spots/map.php?Map=NA>

Operating Techniques



- **READ THE RULES!!!!!!!!!!!!!!**
 - Different contests have different rules. Some allow assistance for single op and some don't. Do NOT assume they are all the same!
- **The band will not be open continuously or with any certainty**
 - Monitor & Listen!
 - Monitor & Listen some more!!

Important Techniques



- **The Same Principles for HF Apply to VHF**
 - Tower & Electrical Safety
 - Station Ergonomics
 - Physical Fitness
 - **ETHICS !!!**
 - A system of moral values and motivation based on right and wrong
 - “The rules are black and white, we make them gray!”
K5ZD, CTU Dayton 2009

Where to Learn the Techniques



- VHF Conferences & Microwave Update
 - Central States VHF Society (CSVHFS)
 - Northeast Weak Signal Society (NEWS)
 - Southeast VHF Society (SEVHFS)
 - Western States Weak Signal Society (WSWSS)
 - Microwave Update Conference
- Not “traditional” hamfests
- Publish proceedings (compilation of technical papers)