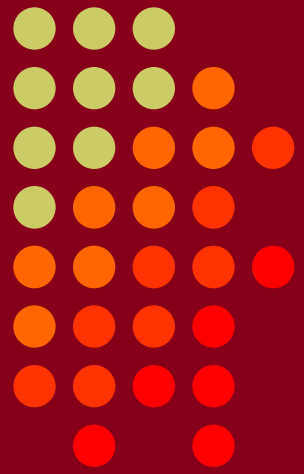
CTU Presents

Getting the Most Out of Your VHF Contesting Experience

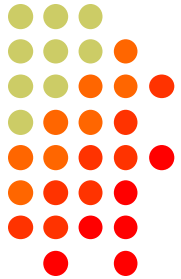


Joel Harrison, W5ZN

• CTU •
CONTEST
UNIVERSITY

ICOM

VHF Contesting – Expectations



- Advanages
  - Magic Bands
  - Super Results from Average Stations
  - Great activity to obtain new operating awards
  - Intense excitement when bands open
- Disadvantage
  - QSO rates are not normally as continuous as HF on 2 meters & above

What Contests are Available?

- **ARRL**
  - January
  - June
  - September
- **CQ**
  - July
- **Many other smaller events throughout the year**

What Contests are Available?

- **ARRL June VHF Contest**
  - The premier VHF contest of the year
  - Occurs during peak Sporadic E Season
  - Excellent weather condx for roving or mountain top operating

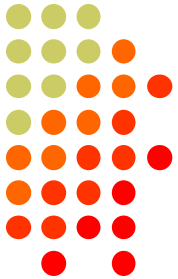
What Bands are Important?

- **6 Meters**
  - The major focus – 50.125 is calling freq
  - Spread out during contest. Stations will be on:
    - 50.080 - 50.105 CW (50.105 - 50.120 DX Reserved)
    - 50.125 – 50.200+ SSB
  - Band can open unexpectedly with Es
    - Keep a dedicated radio here or monitor by other means
  - Provides most Q's and Mult's

What Bands are Important?

- **2 Meters**
  - Second most important
    - 144.200 is center of activity but listen up and down 25 KHz or more in populated areas
  - Es can extend to 2 meters

What Bands are Important?



- **432 MHz**
  - Third most important band
    - 432.100 is center of activity and calling frequency
    - Stations will move 10 to 20 KHz up or down during heavy activity
- **222 MHz**
  - Not as populated as other three bands but plenty of activity in populated areas.
  - 222.100 is activity center

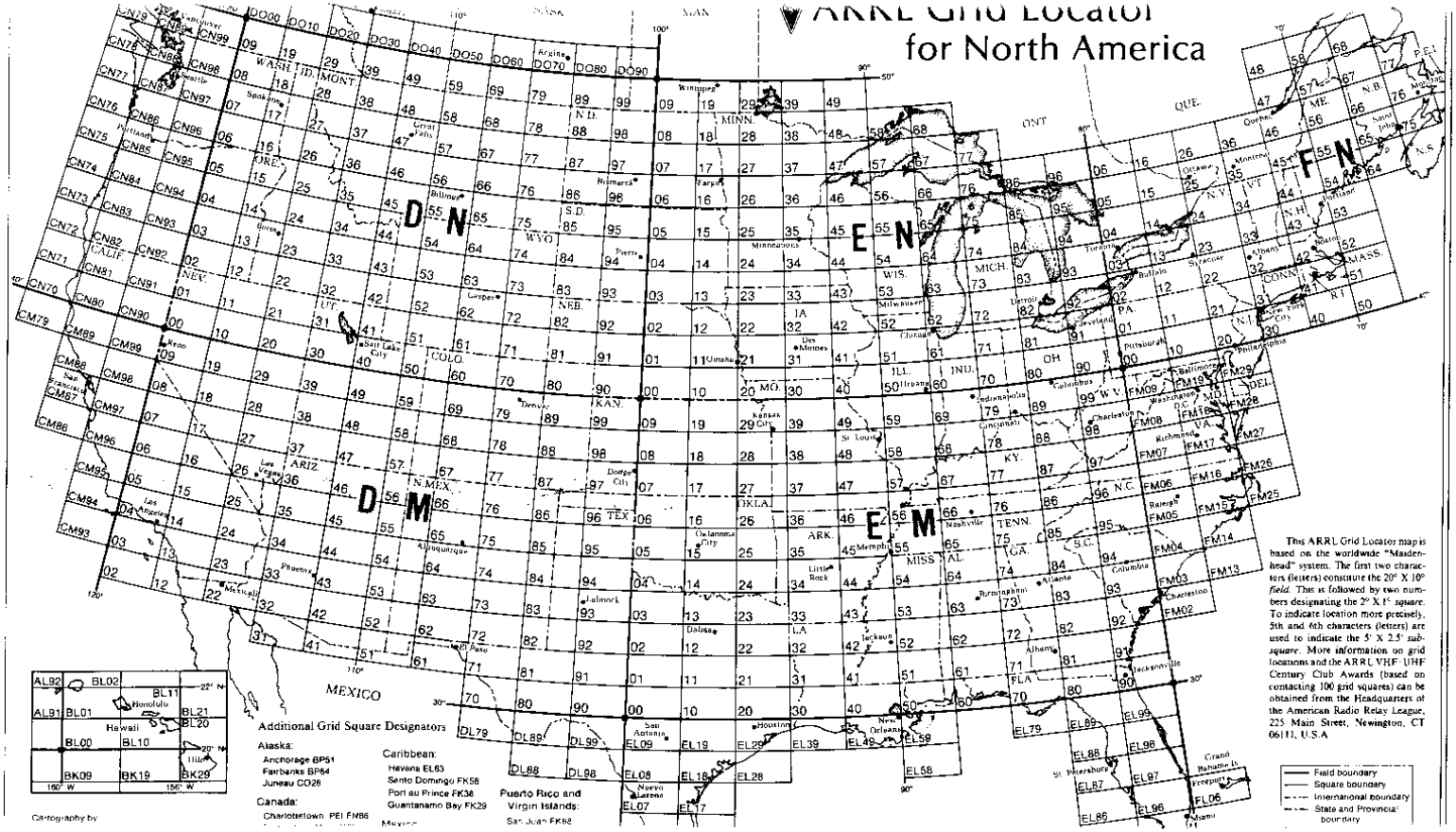
What Bands are Important?

- **Microwave Bands**
  - Not as much activity as in previous years
  - Concentrated in populated areas
  - Many rovers have these bands
  - 902.100 (or 903 in some areas) 1296.100, 2304.100, 3456.100, 5760.100 & 10368.100 is center of activity and calling frequency
    - You normally won't hear stations calling CQ here but they will move stations here from the lower bands

Categories

- **Standard**
  - Single OP
  - Multi Op
- ***Unique***
  - Rover
  - Single Op 3 Band (50, 144 and 432 MHz)
  - FM Only

Contest Exchange Grid Squares



CTU
CONTEST UNIVERSITY

ICOM

Station Basics

- **6 Meters**
  - Radio or transverter is fine
  - 50 watts is great, 100 watt is outstanding
  - 3 element antenna up at least 30 ft is good
- **2 Meters**
  - Radio or transverter is fine
  - >50 watts
  - 13 element beam @ ~50 ft

Station Basics

- **222 – 432 MHz**
  - >50 watts
  - 16 element & 25 element @ ~50 ft
  - Boom length
- **902 MHz & Up**
  - >10 watts
  - Loop yagis & parabolic (dish) antennas

Station Basics - Noise

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

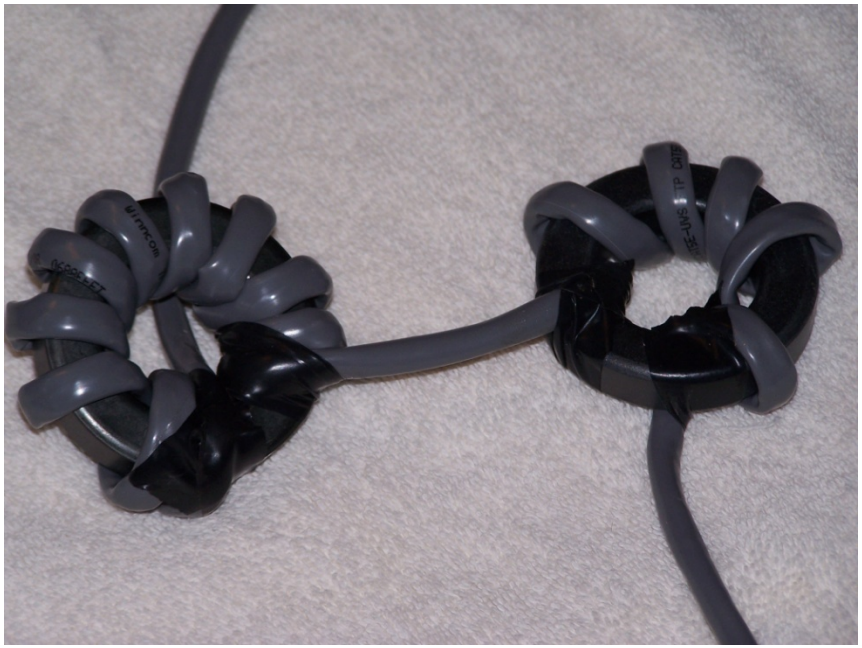
- Sky Noise
- Atmospheric Noise
- Line Noise
- Other man-made noise

Station Basics - Noise

- **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 Basics - Noise

Internet Router noise can be significantly reduced or eliminated.



Also utilize shielded CAT5 cable and connectors

Station Basics - Noise

- **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

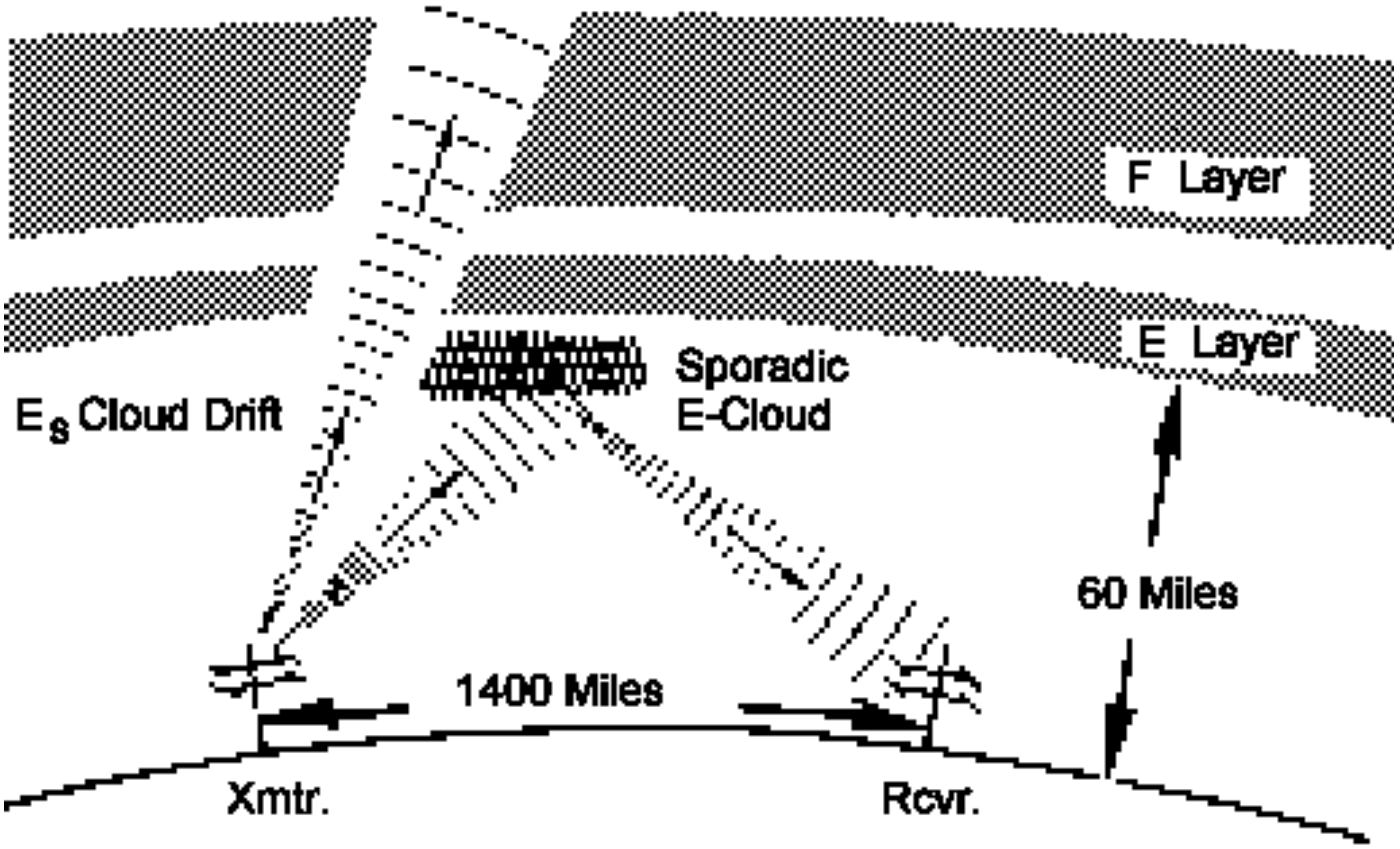
Propagation – What can I Expect

- Sporadic E – “Es”
- Tropospheric Ducting – “Tropo”
- Meteor Scatter – “MS”
- Even EME!!!!!

Propagation – Es

- **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**

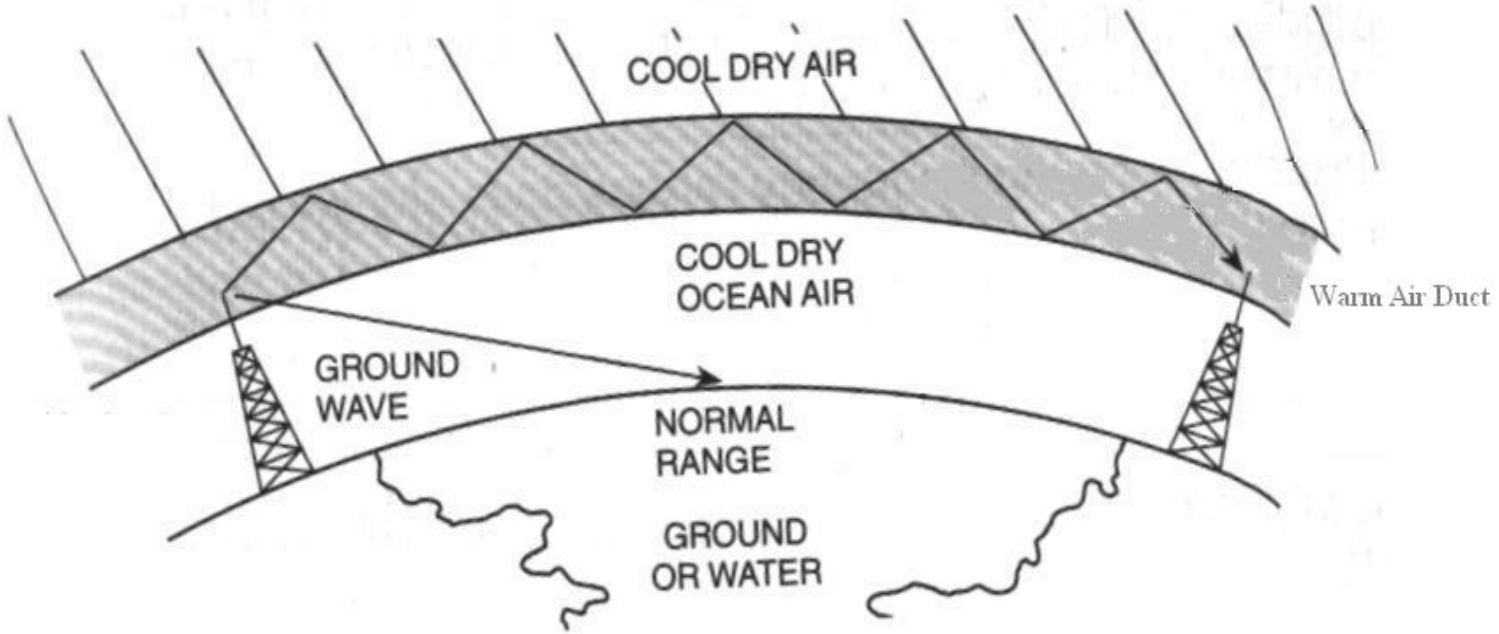
Propagation – Es



Propagation - Tropo

- **Natural atmospheric ducts that form due to temperature inversion and can shuffle VHF and UHF radio waves long distances**
  - All bands
  - Any time, but mostly warm weather months

Propagation - Tropo

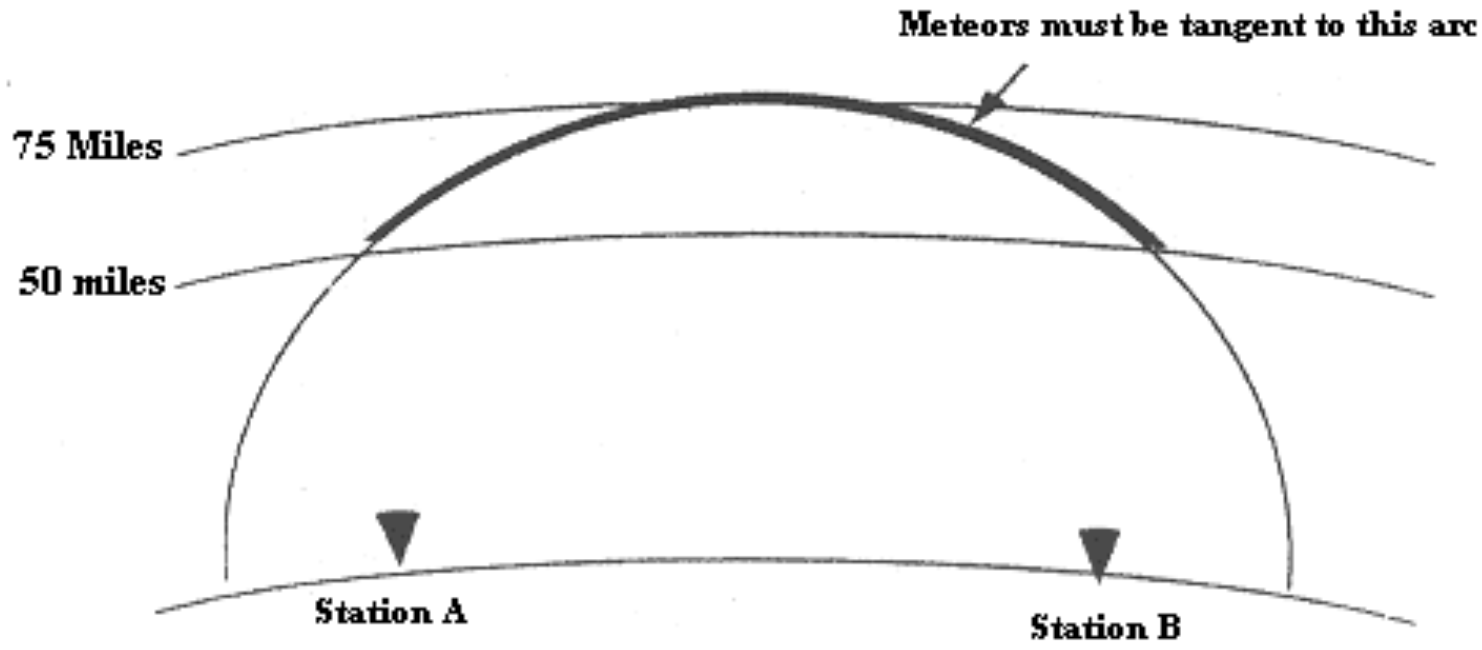


Propagation – MS

- 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 – MS

Reflection will occur when the trail is oriented as shown



Propagation – MS

- **Excellent for 50 & 144 MHz, possible at 222 MHz**
- **Very Predictable Paths**
  - Best times between midnight & approx 9 AM
  - Peak during “showers” – Anytime with high speed procedures like ***WSJT***

Equipment

- Antennas
- Receive Preamplifiers
- Amplifiers

Equipment - Antennas

- VHF antennas are small in comparison to HF antennas
- Boom lengths can be large, 30’ to 50’, but elements length & diameter is much smaller
- Antenna stacking for added gain is much easier at VHF

Equipment - Antennas

- **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
- ***Antenna Rule of Thumb #1***

  Get your VHF antennas above the tree line

Equipment - Antennas

Aiming

- Pointing your antenna in right direction is MUCH more critical than on HF
- Unless two stations are aimed very close at each other you most likely will fail.

Equipment - Receive Preamps

- **Preamp may not be needed unless your receiver has a really bad noise figure**
- **What is a "bad" noise figure??**
  - Total system noise figure depends more on antenna & sky temperature – they will dominate & you can't change them
- **At VHF and above, gain is NOT as important as a low noise figure**

Equipment - Receive Preamps

- **Assume T_{ant} = 3000°K**
- **If RX nf is 20 dB and you add a preamp with only 12 dB gain but it's nf is 2 dB you will improve your system nf by 10 dB!**
- **If RX nf is 10 db and you add a preamp with 25 dB gain but it's nf is 10 dB you will improve by 0 dB and cause other problems.**

Equipment - Receive Preamps

The Simple Bottom Line on Preamps

- ***Preamp Rule of Thumb #1***
  - Approx 90% of the entire receive system noise figure is determined by the NF of the first stage after the antenna. Coax loss adds directly to the receiver NF and can determine up to 90% of your entire system NF.

Equipment - Receive Preamps

- ***Preamp Rule of Thumb #2***

  Every time you cut your system noise figure in half you gain approx 3 dB in signal to noise ratio until you are limited by sky/antenna noise temperature

- ***Preamp Rule of Thumb #3***

  Mast mounting a preamp is like bringing the RX front end right up to the top of the tower.

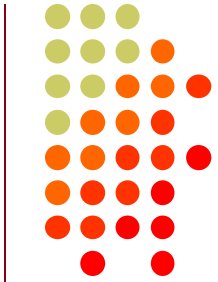
Equipment - Receive Preamps

- **50 MHz**
  - Not needed unless your radio is really deaf
    - Most new radios do need a preamp!!!!!
- **144 MHz**
  - Recommended for radios, DEMI xvtrs are FB
- **222 & 432 MHz**
  - STRONGLY recommended
- **902 & Above**
  - ***Mandatory!***

Equipment - Amplifiers

- Before you sink a lot of money into a high power amplifier, learn the real facts about “gain”!
- Only needed if you want to enter the high power category
- There are no “multiband VHF/UHF amplifiers
- Outstanding gain can be achieved by stacking antennas

Contest Strategy



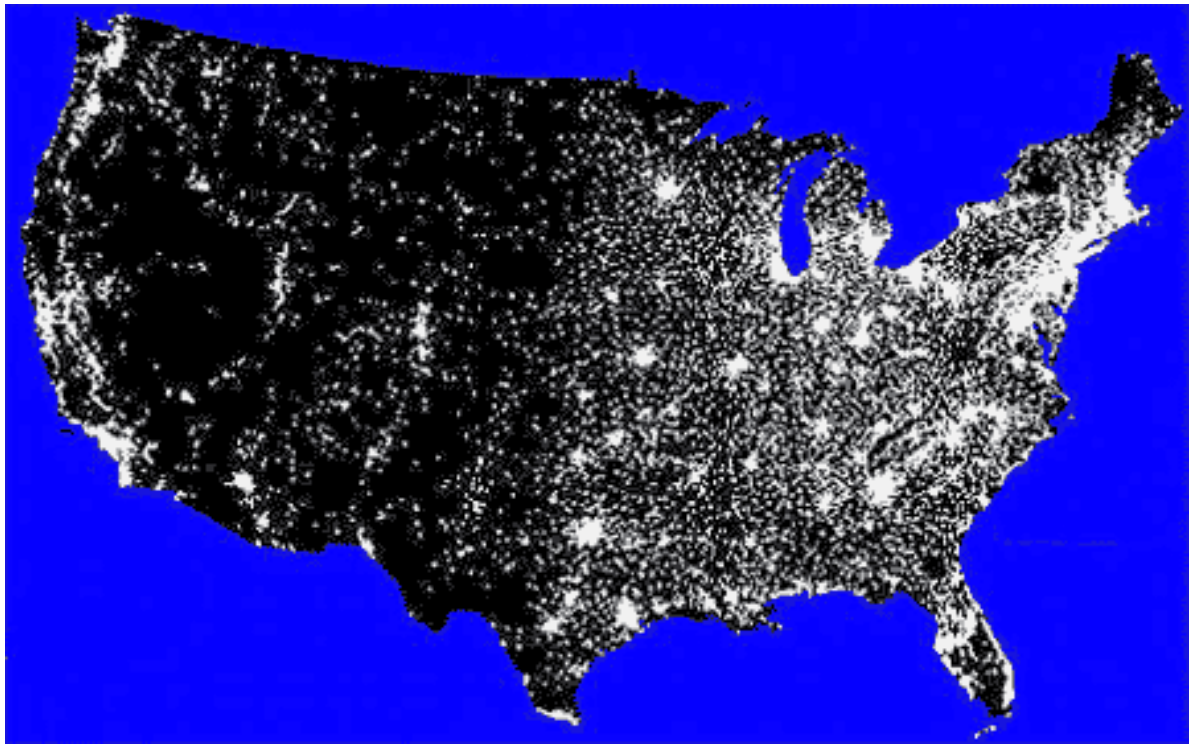
- **Once you decide what you want to do, you must fully understand what will be required to achieve that objective.**
  - How many points do I need?
    - How many Q's? How many grids (multipliers) ?
  - What equipment do I need.
  - When are the prime propagation times to particular areas

Contest Strategy

- **Determine what others are accomplishing**
  - Evaluate top 10 scores for past 10 years
- **Its not all about making the most QSO's**
  - Maximize grid multipliers

Contest Strategy

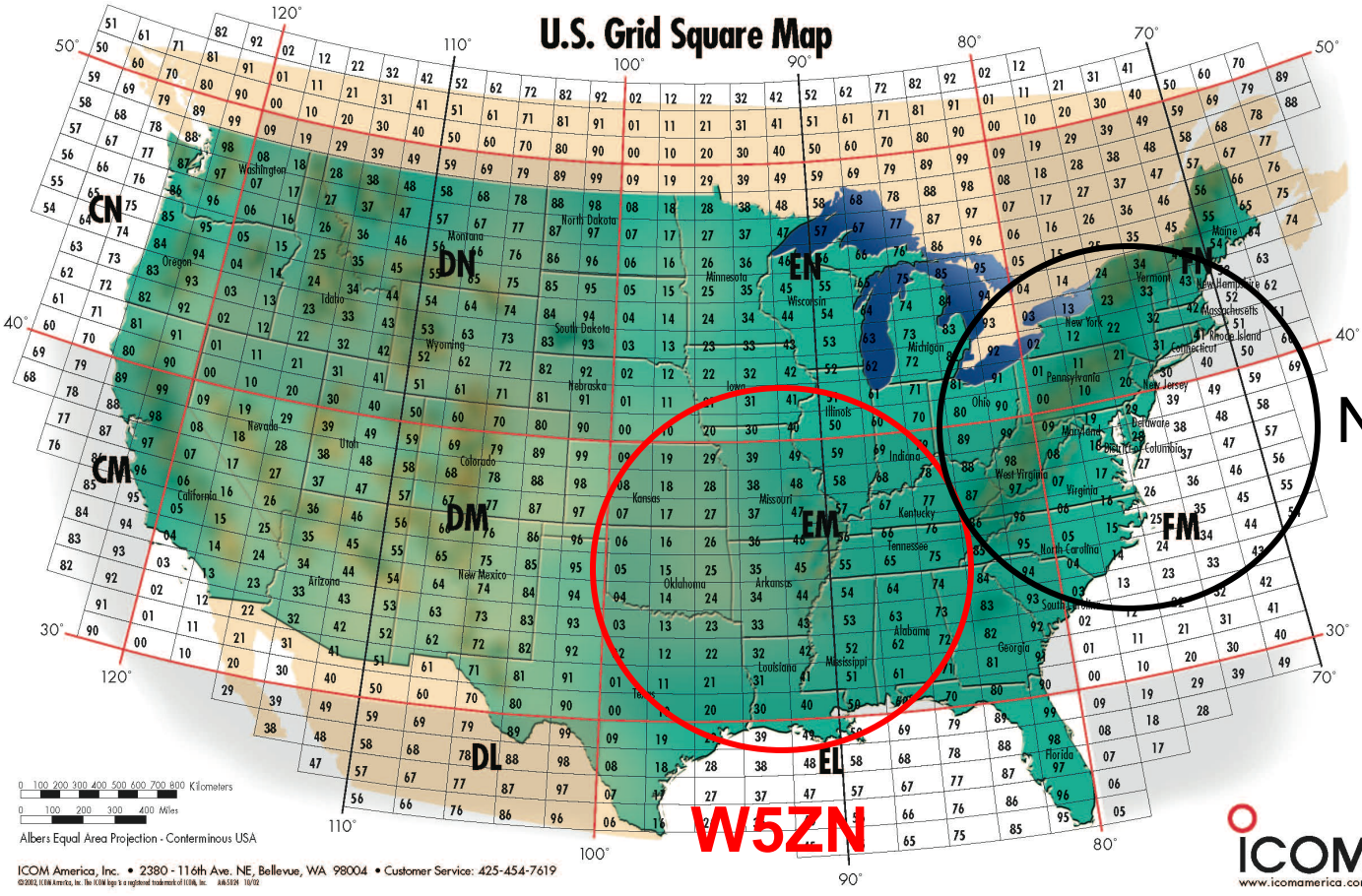
How To Maximize Your Score



Night time Satellite Photo Reveals Population Density

Contest Strategy

Grids Within 500 Mile Radius



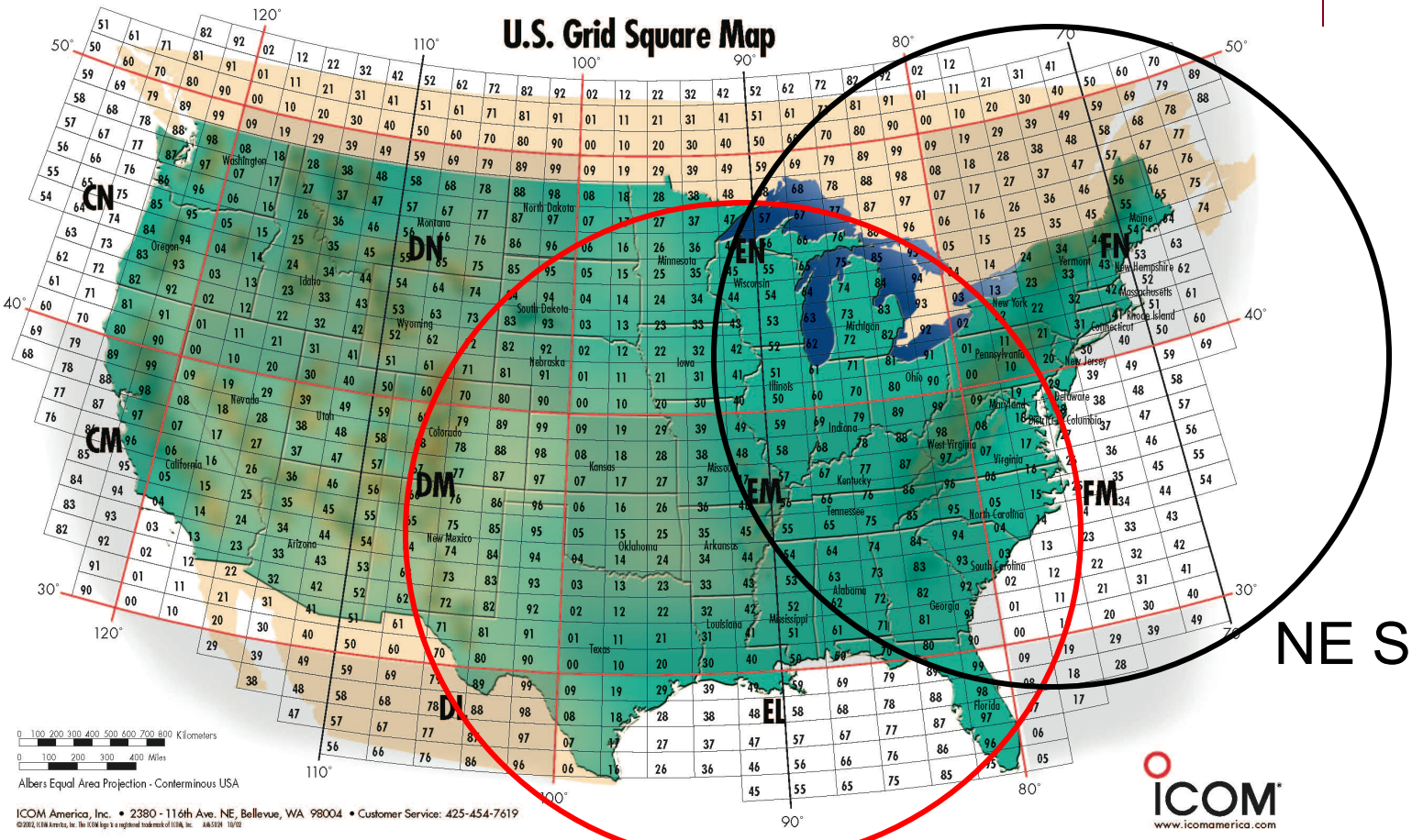
CTU
CONTEST UNIVERSITY

ICOM
www.icomamerica.com

ICOM

Contest Strategy

Sporadic E 1000 mi Radius

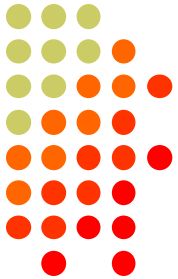


CTU CONTEST UNIVERSITY

ICOM

Contest Strategy

How Can "Dead Grids" be Activated?



- **So you want to be a Rover?**
  - What route should I plan?
  - How do I know where I am when I get there?
  - What equipment do I need?
  - What else should I plan for?

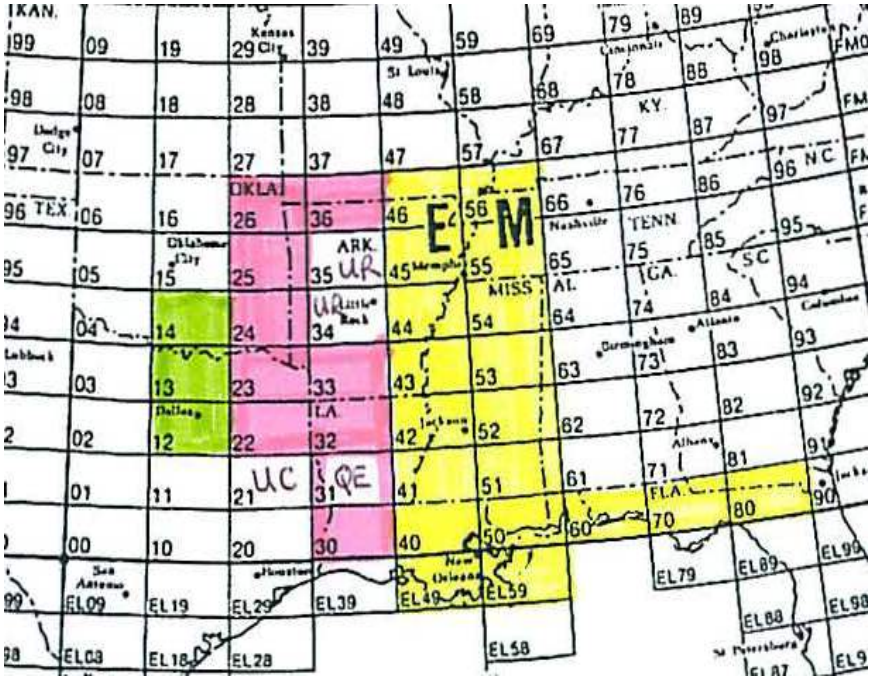
Contest Strategy
Rovers

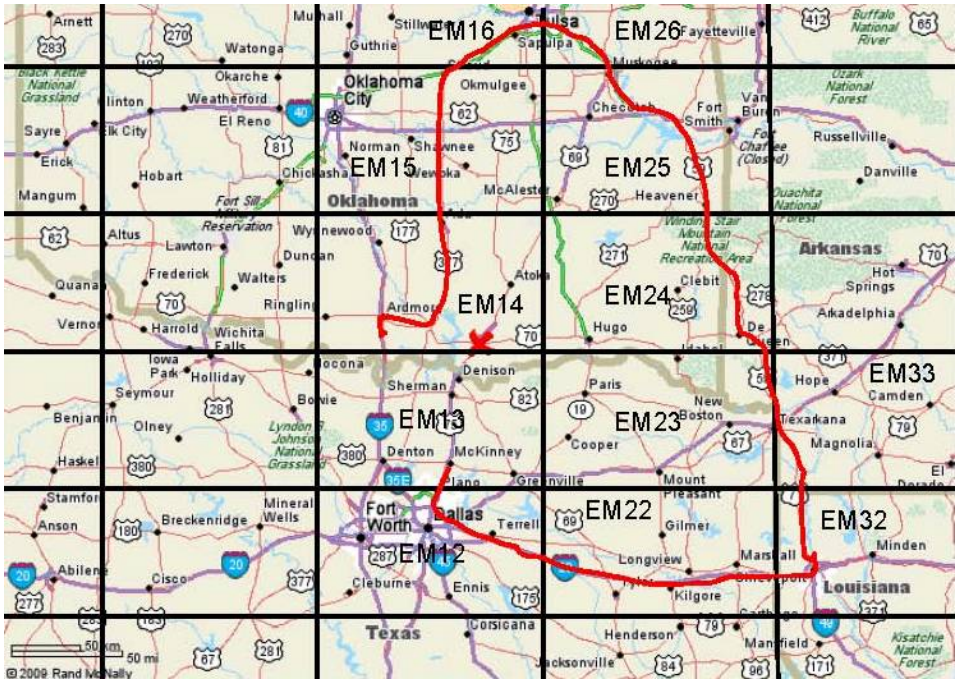
- **What route should I plan?**
  - 6 meters can open to just about anywhere no matter where you are.
  - For higher bands you should plan an approx 400 mile radius of other stations.
  - Use GPS (Smart Phone) to identify your exact location

Contest Strategy

Rovers

- **What route should I plan?**





CTU CONTEST UNIVERSITY

ICOM

Contest Strategy
Rovers

- **What equipment do I need?**
  - Multi-band VHF radios that cover 50 through 432 MHz are great!! (FT-847, FT-736, TS-2000)
    - Can interface with transverters a plus!
  - Transverters for higher bands
  - Smaller antennas

Contest Strategy
Rovers

W5LUA / WA8RJF Rover
Antennas 50 – 432 MHz

W5LUA / WA8RJF Rover
Equipment 50 – 432 MHz

CTU
CONTEST
UNIVERSITY

ICOM

Contest Strategy
Rovers

N2CEI / K4SME Rover Station
50 MHz – 10 GHz

CTU
CONTEST
UNIVERSITY

ICOM

Contest Strategy
Rovers

50 MHz – 432 MHz Rovers

Contest Strategy
Rovers

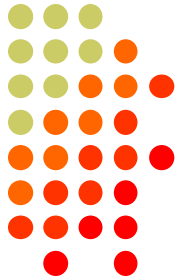
- **What else should I plan for?**
  - Bad weather
    - K4SME/N2CEI got in a tornado in 2011
  - Vehicle breakdown
  - Adequate rest over a 36 hour contest period
  - Emergency Medical Assistance

Contest Strategy
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.**

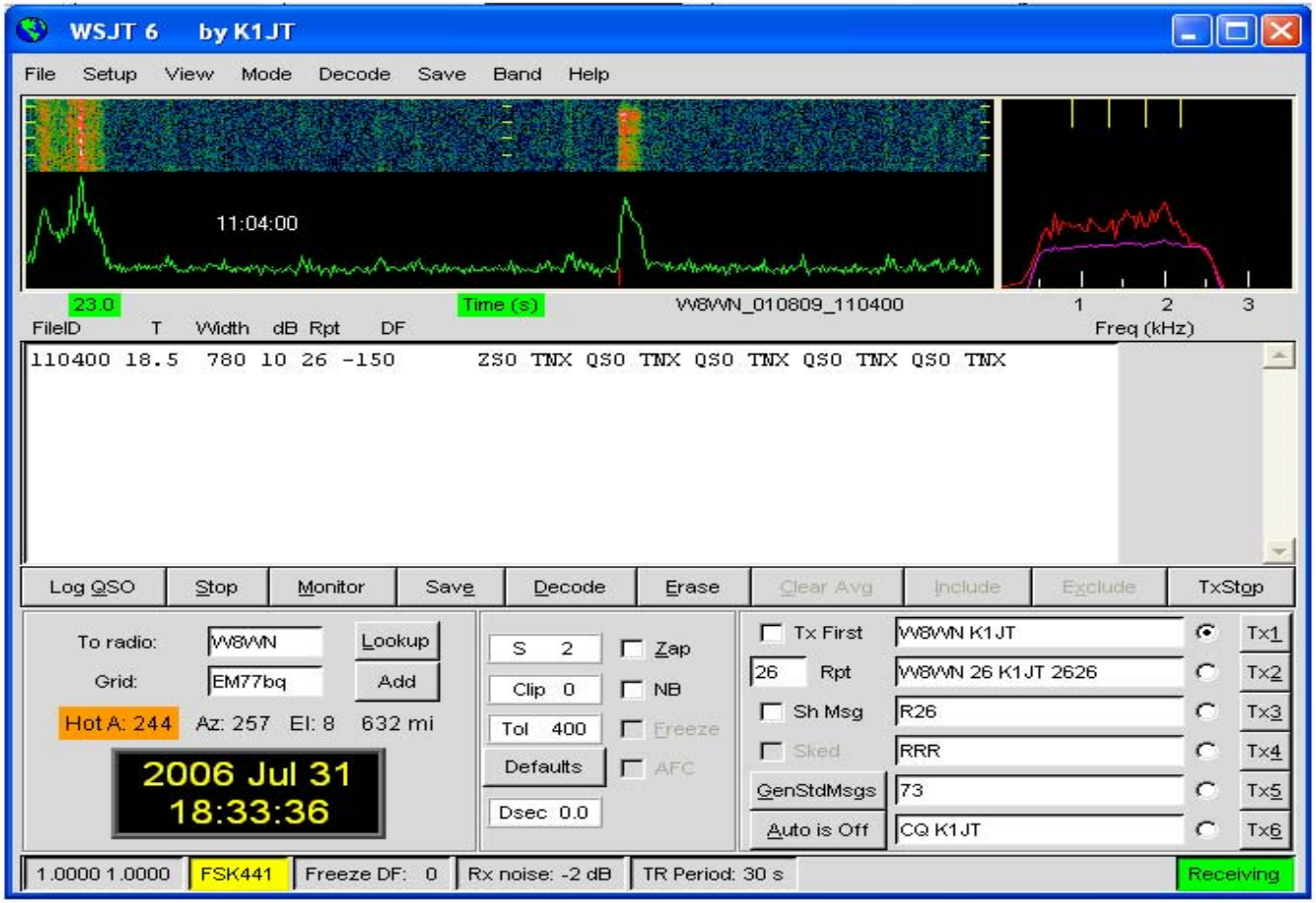
Contest Strategy
K1JT Digital Modes



- **Can Provide Outstanding access to new grid multipliers from moderate stations**
  - FSK441 for Meteor Scatter
  - JT65 for EME
- **EME for Single Yagi stations**

Contest Strategy

K1JT Digital Modes – Meteor Scatter



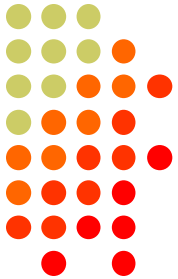
CONTEST UNIVERSITY

ICOM

Contest Strategy
K1JT Digital Modes – Meteor Scatter

- **FSK441 Mode**
  - **Calling frequencies 50.260 & 144.140**
  - **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).**

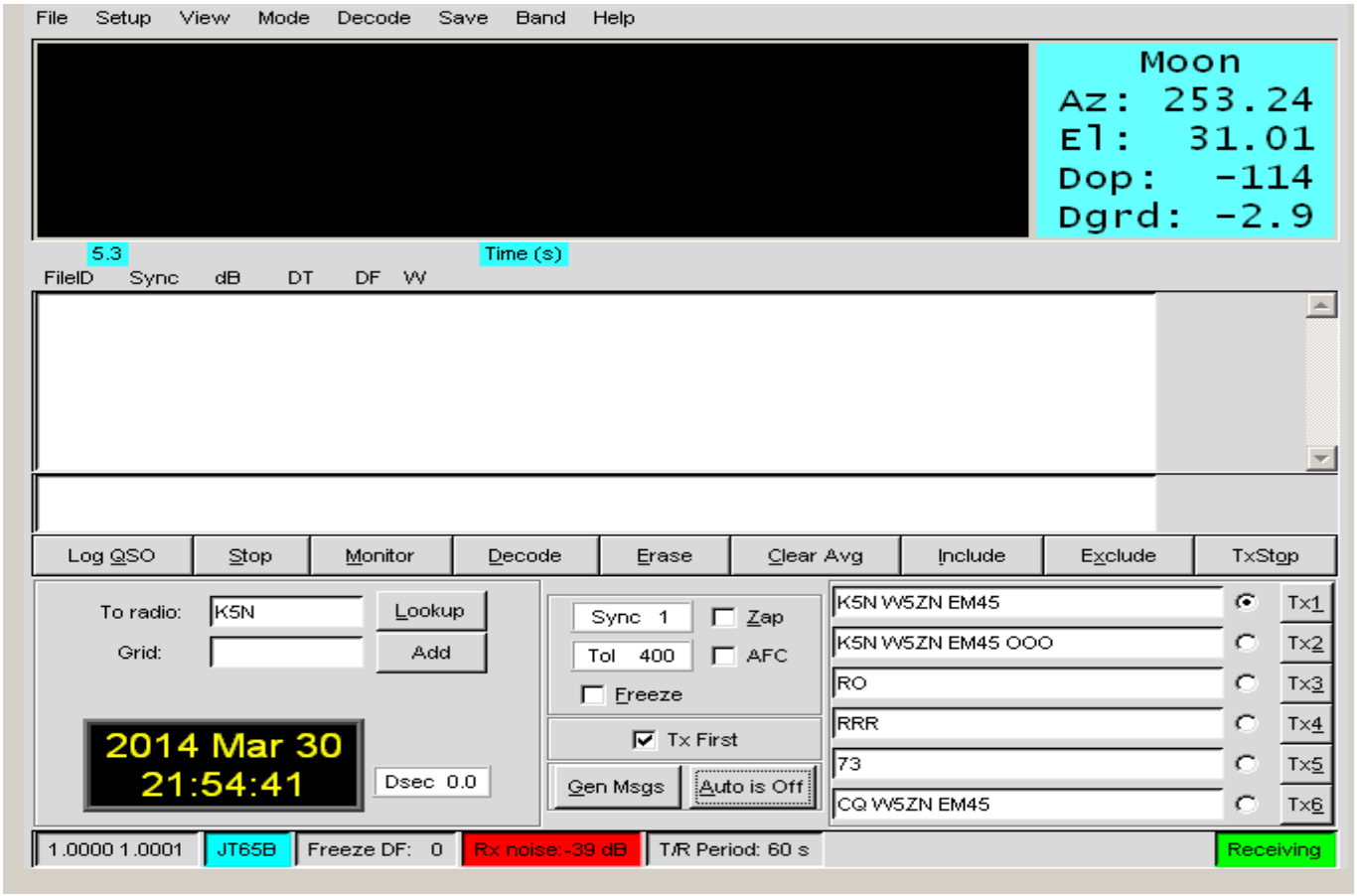
Contest Strategy
K1JT Digital Modes – Meteor Scatter



- **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.**

Contest Strategy

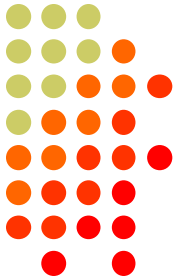
K1JT Digital Modes – Moonbounce (EME)



CTU CONTEST UNIVERSITY

ICOM

Contest Strategy
K1JT Digital Modes – Moonbounce (EME)



- JT-65B Mode
  - 144 MHz and 432 MHz
  - No Calling frequencies
  - Single antenna & 100 W can work big stations
    - More antennas + More power = More Success
    - 2 antennas & 300 – 400 watts is very good
  - Must aim antenna at the moon
    - If you can't elevate antennas then catch moon at horizon on "moonrise" or "moonset"

Contest Strategy
K1JT Digital Modes – Moonbounce (EME)

- **JT-65B Mode (Cont)**
  - **Run 1 minute sequences**
    - **Normally eastern most station runs 1st "even" period (beginning at 0, 2, 4 etc min) and western station runs 2nd "odd" 1 minute period (1, 3, 5 tec min).**
  - **After calls are sent and received send report**
    - **Report is "OOO"**
  - **After report is received send "RO"**
  - **Complete with "R" and "73"**

Contest Strategy
K1JT Digital Modes

- **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 Technique

- **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
- **CAUTION!! Stay within the rules for your operating category when using the above!**

Operating Technique

- **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!!

Operating Technique

- **6 Meters**
  - Daylight hours, early evening
  - ***PRIORITY band when it is open***
- **144 MHz & Up**
  - Anytime
- **Sunday Morning – DO NOT MISS**
- **Midnight to 5 AM – DEAD!!!**
  - Some Rovers may still be roaming
  - Meteors & EME with JT Modes

Operating Technique

- **2 Meter FM**
  - FM is NOT a four-letter word
  - The Q's count and can add up nicely
  - Excites the local club and introduces them to contesting
  - They get to be a part of the big winning team!
  - Give a presentation at the local club, most new hams have an HT.

Operating Technique

- **Call CQ in several directions**
  - Keep rotating the antennas every few minutes
  - Just because you heard nothing in one direction an hour ago doesn't mean no one is there. A station may now have their antennas your way and listening / CQ'ing
  - If you hear a weak partial move your antennas

Operating Technique

- **Keep Track of Grids Not Worked**
  - Keep track of grids not worked. If you know there are stations there keep going back to that beam heading and listen / call CQ.

- **Move Stations to Other Bands**
  - If you work a station on 2 meters (or 6 meters within range) ask them to move to another band for a quick QSO.

Other Important Points

- **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 Can I Learn More?

- 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)