

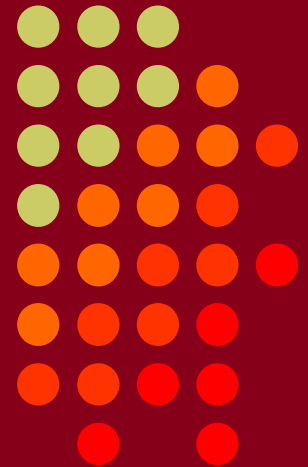
# CTU Presents

## Next Level Contesting; Making the Move to SO2R

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• CTU •  
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# What is SO2R?



- Single Operator
  - One human doing all operating
- Two (or more) Radios
  - Only one transmitted signal at any time
- Technique has been around since 1960's
- Became a competitive necessity in late 80's

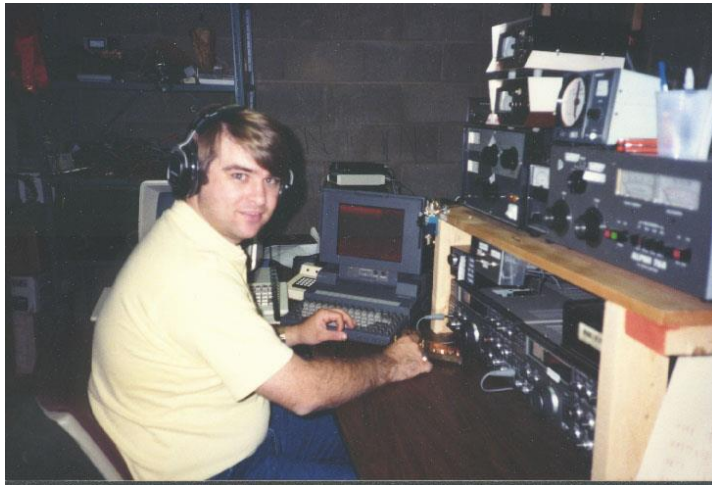
# My History with SO2R



**K5TM – SS CW 1980**



**N5AU – SS CW 1984**

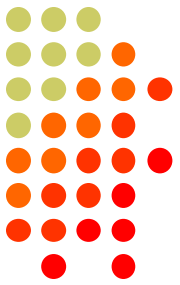


**K5ZD/3 – SS CW 1990**



**K5ZD/1 – May 1996**

# Why Use Two Radios?



- Maximize productivity – boost score
- Make better decisions – boost score
- Reduce boredom – boost score
- Increase the fun – boost score
  
- Be more competitive (WIN!)

# Why Does SO2R Help?

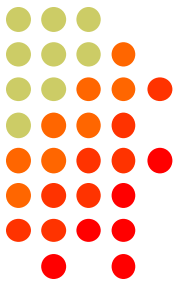


Enables better use of time



Use transmitting time to listen  
and line up QSOs

# How Does SO2R Help?



- Winning requires...

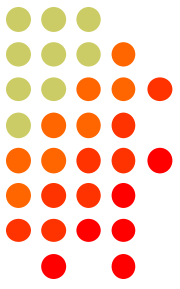
- Working the most guys who “aren’t in the contest” – they answer CQs
- Working the most rare multipliers – they answer CQs

*ABC  
Always Be CQing*

- Paradox

- You must also work everyone else who is calling CQ!

# SO2R or 2BSIQ?

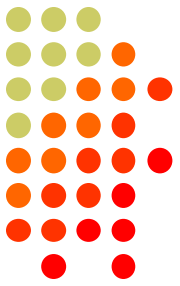


- 2BSIQ\* – Name given by CT1BOH to the concept of interleaving CQs on two bands
- Same infrastructure as SO2R
- Can greatly increase rates on CW and RTTY
- SO2R is a prerequisite to doing 2BSIQ

\*2BSIQ - Two Bands Synchronized Interleaved QSOs

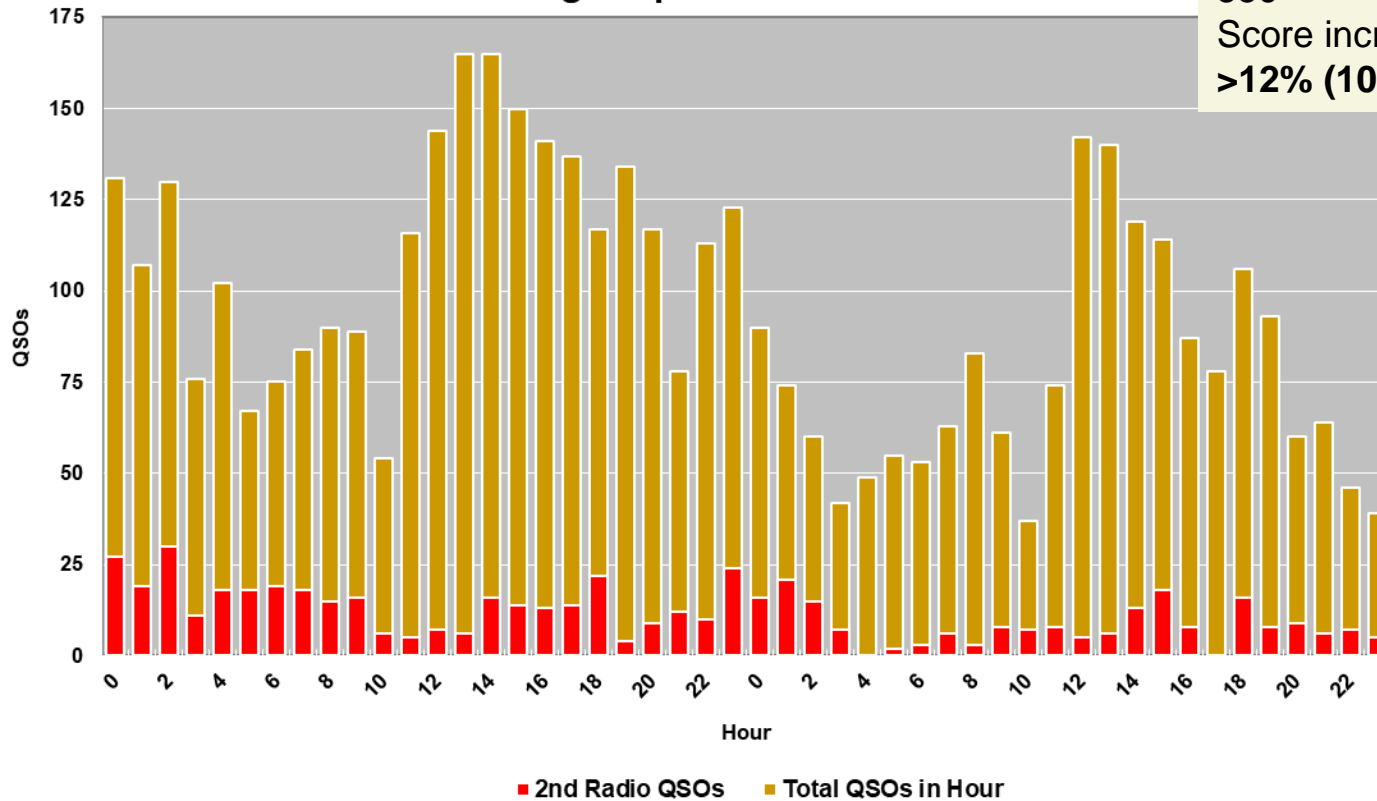
See [https://www.contestuniversity.com/wp-content/uploads/2019/05/3-N6MJ-2BSIQ-and-SO3R\\_-Riding-the-edge-of-Human-Capabilities.pdf](https://www.contestuniversity.com/wp-content/uploads/2019/05/3-N6MJ-2BSIQ-and-SO3R_-Riding-the-edge-of-Human-Capabilities.pdf)  
or <https://www.of.org/wp-content/uploads/2017/04/2BSIQ-20170331.pdf>

# How Much is SO2R Worth?



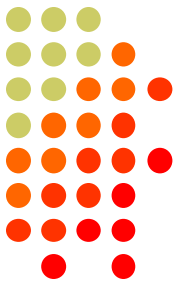
**K5ZD CQWW CW 2000  
Single Op Unassisted**

Second radio QSOs  
**550**  
Score increase  
**>12% (10-15% is typical)**



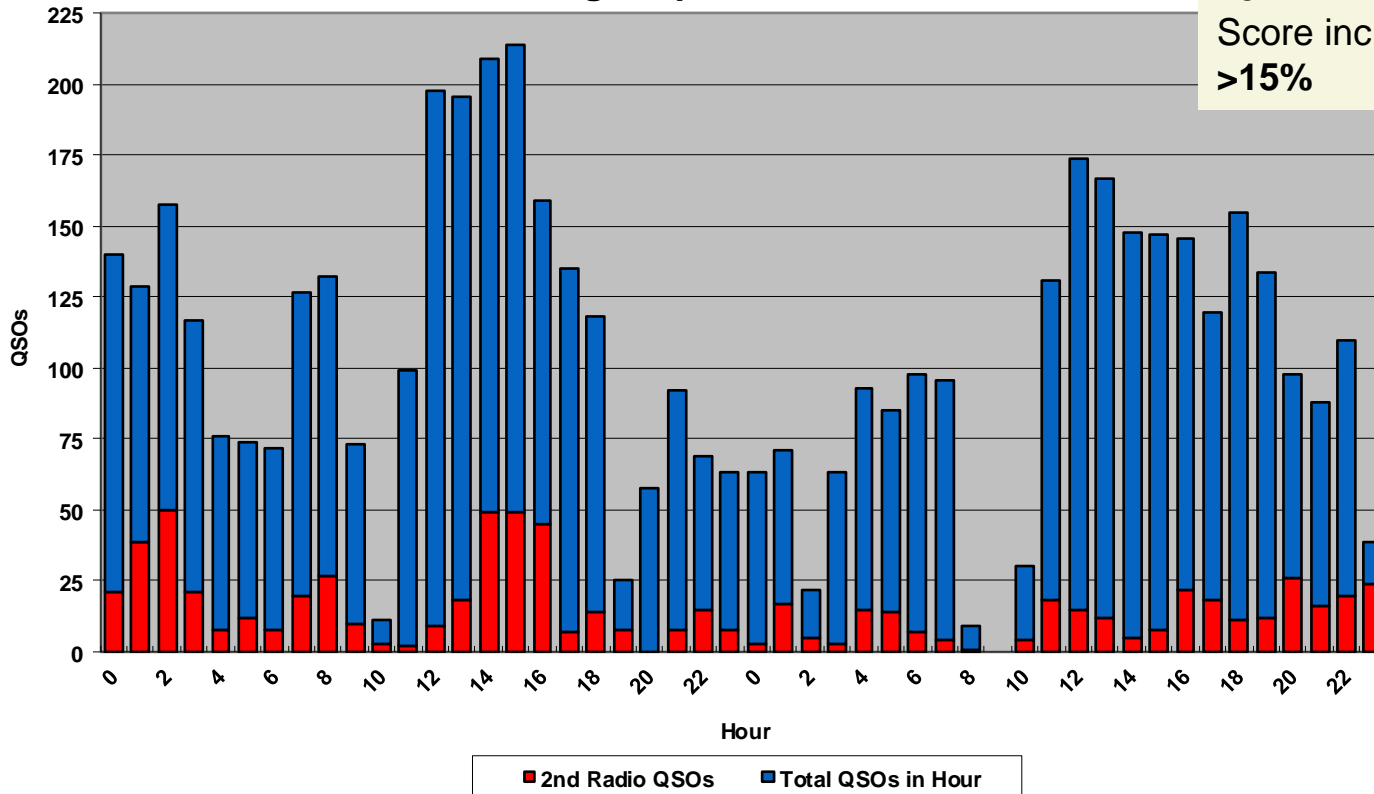


# How Much is SO2R Worth?



**K5ZD CQWW CW 2023  
Single Op Assisted**

Second radio QSOs  
**731**  
Score increase  
**>15%**

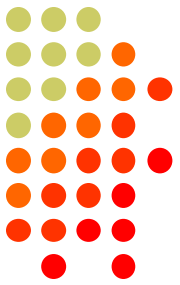


# When is SO2R Most Effective?



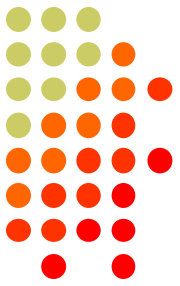
- Best when you have:
  - Ergonomic station design (easy to use)
    - Efficient (and automated) audio switching
    - Minimal self-interference
  - Low to moderate QSO rates
    - Less than 80/hour
    - Especially helpful for low power or QRP
- Least effective when:
  - Very high noise situations
  - You're unable to hold a good run frequency

# How Do You Do It?



- *Call CQ!*
- When transmitting, dial the second rig's VFO!
  - Look for multipliers
  - Look for QSOs (best use of time in low-rate situations)
  - Check for band openings

# What Does it Sound Like?



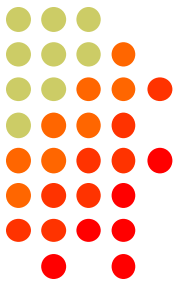
- Listen to one radio at a time into both ears
- Listen with one radio in each ear
- Listen to one rig whenever you're transmitting on the other
- Do both
  - Split audio, but never be more than a keystroke away from putting both ears on the radio of interest

# How Do You Get Started?



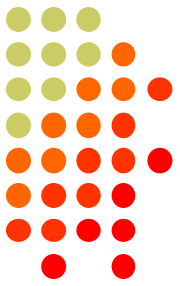
- Add a second radio!
- Minimal setup:
  - Two inexpensive radios, two multiband antennas
  - Manually switch the key/mic line and RX audio between rigs
  - Ensure that you cannot transmit on both rigs at the same time; this is illegal in almost all contests
  - Protect the receiver front end!

# The Challenges of SO2R



- Achieving zero interstation interference
  - You must be able to hear while transmitting
- Efficient switching
  - Minimize complexity of using two radios
- Learning the skills
  - Requires practice!

# Minimizing Interference



- Antennas
  - As far apart as possible — difficult for most of us
  - Avoid tribanders or multi-band antennas if possible — less rejection of other bands
- Radio Protection
  - Coaxial stubs — good, especially with monobanders
  - Band-pass filters — better
  - Receiver protection circuit

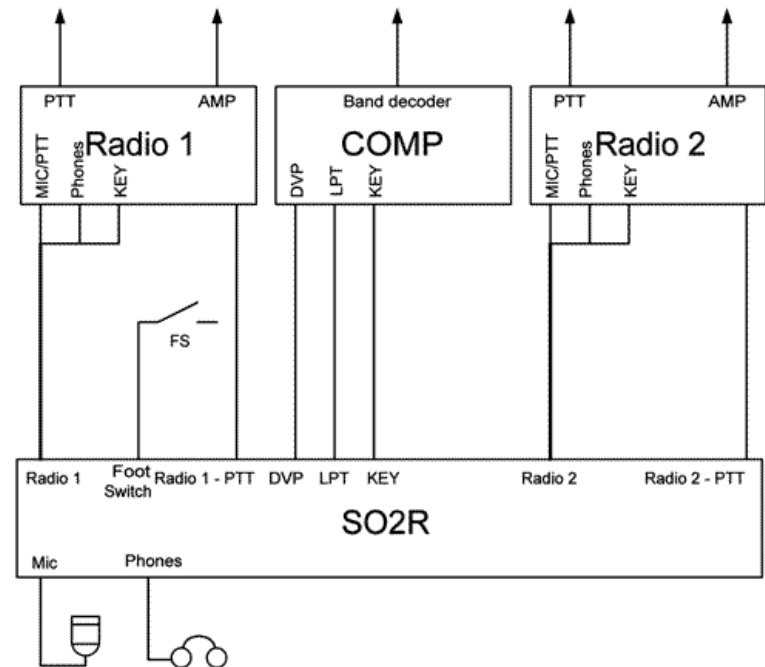
*Managing Interstation Interference by W2VJN*  
[https://www.vibroplex.com/techdocs/INRAD/MII\\_W2VJN.pdf](https://www.vibroplex.com/techdocs/INRAD/MII_W2VJN.pdf)

# Efficient Switching



- The SO2R controller needs to deal with
  - Receiver audio
  - CW key line and/or mic audio
  - PTT
- Station switching deals with
  - Antenna feedlines
  - Associated band-pass filters or coax stubs

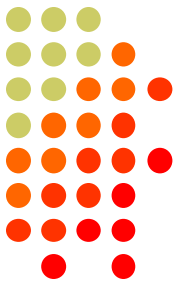
## Typical SO2R Setup



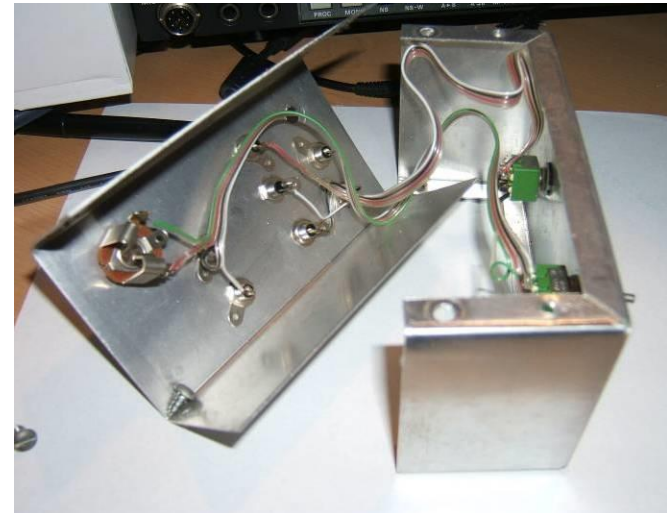
Source: <http://www.ok1rr.com/view.php?cisloclanku=2004122505>



# My First SO2R “Controller”



Front View



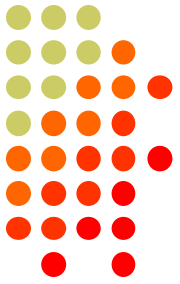
Inside View



Rear View

**This simple box won many contests!**

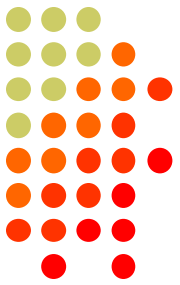
# SO2R Controllers



- Ham Radio Solutions, EZMaster, \$600+
- microHAM MK2R, \$800+
- Top Ten DX Doubler, \$200+
- RigSelect, new in beta
- Array Solutions SO2R Master, no longer avail
- Home-brew solution, <\$100 depending on features and parts used.



# Computers and Software



- Interface rigs to PC
  - Frequency control (serial/USB interface)
- Use all the control outputs available to you
  - CW output (serial or parallel) and paddles (parallel)
  - PTT output to key radio(s)
  - Radio A/B select output for switching receiver audio/CW/voice
- Software
  - All of the major contest loggers support SO2R
    - WriteLog
    - N1MM+
    - Dxlog
    - WinTest
    - TRlog
  - Two logging windows
  - Multi-keyboard support
  - Switching and Automation

# One Keyboard or Two?



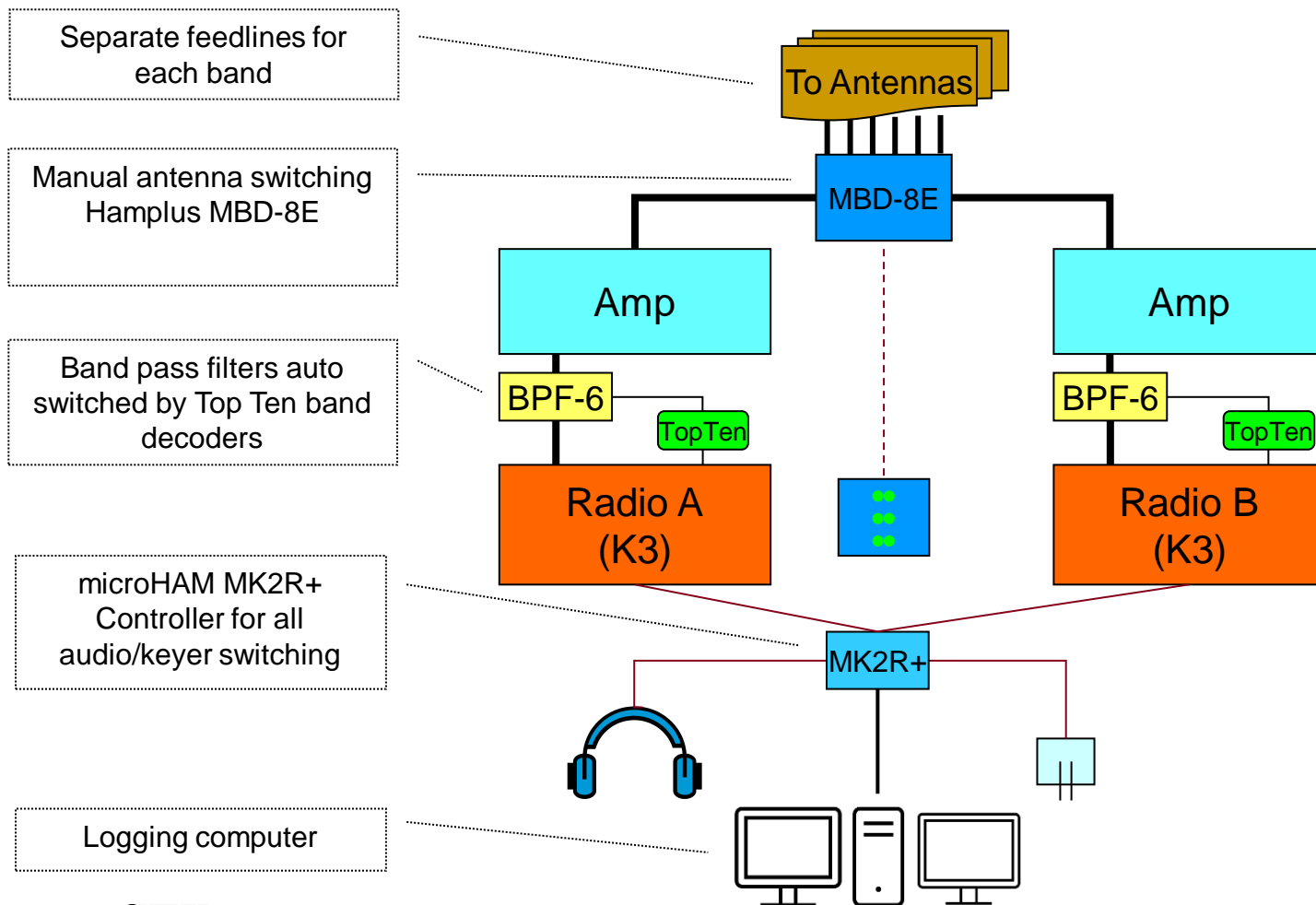
## One keyboard

- Keep hands on one keyboard
- Requires good keyboarding skills to change radios quickly
- Less equipment

## Two keyboards/computers

- Requires more physical movement (less ergonomic)
- Enables data entry on either radio without impacting the other
- Requires more room on the operating desk

# K5ZD SO2R Station Diagram



# K5ZD Station Layout



Rotators on left so can turn while sending

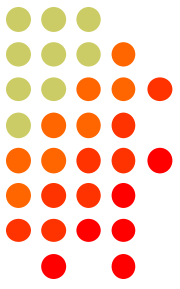
Monitor near keyboard to reduce head movement and mistakes

L-shape table keeps everything within reach

Antenna switches on right to minimize chance of changing while sending



# What About Low Power/QRP?



- SO2R is very effective with a small lot and close spaced antennas for LP/QRP entrants
  - You can get by with less filtering or antenna separation
- You can do well with simple antennas
  - Tribander for the CQ rig
  - Wires, such as parallel dipoles with single feed point, for second radio
- It's possible to double your rate, especially during slow times
  - Call CQ whenever possible
  - Use tune second radio while waiting your turn in a pileup

# Please...



Don't attempt doing two radios until  
you have mastered using one very well



# You are ready for SO2R when..



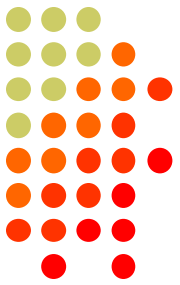
- You are operating one radio and find yourself wanting to
  - watch TV
  - read a book
  - look at your phone

# Caution



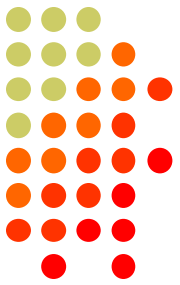
- Learning takes time...
  - Prepare for a few contests where score may not improve
- Example: Driving a car
  - Had to think about everything at first
  - With experience, able to focus on other things

# SO2R Skills



- Know the “flow”
  - Contest QSOs have a rhythm and sequence
  - Use timing to know when you can make it work
- Keyboarding skills
  - Know your software
- Practice until it is automatic

# How to Practice SO2R?



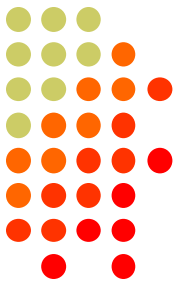
- Operate RTTY contests
  - You can focus just on the “flow” and switching
  - Transmissions are very long
  - Computer does the copying
- Any contest with activity on 2 or more bands
  - Call CQ on one band while S&P on the other
  - Try S&P on two bands at same time
- Listen to two audio streams
  - W4AN would turn on both radios in shack and try to follow two QSOs on CW while doing other things

# Technique Differences for SSB?



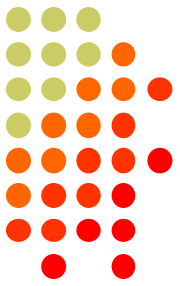
- SSB is more difficult
  - Transmissions are shorter
  - More QRM, harder to hold CQ frequency
  - Computer doesn't do all the talking
- Tips
  - Use voice keyer to CQ
  - Voice keyer to call stations and send exchange on second radio
  - Focus on “easy” QSOs or multipliers only

# Final Advice



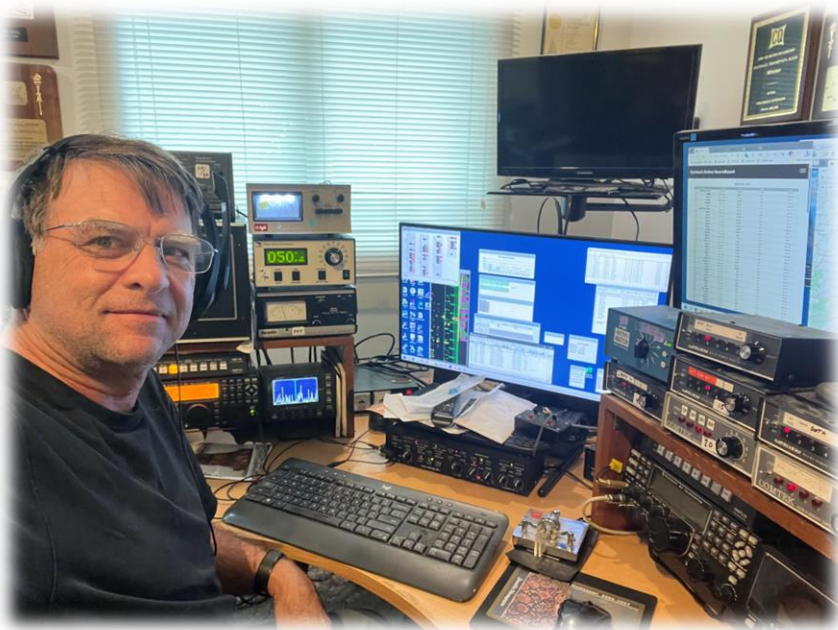
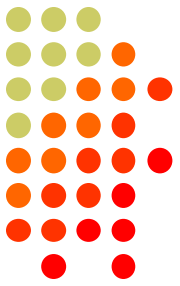
- The purpose of SO2R is to increase your efficiency
  - Don't lose your run frequency!
  - Make smart decisions about who you call on the second radio
    - Snappy operators with good signals are best
    - Be loud enough to work whomever you call
- Don't be an SO2R lid
  - Use frequencies wisely and be courteous
  - Anyone listening to you on the air should not be able to tell that you're doing SO2R

# SO2R Resources



- Hear and watch SO2R operation
  - KA1IOR YouTube video series
    - [http://www.youtube.com/watch?v=kHCveAeju\\_A](http://www.youtube.com/watch?v=kHCveAeju_A)
- Lots of station photos
  - K8ND SO2R Resources
    - [http://www.k8nd.com/Radio/SO2R/K8ND\\_SO2R.htm](http://www.k8nd.com/Radio/SO2R/K8ND_SO2R.htm)
- Article about one contester's experience
  - ZS6AA A Simple SO2R Contest Station
    - <http://zs6aa.files.wordpress.com/2008/02/a-simple-so2r-contest-station.pdf>
- Tips on advanced SO2R techniques
  - N2NT Presentation at CTU 2016
    - <https://www.contestuniversity.com/wp-content/uploads/2021/03/8.-N2NT-CTU-2016-Improving-Single-Operator-2-Radio-SO2R-Techniques.pdf>

# Questions?



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