



PVRC Newsletter

October 2020

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Website: <http://www.pvrc.org>

Meeting Info: <http://www.pvrc.org/chapters.htm>

Facebook: <https://www.facebook.com/groups/PotomacValleyRadioClub/>

President's Letter – Tom K3AJ

Congratulations to the following PVRC members who are recipients of PVRC President's Leadership Awards for 2019:

Matt Shelburne W4GO – Most Improved Contester

Matt has been a PVRC member since 2018 and is a member of the Rappahannock Chapter. First licensed in 2012, he is active chasing DX and contesting on all bands from 160M through 70CM. He operates all modes – SSB, CW, RTTY, FT8 and other digital modes. He has a unique antenna farm of many directional and non-directional antennas, all supported by trees! Matt also has a serious mobile station set up and has made some epic mobile tours during the VAQP in 2018, 2019 and 2020. Since joining PVRC in 2018, Matt has submitted 20 5M scores and has amassed over 5 million points in the 5M Award Program, mostly as a single op, but also via some multiop stints at NR4M and KA4RRU.

Mark Bailey KD4D – Leadership of the PVRC Bylaws Team

If you have been a PVRC member for any length of time, you surely know that Mark is a recognized world-class contester. He has achieved many winning scores as a single op in both CW and SSB contests, generally operating from other members' stations. He is a mainstay of Team W3LPL, where he has excelled at the very difficult role of leading the 40M team and has also led multiop efforts at N3HBX. Mark has been a competitor in WRTC 2018 and is on-track for a return to WRTC in 2022. A PVRC member since 1997, Mark has served the club in many ways, including serving as a past President. In 2019, Mark took on the most difficult task of leading a team examining some much-needed updates to the PVRC bylaws. Mark is very skilled at managing both business processes and people and put those skills on display, achieving a carefully crafted consensus accepted by the Trustees and approved by the members. We owe Mark and the Team (see below!) a debt of gratitude for getting this done.

Jay Horman W3MMM – Leading PVRC’s effort to achieve CQ Contest Hall of Fame Status for W3ZZ

Jay has been a member of PVRC since 2008 and a ham since 1982. Jay is an active contester, with many scores submitted and achievement of the 5 Million level in the 5M Award Program. Jay is currently serving as a Vice President of PVRC. He epitomizes the old saying, “If you want something done, ask a busy person.” Jay has demanding family and career obligations but felt a real passion around leading this effort. It took two years and a failed attempt in 2019, but in April 2020 we got the good news that PVRC legend Dr. Gene Zimmerman, W3ZZ (SK) was inducted into the CQ Contest Hall of Fame. Preparing a nomination that would elicit sufficient support took a lot of research and understanding of the process involved.

Dick Allardyce, N4RA – Rejuvenating the VA Metro Chapter

Dick accepted the challenge of rejuvenating the dormant VA Metro Chapter. What with the number of members living in NOVA and the traffic challenges of getting to meetings in that environment, this wasn’t an easy task. Dick was tenacious and did not give up when the first venue tried wasn’t too successful. Just before the pandemic hit, Dick hit the jackpot with the first well attended meeting in NOVA in quite a long time. And he has hung on and kept the chapter going via on-line meetings. Dick is a real veteran of PVRC, being a member since 1976 and is a very active one at that, now closing in on 18 million points earned in the 5M Award Program. Although Dick lives in Northern Virginia, all of his operating is done from his station in Yellow Spring, WV – both on-site and remotely.

Glen Anthony Brooks, WM3T – For outstanding service as chairman of the SW VA Chapter

Anthony has a history of service throughout his long association with PVRC – he has been a member since 1996 - and has served as Secretary of PVRC. A few years ago, Anthony stepped up and took over the SW VA Chapter at a critical time and was able to have it grow in numbers and activity level under his leadership. Anthony has been an active contributor to PVRC on the air, with over 60 scores submitted and is now very close to the 10 million level in the 5M Award Program.

The following PVRC members will be receiving President’s Service Award certificates for their contributions to PVRC as members of the PVRC Bylaws Team:

**Doug Hart, AA3S
Ken Low, KE3X
Kay Craigie, N3KN
Ken Claerbout, K4ZW
Nate Moreschi, N4YDU
Buddy Smith, W4YE**

PVRC Scholarship Program

PVRC is pleased to announce its newly established PVRC Scholarship. Our new scholarship provides funding towards the educational expenses of a young Amateur Radio operator who is pursuing a post-secondary education. There are no requirements as to field of study. Applicants must be pursuing full-time studies at an accredited undergraduate degree-granting institution.

Our scholarship is funded entirely by PVRC member donations paid direct to the ARRL Foundation - the fund's administrator - with no involvement of PVRC in the scholarship's administration. An annual administrative fee is assessed by the Foundation at less than one percent of the scholarship value.

www.arrl.org/scholarship-program

Our first scholarship will be awarded next year, with funds contributed by PVRC member totaling at least \$1,500. We already have \$1500 in pledges for our first scholarship award. PVRC members may increase the value of next year's scholarship by making contributions before December 31, 2020 using this donation form:

www.arrl.org/files/file/Foundation/ARRL_Foundation_Donation_Form.pdf

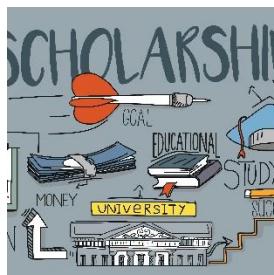
The ARRL Foundation is a tax-exempt non-profit 501(c) 3 organization as described in the Internal Revenue Code. Contributions are tax deductible to the extent permitted by law, consult your financial advisor regarding your eligibility for tax deductibility. PVRC members over age 70 1/2 can make a qualified charitable distribution (QCD) direct from their IRA.

www.irs.gov/publications/p590b#en_US_2019_publink100041439

We are grateful for the leadership of Frank Donovan, W3LPL who came up with the idea of a PVRC sponsored scholarship and took this through the entire process.

73 and Go PVRC!

Tom K3AJ
President, PVRC



PVRC Awards Program – Dan K2YWE

The past PVRC contest season has evidenced great member activity both in terms of participation and scores. Below are statistics for PVRC awards earned by members in the 2019-2020 season. Everyone who contributed scores to the club, whether or not they achieved a new award or level, is to be congratulated on the continuing success of PVRC as a leading force in the contest community.

- Progress Awards (1-4M) - 34**
- 5M Award (Plaques) - 7**
- 5M Endorsements (10-150M) - 59**
- Olympics Medals (Bronze-Silver-Gold) - 90**

In addition, 2019-20 season awards also include the Top Gun, Battle of the Potomac, W4MYA, and K3LP perpetual trophies.

Almost all awards will be sent directly to recipients this year. *Kindly make certain ASAP that both your email and mailing address in the PVRC roster are correct. *

As your treasurer (you knew this was coming), I am very much aware of the cost of sustaining these awards which are important in recognizing member efforts and contribute substantially to the competitive success of PVRC as a whole though the incentives that they provide.

Please consider a donation to PVRC if you have not already done so this year. A PayPal link is on the PVRC home page and checks sent to my roster or QRZ postal address are equally welcome.

<u>PVRC Officers:</u>		<u>Trustees:</u>	
President:	K3AJ Tom Valenti	K3MM, N3OC, K2AV, K4ZA, W3LPL, N4MM, N4ZR, W2RU, W3LL	
Vice President:	N4GU Mike Barts	<u>PVRC Charter Members (all SK):</u>	
Vice President:	W3MMM Jay Horman	W3GRF, W4AAV, W4KFC, N0FFZ, W4LUE, W7YS, VP2VI/W0DX,	
Secretary:	N3QE Tim Shoppa	W3IKN, W4KFT	
Treasurer:	K2YWE Dan Zeitlin		

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Station Ergonomics – Rick NØYY

Every contester asks a similar question every year, “What can I do to improve my score?” A new antenna is one answer. Or maybe an amplifier?

But there is one item that may have more impact than large, electronics-oriented acquisitions. The key to score improvement is a simple “butt in chair” concept! That’s right – if you are not sitting in front of your radio, you are missing Qs – either by running or search and pounce. So, stay put and watch your score climb.

This principle applies to both day-to-day operating as well as contesting. If you are sitting there chasing that DX-pedition it is very similar to contesting. Success is measured by butt-in-chair! But you need to assess your personal goals and limitations. Here are some example questions:

1. Will you operate SO2R? Or will a second radio be just a backup? Is a second radio for other uses, e.g. VHF/UHF?
2. Do you wear bifocals? This will have an impact on panel and screen placement.
3. Are you a knob tweaker or do you only touch the VFO knob and volume control?
4. Are you a contester or a DXer? The difference is subtle but deserves some assessment.
5. How automated is your station? Is everything controlled from the keyboard? (e.g. when you click on a spot does your radio change bands? Do the amplifier and antenna follow? When you change modes do you have to reset interfaces and move cables?)
6. Are you constantly adding capabilities that require new interfaces, cables, controls, etc.? Or is your station “stable”?

All of these things will impact your station design decisions.

Those that work in office environments find that sitting in front of a computer all day has a fatigue impact. Eye strain, neck strain, sore lower-back, are all reasons to get up and move around. But each time you get up you are not making QSOs. And history shows that you are prone to distractions when you are away from your radio.

The good news is that office ergonomics have studied many of the same issues as needed for station design! I have tried to capture some of those concepts in this short note. I guess I heard all the recommendations and took the candid, “yeah, yeah” attitude. When you are younger you can afford to be a bit more cavalier – but as you age... well, then things start to become more “challenging”.

It was in 2006 when I did a single op as FG/NØYY for the ARRL DX CW Contest that it all came to a head. 48 hours in a folding chair with a radio on a card table with the notebook computer off to the side, took its toll. When you are “in the zone” none of that makes a difference. But when you are calling CQ into a dead band or the static on the low bands is driving you crazy, you look for any reason to get up and walk around.

But Qs are Qs and you don't make them when you are walking on the beach or raking leaves. You need to sit in front of that radio and keep at it. So, if you are going to sit there, why not make it comfortable? You already know that you will hear the CW for a week after the contest echoing in your head – so at least your shoulders and neck should be able to relax and rest!

The concept of ergonomics is putting everything you need to touch or see in a logical, comfortable position – one that does not force your body into unusual positions or repeat stresses. So here are a couple of things for you to consider.

- 1) What is the height of a standard desk or table?
- 2) What is the height of a “computer desk”?

A standard kitchen table or traditional desk is 30 inches in height. But a standard computer table or desk is 28 inches in height. Let's set that reference point aside for a moment.

There is no “number” that will fix this – it is a balance of many different characteristics. How tall are you? What are the proportion of your legs – sole of foot to knee and hip to knee? These will wind up being part of the overall determination.

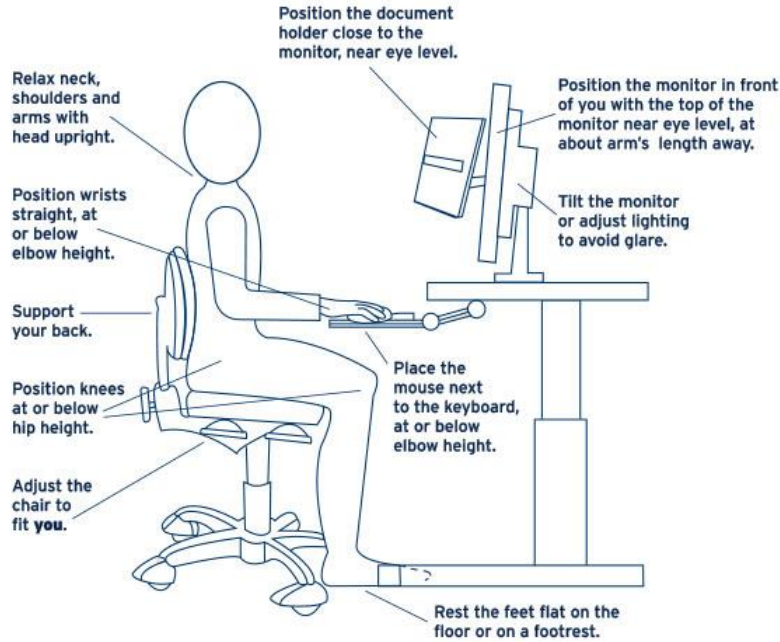
So, my starting point is a good comfortable chair. It should have adjustable height. The seat pan should be adjustable to ensure that you do not have too much pressure on the backs of your legs. The ideal is for the pan to tilt forward slightly – not so much you feel like it is tipping you out of the chair, but you should be supporting your body with your spine straight.

Your chair should have an adjustable lumbar support so that when you are sitting upright, the lumbar support fits the curvature of your lower back. It should provide support that removes the stress on your back from sitting for long periods.

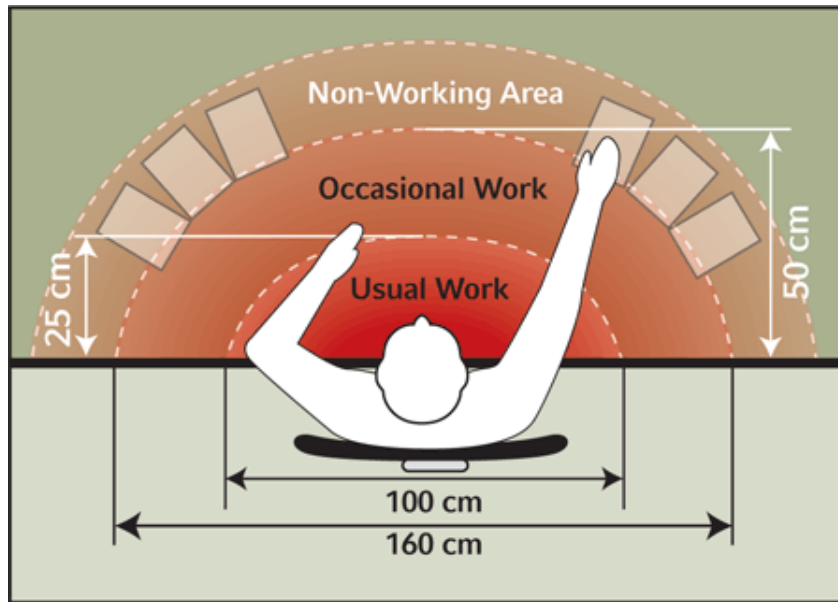
The seat pan and the back support should be adjustable as well. It is important to be able to adjust where you sit, where your knees are with respect to the front edge of the chair pad, and where your back is and how to adjust the seat back to the correct point. Pretty complex! Now you understand why shopping for a chair is so critically important! Feet should be flat on the floor. Seat height should be set so the hips are the same or slightly above the knees when the feet are flat on the floor.

If you have armrests on the chairs, they should be adjustable so that the height of the arm rest should be level with the work surface height. This allows for the arm to be supported when using the keyboard or during reaching other knobs/controls, etc. (Make sure you keep your feet flat on the floor!) Wrists should be at or slightly below elbow height. This now sets the ideal height of your operating surface!

I've copied a couple of graphics available on the internet to depict what I am referencing. It helps get a graphical reference to what I am discussing.



The next thing to consider is your “reach radius”. You want to keep your arms supported while you “operate” so there is no stress on your shoulders or that you change the geometry of your arms, wrists, elbows, etc.



Sitting in the chair at the operator position should allow about 3 inches between your stomach and the table edge. That may vary with body dimensions. But your wrists or forearms should be supported by the work surface top. The mouse should be at the same height as the keyboard.

All displays should be perpendicular to your eyes. This includes the front panel of radios. Your reach radius needs to consider the tuning knob on the radio!

Let's focus for a moment on the display. This is something everyone interfaces with but there seems to be an almost "afterthought" approach to placement. Look at the first graphic and read what it says about the monitor. The top of the monitor should be at eye level. Not the bottom! With the top at eye level, those with bifocals are using the reading part of the lens for the lower part of the monitor where the entry window is usually placed – not always or by everyone – but... Maybe you have computer glasses that are midway between the long distance and reading prescriptions, but again that is somewhat secondary. The key is neck strain. Are you tilting your head to see the lower part of the screen? Not a problem for the first 10 or 15 minutes, but the longer you hold that position, the more strain it places on your neck which quickly becomes a headache which compromises your "enjoyment".

The keyboard should be in front of you. But here is subtlety to consider. Do you have a keyboard with a keypad? In this case center the spacebar in your sitting position – not the entire keyboard. You will find that 3 inches of offset will rear its head about 12 hours into the contest.

And maybe a quick word about the infamous "mouse" – chasing that mouse all over the work surface challenges that stretch "stress" referenced earlier. Trackballs solve that issue as it keeps your hand in a single location. Now your thumb or forefinger do the cursor movement and the clicks are adjacent to the ball. And your arm stays supported in a more ideal position. Consider Air Traffic Controllers – they use trackballs for cursor movement!

Now for some esoterica: The front edge of the work surface should be rounded so there is no "edge" for your forearms or wrists to rest on. You will not notice this in the first hour or maybe two hours – but at the end of a 6 hour shift you will really know that those deep red indentations are uncomfortable!

Everyone has their own crazy requirements. For me it is desktop clutter. My operating position does everything possible to avoid headphone/microphone/keyboard/mouse cables, etc. I also avoid placing unnecessary equipment on the desktop or on shelves at the operating position. Why? Because as fatigue sets in, I found that I was reaching for knobs and then forgetting what I had set them to! Much of this goes back to my earlier comments related to station automation.

For me, band decoders, bandpass filters, antenna switching, etc. are all mounted on the bottom or back of the desk/work surface. This also has the benefit of managing all the cable clutter between all of these various devices.

Obviously, there are variants of these "suggestions". For example, are you designing a station for multiple operators? Now what? Well again, back to your body dimensions. Are you tall, short, are your team members taller or shorter, etc.?

Here is how I compromised on those issues when I designed the multi-operator positions for PJ2T. We had adjustable height chairs. I wanted to make sure that the shorter

members of the team could sit with their feet flat on the floor and have their arm geometry, so the arms were at table height. What I found was a desk height of 27 inches would allow short and tall ops to sit comfortably and make up the difference with slight adjustments in chair height. Taller ops had less “back of leg” support than shorter ops, but that compromise seemed to work as well.

My design focus is on the monitor and the keyboard. I will admit that I did the planning on an operator running where the focus is on the keyboard and the monitor. There are two exceptions – search and pounce – where you interact with the radio more; and digital modes like RTTY where you interface with the mouse more.

As you think your way through the reach radius, consider note pads, keyer paddles, the mouse or trackball, etc. My goal was hands on keyboard – no other “distractions”. When the operator position gets cluttered the fatigue starts to increase. Yeah you need paper and pencil – but within reach not in your hand! That busted call, the log correction, etc. all beg for a note – but it should be the minimal exception – not the norm. Same goes for the keyer paddle. The operator interface focus should be on the keyboard.

Yeah, I admit that those attributes are a bit Draconian, but I needed a goal. I also try to minimize cable clutter on the desktop. I like my connections under the tabletop – keeping the work surface clear of things that will be under a keyboard and start it to rock and roll – like a headphone cable. Or under your wrist and create another dent that will stay red for an extra hour or two.

All of this is targeted at ensuring that you have no excuses to violate the “butt in chair” mantra. Now about that 32 oz container of ice water...

I also realize that this is a set of design goals. They are not hard and fast – but serve as good guidelines when they can be put into practice. But even if you only go as far as a comfortable, adjustable chair – you are setting yourself up for success.

There are hundreds of pictures on the internet of station layouts that offer similar insights. Maybe the focus is on radio placement, or receive antenna switch positions, but the point is that there are things in that reach radius to consider.

If you read the post-mortems from contesters you hear stories about having to stand up and operate to fight the fatigue. I did not discuss the solution set found in modern offices of standing workstations. Those new stations collapse to support sitting operations and then extend to allow standing – all done to stretch the back and remove the fatigue and stress. Those same principles apply here. And maybe those standing work stations would be a solution for you to consider!

Now you have another secret weapon in your arsenal to grow your score every year.

Roving in the 2020 Maryland QSO Party – Iain AD5XI

I decided to activate some of the less populated, and thus rare, counties towards Maryland’s Eastern Shore. In a 7.5-hour, 200-mile round trip I was QRV on 40m CW/SSB and 20M CW/SSB for around 5 hours.

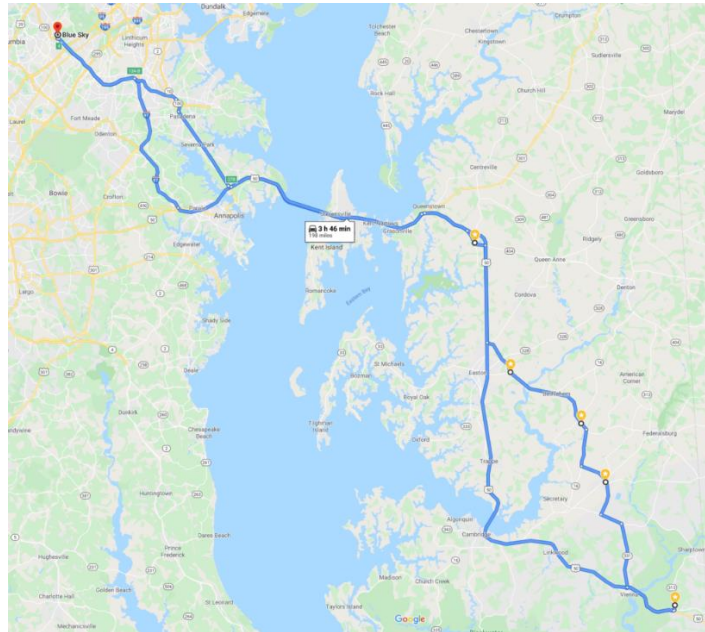
Summary:

Band	CW Qs	Ph Qs	Dig Qs
160:			
80:			
40:	36	11	
20:	2	2	
15:			
10:			
6:			
2:			
432:			

Total: 38 13 0 Mults = 27 Total Score = 7,020

I made 51 QSOs from 7 counties, having picked some operating spots using Google Maps the night before.

The route plan:



The gold markers to the right are the stop-off points to operate from.

On the drive home it was less obvious which county I was in at any given time, so I decided to relax and enjoy my music playing rather than the noise of the HF bands.

Band conditions were not great, and the clash with the Worked All Europe CW Contest wasn't ideal. Having said that, I still worked more CW than SSB. I would probably have made more contacts had I also been QRV on the drive back, but I'd had my fun by then.



A rare sight: AD5XI operating on 40M SSB from Talbot County, MD.

I was using my Kenwood TS-480SAT and a Little Tarheel HP screwdriver antenna on the rear door of the Honda CR-V. Many lessons learned, a lot of RFI on 20m, which I have since solved. Also, RFI got into the laptop, radiated from the laptop charger cable and so on.



The AD5XI mobile antenna, photo taken in Wicimoco County, MD.

The weekend after the contest I spent a day moving the antenna further up the door to get the coil clear of the car, added a longer 56" whip to the antenna rather than the existing 32" one. I've liberally applied ferrites to any DC or RF cables in the cabin that did not have them. That all seems to have much improved the noise on receive and RFI on transmit.

This was a good way to get some fresh air and explore new places without having to have any close contact with anyone on the way. I would no doubt have made more QSOs from my home station, but that is a much more trodden path than operating from the car is.

Downsizing Lessons Learned – Bill K3WA

We're all getting older. At some point many, if not most, of us will downsize. With children and grandchildren grown and gone, the desire and ability to maintain a large home and ham station diminishes rapidly. The effort of maintaining a large property becomes overwhelming. Or maybe the cost. Or whatever. For those of us who don't feel the need to downsize you have my congratulations and never-ending jealousy. But for the rest of us.....

It has been a year and a half since I moved to North Carolina and downsized. It took me the better part of nine months to get my station setup the way I wanted and organized. I learned a few lessons along the way and decided to share them with you. As they say, "Your Mileage May Vary"

I knew going in that downsizing, especially to a HOA controlled no antenna neighborhood, was not going to be easy. Giving up towers, beams, beverages, etc. would be a culture shock. The days of top ten finishes and routine number one finishes in my district and section would fall into the rear-view mirror. And I worried that downsizing would diminish my ability to enjoy my ham hobby that started in 1956.



After moving in, we had a room built in the walk-able crawl space under our house. I brought my equipment with me – overkill for my new circumstances. I set up a comfortable and well-equipped ham shack. Full legal limit, all the bells and whistles just ready to satisfy my contesting addiction - except for antennas.

No antennas allowed here. I put up a 20 ft flagpole which kind of works on 80 through 10. And I got what I expected. I could still contest, just not with the results I

was used to. What did I learn?

Expectation management. Go into downsizing with your eyes open. Know you won't be able to grab or hold run frequencies like you're used to doing. Rates will go down. You'll be doing more S&P'ing. But you will still be contesting. As you evolve your tactics you will be able to get back some of what you lost. You will get enough surprises along the way that keeps contesting fun. In the 2020 ARRL DX Contest I was running Europe on 40-meter CW. Rates were slow but steady. In the middle of the run I was startled when a JT called in with a good signal. That was just as exciting as the first JT I ever worked 20 years ago! And later I was able to run Europe on 80 meters with my flagpole. Never expected that.



Station maintenance. Maintain your station as if it was a super contest station. Your antenna could be a stealth wire, single G5RV, or even a flagpole. Use the very best feed line you can afford. Super contest stations work hard to gain every dB advantage they can - you should too. Cheap coax = more loss. Ditto for old coax. Using 20-year-old RG8 from Radio Shack? Don't. Make your station as effective as you can. Recently, Frank W3LPL put out a great message on the PVRC reflector about maintaining coax connections and subjects like that. Go to the archives, get it, read it until you have it memorized, and then read it a few more times. Then **do it!** Ditto for grounding and bonding. What works for the big guns will work for you. You will do better and have more fun.

Station building. Look to known contest stations for inspiration. Do everything you can to make your downsized station comfortable and ergonomic. Each step you take along this path can and will go a long way to your contesting success. Comfort leads to more butt in chair time in the contests. Ergonomics help that too and also are better for our health as we age.

Know your station. Once your station is built, take the time to understand how well or poorly it gets out. Use the RBN at different times of the day and different bands. You may find that there are areas where your signal is strong, other places where its not. During contests take the time to see how your signal compares with others you know. You might be happy or sad with the results. But you will have actionable information to decide how to best use and make your station even better.

Operating. Operate like you're a really big gun. There's an old saying "If you think you are loud, you will be loud" or words to that effect. That does work, but it's not magic. There's no magic. It's all internal to you – it's about confidence. Your confidence. Get out there and run as much as you can. You may want to start S&P'ing. Make a pass through the band. The first hour usually is pretty good. It's the rest of the contest that matters. Go back to the bottom of the band and start cruising up. Just as soon as you find a clear spot – call CQ. You never hear the big gun teams stop CQ'ing. There's a reason – it works. And it will work for you too. Odds are you will get some answers. Don't be impatient. It often takes a few minutes to get a run started. It's a contest, people want to work you, just as you want to work them. Especially on day two of a contest. There's lots of hams who only S&P. You'll never work them unless you call CQ. You may lose the frequency. So what? Work some stations, loose the freq, find another and CQ again. Keep going. A downsized station rarely gets to hold frequencies for long

runs. You can make it up with a lot of short runs. Be aggressive (not obnoxious – aggressive) And forget about those who say, “I can work everything I hear”. That usually means they aren’t hearing all they should be able to hear. Don’t let sayings like this affect your confidence.

Hone your skills. Successful contesting takes skills. Practice makes perfect. Enter every single contest you can. Get as much as you can. If you can make the time, do the CWT short contests every Wednesday. Doing so will make you a better contester while enhancing your call recognition.

Downsizing isn’t fun. It’s rarely anyone’s first choice. There is still life after downsizing. I even got a clean sweep in the 2019 November Sweepstakes. You don’t have to give up ham radio when you downsize. You can still contest. And once in a blue moon you can even win one.

And, as important as anything else, your membership in PVRC is worth at least 10 Qs and 2 mults in any contest just from what you learn from other PVRCers.

“Name That PVRCer” Contest



Can you name the young Heathkit-junkie PVRCer pictured above?

Send your guess to the [PVRC reflector](#) – first correct answer will receive a pass for a free appetizer from the Zoom menu at any online PVRC meeting before 1 April 2021.

Have a picture you think will stump the club? Send it to [jpescatore at aol dot com](mailto:jpescatore@aol.com) for use in a future newsletter.



Heathkit SB220/SB221 Upgrades/Modifications Part 2 - Alan WA3EKL

We are now going to learn about some soldering issues I found and continue with the modifications and upgrades going into detail on how to perform some of those upgrades and modifications.

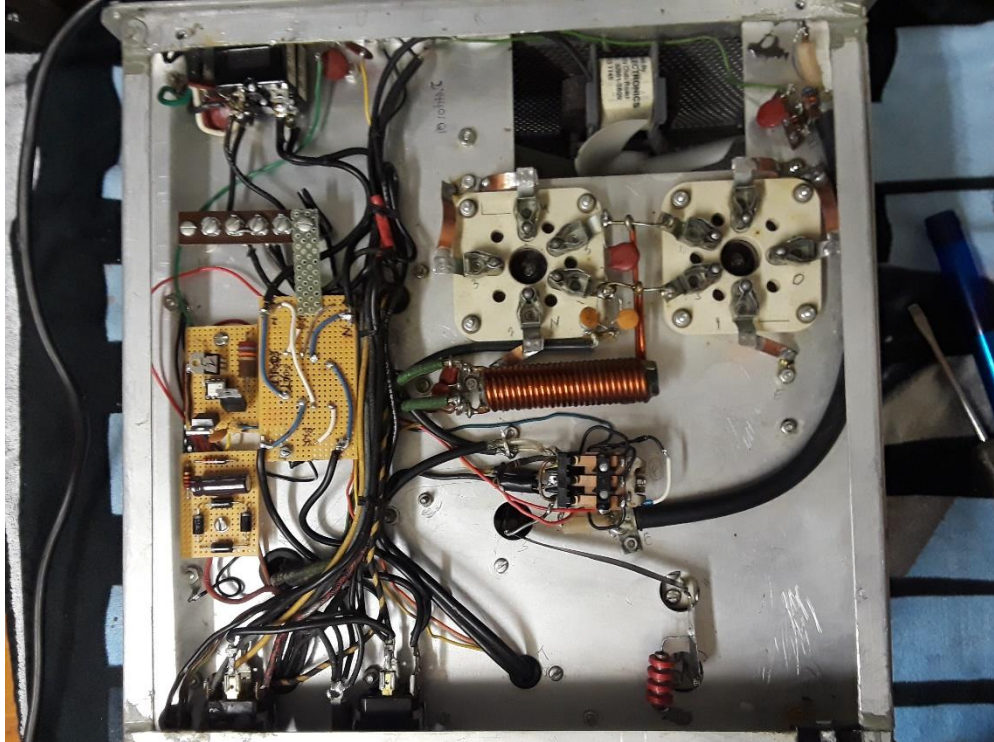
I have worked on five of these amps recently. One was in original condition and assembled by a naval electronics technician. One was by the original owner whom I know very well. Three were from eBay. All five had one thing in common. The tube socket tabs where the components were attached were not soldered well, especially the short buss wires going between the filament tabs of each tube. I know how to solder because in my younger years I did flight soldering work at Goddard Space flight Center and held a Flight Soldering certification and was a Flight Soldering Instructor. I believe it was the buss wire and the solder supplied by Heathkit that was causing the problem.

The wiring and soldering were so bad in one amp I re-worked most of it. Prior to reworking the bottom of the chassis and before I made any of the above mods I was getting 500 watts out on 10 meters into a 50 dummy load. After cleaning up the work and solder connections amazingly I got out 650 watts on 10 meters into the same dummy load with the same amount of drive! When I removed the components from the grid tabs I also removed most of the solder, then burnished the tabs with a green scouring pad. Only then could I get the tabs to take new solder effectively.

I use Ersin Multi-core solder which is hard to find. It has a synthetic core. I never use Kesters solder which has a natural rosin core. From my previous days at Goddard we found Kesters solder made an excellent solder joint the first time you heated it. However, if you had to reheat it there was a 50% chance the joint would fail inspection. With Ersin solder you could re-heat the joint as many as 4 to 5 times before a failure. We believed it was not the solder but the core material. You can find Ersin on eBay but get your wallet out! I do not know what core material Kesters solder is presently using. If you are making bright shiny joints that do not look grainy when they cool or look like someone dragged a fine-tooth comb across them as they cool then keep on using whatever solder you are using so long as it is not acid core!

The biggest common solder problem I found was the two short buss wires going between the filament tabs of the two tubes. On every amp the solder appeared to have just stuck to the wire, not evenly flowing to and around it. There is a great amount of current flowing through those wires going into those tabs to heat the filaments. Plus, the RF drive goes into those wires. I had to scrape the surface of the wires and buff them with the green pad before the solder would flow properly and use a 120 watt soldering gun. I believe the buss wire Heathkit supplied had some type of coating on it that the solder of the time would not adhere to properly and nobody thought about buffing the tabs to get the oxidation off before soldering to them.

Below are two typical pictures of the underside of my amps. This amp was acquired on eBay. Part of the base is held together with epoxy but this one performs as good or better than the others!



On the left side upper perf board is the home brewed Key All soft key circuit. Lower left is the rebuilt low voltage power supply. Next to them is the bottom of the home brewed slow start circuit. It is held to the bottom of the chassis with double stick tape on the relays. The green perf board is extra insurance the board will never fall on to the bottom of the cover shorting the AC plus the lower left screw in the board is screwed into a threaded standoff that is epoxied on to the bottom of the chassis. The other two boards are screwed into threaded standoffs.

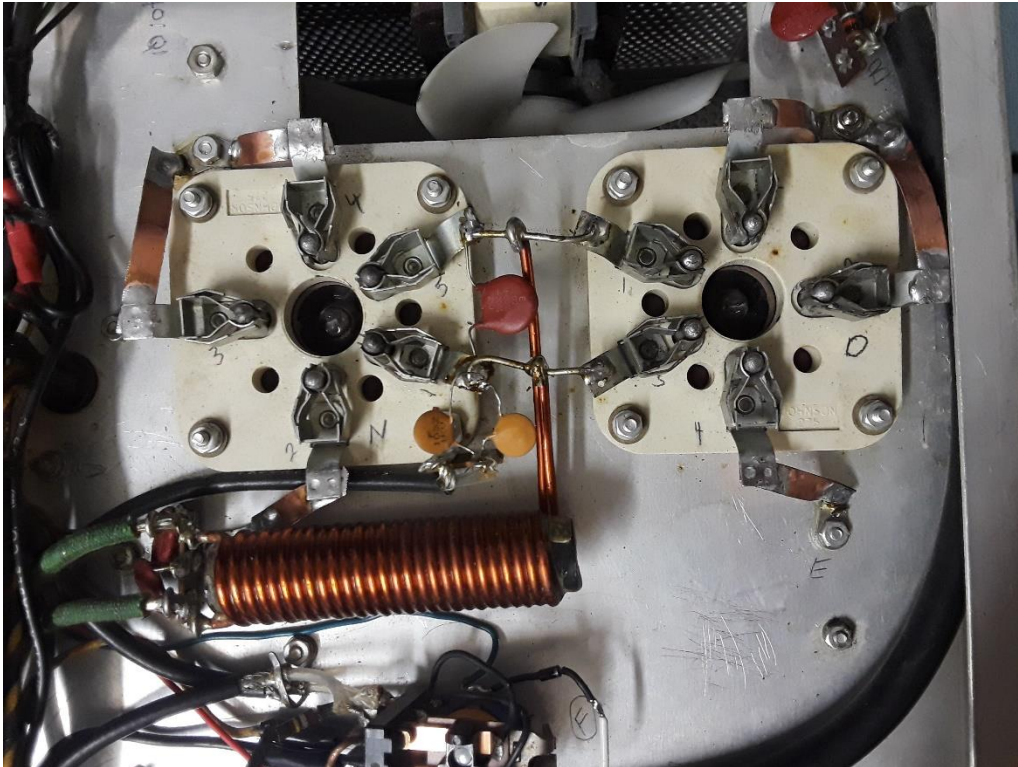
Looking at the relay you can see the two series diodes on the right. On the left are two red wires. One comes from the low voltage power supply and connects to the relay coil. The other short red wire connects to the coil and its other end connects to the 100k resistor I spoke about above when the center terminals are used for biasing the tubes. Looking back at the green perf strip where the screw holds it down into the 4-terminal strip, notice a wire under its upper right corner with black tape around it. That is the end of the Black/Green wire which was removed from screw terminal three counting right to left. The two outer screws are only holding the terminal strip to the chassis on stand offs.

The bottom left Corner near the low voltage power supply is a hole with a grommet and two large wires coming out. These are the 5-volt filament transformer wires that feed the bifilar filament coil. Just to the front right of the left most front switch is another hole with a grommet which is difficult to see. This is the filament transformer primary winding hole. The other end of the disconnected black/green and black/yellow wires come out of this hole. These are the ones you cut and short together with the wire nut, when going to 240 volts AC input. (Put the system back to normal if you go back to 120 volts input) In the upper right just below the fan you can get a good look at the tube sockets and clearly see the grids are grounded to chassis with copper straps. All the original RF coils, capacitors and resistors have been removed from the grid pins. Plus, the two series

resistors with the input capacitors to the filaments have also been removed which was a mod to supposedly reduce parasitic VHF oscillation.

In one amp I found a kit with the resistors in the filament chain plus the tiny #26 wire coils and double resistors in the plate leads and tiny #26 from the HV choke coil to the HV bypass capacitor on the Plate tuning capacitor. All the resistors were fried. So much for the parasitic suppression reduction kit. I believe the coil wire was much too small and the resistors were taking way too much of the RF.

Here is another picture of the underside of an amplifier.



This is a better view of the grids being grounded. Note the straps are soldered on only one side. Thus, any RF only has to flow down one side of the strap and not flow around to the other side of the strap to get to ground. Also note the soldering on the filament tabs. This was before I re-soldered them. Note the solder was not flowing around the wire or evenly.

Here is a little extra. I mentioned the fan just above. You should oil your fan once a year with a good fine oil. **WD40 is not oil.** Do not use it for lubrication. If your fan has died, then go the Lowes or Home Depot into the bathroom exhaust fan replacement section and purchase a BROAN BP27 \$21. It is the exact same motor with a longer shaft, and the exact same diameter shaft and it turns faster moving more air keeping your tubes cooler. All you have to do is hack saw the shaft a little shorter and press on the old fan blade. File the end you just cut to take the burrs off, so it is easier to press on the old fan blade. With the amp just sitting in idle, the fan moves so much air around the tubes you can hardly feel any heat coming off the tubes out of the top of the amp.

Now we can turn the amp over and do a little work on the RF section.

This is where we want to change out the High Voltage Capacitor bank, the Rectifier/Metering board and change out the original parasitic VHF suppression components. This is how we accomplish that feat. First pull the power plug. Second, make sure the High Voltage Meter is reading ZERO. Now remove the case. Now start to remove the top cover. When you remove the last screw, the shorting tab should short the HV to ground. First, has someone disconnected the shorting tab? Second, are you absolutely sure your HV metering was working? Are you absolutely sure there is still not a charge in the High Voltage capacitor bank? **No, you are not!**

Take a big insulated screwdriver and place the blade against the chassis and slide the tip over until it touches the top of one of the plate caps. Do it again. Now think about this. There is still a choke coil, a metering board and some wire between the capacitor bank and your life. If one of the bleeder resistors is open, then there is a good chance the bank is not discharged depending on when the amp was last turned off. If the choke coil is open, then grounding the plates was useless.

So here is what you do. In order to replace the capacitor, you will have to remove the side of the amp with the capacitor bank which will expose the resistor board. At the bottom left of the board is the High Voltage lead. Short that terminal to ground with your screw. Hopefully you won't see the "dragon fire." Now we are ready to start disassembly. I am going to tell you how to mechanically get things apart easily, just reverse the procedure when reassembling. If you have bought the Harbach Rectifier/Metering board follow it's instructions on all the wiring.

There are three wires attached to the capacitor bank board. Upper left, "-" terminal. Lower left "+" terminal and center left, one lead of the HV transformer. Un-solder all three leads. Next take a close look at the Rectifier/Metering board that is attached on standoffs to the left side of the capacitor bank case. Whether your changing out that board or not it is still going to have to come loose from the Capacitor bank case. Now look at the lower left screw in the Rectifier/Metering board. This is the one that is impossible get to unless you have some special tool I don't know about. All you have to do is just unloosen this screw about one half a turn. I did it with a small 90-degree screwdriver. Now remove the remaining three screws that hold the Rectifier/Metering board to the case. Now look at the top left of the Rectifier/Metering board. There is a short, usually bare, wire going from a capacitor ground terminal over to the board and soldered to it under the top left metal stud. You need to unsolder that wire but cannot do it at the moment because the stud in the way. Not to worry it will be out of the way shortly!

Now turn the amp up on its side so you can get to the four nuts that hold the capacitor case down on to the chassis. One of the nuts holds down the low voltage power supply strip. You will have to move the wire bundle going through the center of the amp slightly to get to the two back nuts. Don't lose the lock washers down into the guts of the amp! When the four nuts are off turn the amp back up to it's normal position where you started with the capacitor bank facing you. Start to lift the capacitor case up and notice the Rectifier/Metering board begins to rotate on the lower left screw you loosened. When the case is about one inch above the chassis the board has rotated enough to unsolder the Ground wire from the upper left area of the Rectifier/Metering board. In addition, the lower left screw in the Rectifier/Metering board has now become accessible to where you can much more easily get a short screwdriver into it and **GET IT OUT**. It only took

me four amplifiers to figure this out and as much as an hour in some cases to get that lower left screw back in place. When you are putting the thing back together don't forget to solder the wire and put in the screw before pushing the capacitor cage fully back down into the chassis!!

Once the screw is out, the wire is unsoldered and the Rectifier/Metering board is loose, then you can lift the capacitor case completely up and replace the capacitors. If you have the original capacitors still in there from Heathkit or someone has replaced them and did not replace the cradles the capacitors were sitting in then I have a suggestion. The cradles completely surround the capacitors from end to end. This is one reason for the heat problem; no air circulation. On one amp I cut the plastic cradles with a hack (use a miter box if you have one) to about 3/8 inch to 1/2 inch wide and put a set at each end the capacitor bank. You will understand when you take the case off the bank. The newer amps have two Teflon rectangular plates about 3/16-inch-thick with 8 holes that just slide down over the capacitors. That means you cannot buy just any capacitors to put into these amps. You have to buy capacitors that fit into the holes. If you have the screw in board that adds more to the formula because now you need the correct diameter capacitors plus you also need the correct distance between the terminals on the capacitors so the screws will fit through the board into them.

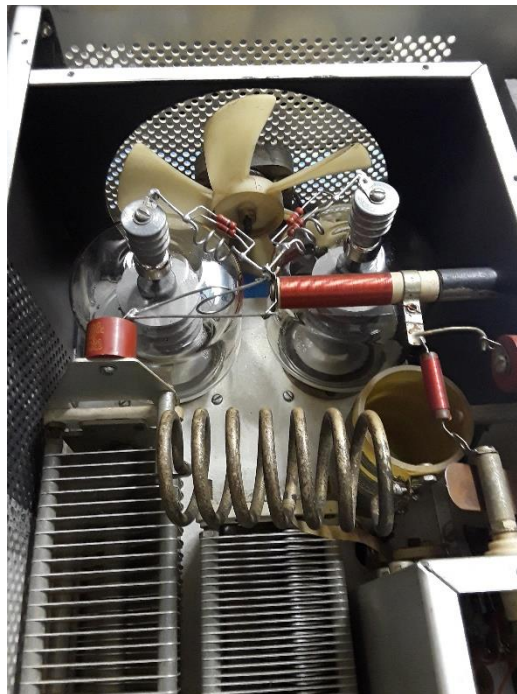
Finally, we get to the Parasitic VHF reduction part. This is where I took the best from all that I gleaned of all that I studied. The most interesting thing I learned was it's not the SB220 or the SB221 that is causing the parasitic oscillation. It's the modern-day higher gain 3-500 tubes that can cause the problem. Note I said "can." Most 3-500's do not, but some do so we put measures into these old amps to prevent the oscillation. I also learned that what was used in the past will not work with the high gain modern day tubes today. Reducing or lowering "Q" and adding resistance to the plate circuit seem to be the best way to reduce or prevent VHF parasitic oscillations. To that extent this is what I have done.

The high voltage goes through a large red choke coil. At the top of it there is silver plated copper braid that went over to the green or red plate "high voltage doorknob" blocking capacitor that is attached to the pi network Plate Tuning Capacitor. This was Heathkit's way of reducing parasitic oscillation which is no good today. I have replaced the braid with two pieces of 16-gauge Nichrome 60 round wire RW0266 (Amazon). One piece is straight and goes directly between the top of the choke and plate blocking capacitor. The second piece does the same except it has a one turn loop which was made from turning the wire around a AA battery. This creates two RF pathways from the choke to the PI network with different time constants and resistance because it's Nichrome wire and allegedly suppresses parasitic VHF Oscillations. That is the first fix.

Heath kit also wound 4 turns of wire around a 47-ohm 1 watt resistor and placed that combination in series with each plate lead to the top of the choke coil. In every amp I worked on the resistors appeared fried. Per two internet sources I have replaced each resistor with two 100 Ohm 2-watt Metal Oxide Film resistors. They are sitting physically in parallel one over top the other so that the air from the fan can hit them. There is also a coil of the same 16 gauge Nichrome 60 round wire, 3 turns wound around a 9/32 inch drill bit and the turns were spaced with a 11/64 or 3/16 inch drill bit. The resistors were then soldered to the coil. The coil was soldered between the plate cap solder lug and the top of the choke coil. The picture below shows one view of a finished amp.



You can see the two parallel resistors and their coils plus the third one turn coil going between the red capacitor and the HV choke coil.



In this picture you will notice the inside of the amp RF cage is painted Black. This is to keep the radiated heat that normally reflects off the shiny surfaces from reflecting back to the tubes and heating them further. The internet said get some black shoe polish with a dabber and paint the inside. I could not find that type of shoe polish anymore, so I

bought some flat black high temperature paint from Lowes or Home Depot the kind that you put on a grill. I also bought a few of those 98 cent two inch wide foam pads brushes on a stick. Some of you stop laughing. Carefully painting so as not to get the paint on the tube sockets and everywhere else I didn't want it the task took me about one hour to complete on the first amp with plenty of cleanup time. I said there has got to be a better way. So, I borrowed one of my granddaughters ¾ inch wide paint brushes and did the next amp in 15 minutes with considerably much less paint where I didn't want it. So learn from my mistake.

I want to tell you about Nichrome wire. You **cannot** solder to it using normal soldering techniques. It will not take normal solder no matter how much heat you apply to it. In fact, more heat makes it worse. This is how I did it with much research on the net. First I bought some "low temperature "Silver solder" from Amazon. It melts at 450 degrees. .031 dia SRA Soldering Products. Next from Amazon I found something called "Rubyfluid" SOLDERING PASTE. The rubyfluid is an acid-based paste which when applied to the Nichrome wire and heated at low soldering temperatures with a 25 watt iron breaks through the oxides on the Nichrome wire and allows the Silver solder to combine and adhere to the Nichrome wire. What you are doing is tining the Nichrome wire where you intend to solder to it later such as at the tips of the coils.

Once the silver solder has cooled and adhered to the Nichrome you can then apply normal solder to the silver. However, there is always a however! You must remove any traces of acid left behind by the Rubyfluid. My coils I first scrubbed with 91% Isopropyl alcohol and an acid brush (toothbrush). Then liberal scrubbing with toothbrush and cold water. Then I got a large plastic pill bottle, put about ¼ teaspoon of Arm and Hammer Baking Soda in it, filled it with water, shook it up with the top on to make a basic solution then let the coils soak in the solution for about 15 minutes to neutralize any remaining acid. Then more water rinsing and alcohol just before I soldered them. Don't scrap or use a scouring pad on the coils after you have applied the silver solder. It will remove the silver and you will have to start over putting silver back on the wire.

IN REVIEW

- If you are going to change out the capacitor bank also change out the Rectifier/Metering board.
- While you have the tubes out paint the inside black.
- Since you are working on the top of the amp put in better parasitic VHF oscillation protection.
- If the capacitor bank has been upgraded, then you will need to install the Slow Start circuit.
- It would be very wise to also install the Soft Keying circuit so that you won't blow up your modern-day transceiver.
- Be you sure you make the transmit/receive relay modification, plus put in the protective diodes.

- If you have installed the Soft Key circuit and the Slow Start circuit then you need to upgrade the low voltage power supply.
- While you are under the chassis don't forget to remove the capacitors, resistors and chokes coils on the tubes grid tabs and replace them with short copper straps to the nearest ground lugs so the grids can never go positive.
- If you install the QSK circuit, you will still have to install a Soft Keying circuit.

My amps just went through a contest and the Key All circuit in the 20-meter amp is still working fine.

This was a long fun project, but the results were well worth it. Easier tuning, better VHF Parasitic Oscillation Suppression, better HV regulation, more output and cooler tubes.

I hope you have enjoyed these articles and I hope this helps someone fix, modify or upgrade one of these great old amps.

Membership News – Tim N3QE

PVRC did not add any new members in the latest reporting period.

Chapter leaders please remember to complete the [Meeting Attendance Report](#). Members can check and update their roster details via the [Roster Lookup](#).

Upcoming Contests – from [WA7BNM](#)

October 2020	
+ Oceania DX Contest, Phone	0600Z, Oct 3 to 0600Z, Oct 4
+ California QSO Party	1600Z, Oct 3 to 2200Z, Oct 4
+ UBA ON Contest, SSB	0600Z-0900Z, Oct 4
+ K1USN Slow Speed Test	0000Z-0100Z, Oct 5
+ Oceania DX Contest, CW	0600Z, Oct 10 to 0600Z, Oct 11
+ Scandinavian Activity Contest, SSB	1200Z, Oct 10 to 1200Z, Oct 11
+ K1USN Slow Speed Test	0000Z-0100Z, Oct 12
+ Stew Perry Topband Challenge	1500Z, Oct 17 to 1500Z, Oct 18
+ K1USN Slow Speed Test	0000Z-0100Z, Oct 19
+ CQ Worldwide DX Contest, SSB	0000Z, Oct 24 to 2359Z, Oct 25
+ K1USN Slow Speed Test	0000Z-0100Z, Oct 26
+ UK/EI DX Contest, SSB	1200Z, Oct 31 to 1200Z, Nov 1

PVRC DXCC Challenge Standings – Frank W3LPL

Below are the DXCC Challenge totals for PVRC members, transcribed from the ARRL DXCC data as of the 20th of each month or so. Thanks to Frank for the data each month to make this a regular feature. Please report any omissions or errors to [Frank](#).

CALL	DXCC	CALL	DXCC	CALL	DXCC	CALL	DXCC
W4DR	3185	N4QQ	2494	K4WNW	2004	WB4DNL	1506
W3UR	3152	W2GG	2436	W0YVA	2001	N4ZR	1491
W3LPL	3137	K5RT	2425	N3QE	2000	K3WC	1430
K4CIA	3116	N4TL	2406	N3KN	1968	N3HBX	1428
N2QT	3085	K5VIP	2360	K5RJ	1961	N3AIU	1415
W4PK	3038	K1GG	2352	N3KS	1906	N8II	1390
N4MM	2979	W3OA	2344	N3ND	1867	W8AKS	1390
W3DF	2939	W2YE	2334	W3KB	1815	W4PRO*	1377
WX4G	2934	N4GG	2327	K4EU	1795	KF7NN	1377
K1HTV	2924	WA2BCK	2316	W3DM	1791	W9GE	1364
K2PLF	2903	K1ZZI	2308	K3SX	1772	ND3F	1319
K5EK	2900	W4VIC	2304	N4GU	1738	N1SZ	1317
KG7H	2879	W3YY	2297	KE4S	1728	N3MK	1317
N4DB	2849	N3RC	2265	W2CDO	1724	K4ZA	1313
N3NT	2835	W2GPS	2255	N4XYZ	1720	NR4M	1224
W0VTT	2824	NW4V	2219	W4GP	1710	N3RR	1199
W3LL	2816	K4FJ	2208	W3FOX	1704	W3NRJ	1188
K3WA	2796	K3TN	2189	NE3H	1668	N3OC	1183
W3KX	2788	N4ZH	2188	K4QE	1666	K3AJ	1172
KG4W	2782	K1EFI	2176	K3WI	1652	W3US	1082
K1AR	2754	K2BA	2129	W3UL	1627	N3COB	1049
AB3CV	2682	W3TN	2125	K3KY	1606	W3OU	1046
WB3AVN	2655	K3PU	2107	K3STX	1579	W4ZV	1046
W4FQT	2622	W3GG	2071	KE3X	1571	K4ZW	1038
N3KK	2575	W3MR	2070	NA1DX	1564	NE3K	1036
W3BW	2546	N4NW	2068	N3AO	1527		
K4SO	2499	AA4NC	2061	WB2ZAB	1522		
K3JT	2495	N4JQQ	2022	AA4FU	1519		



From the PVRC Treasurer – Dan K2YWE

PVRC has chosen not to implement an annual dues requirement. We depend on the generosity of all our club members to finance our annual budget. In addition, active PVRC members are expected to participate and submit logs for at least two PVRC Club Competition contests per year.

When contemplating your donation to PVRC, each member should consider the benefit you are receiving from PVRC and its many opportunities for your personal growth in our wonderful hobby, then donate accordingly.

Direct donations to PVRC via Credit Card or PayPal may be made by clicking this "Donate" button and clicking the next Donate button that appears on your screen:



Donations to PVRC are not tax deductible

Eyeball QSO Directions

The latest info on local club meetings and get togethers will always be sent out on the [PVRC reflector](#) and posted on the PVRC [web site](#).



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Red: ARRL HF Circle
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Around 37.43168N,
77.858482W

Blue: CQ HF Circle
250 mile radius
Around 37.43168N,
77.858482W



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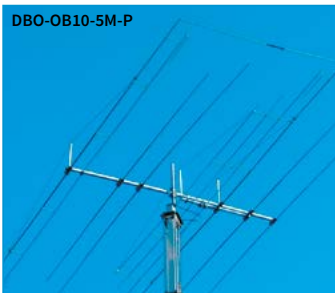
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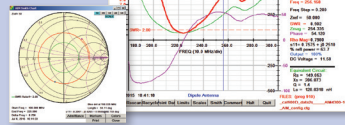
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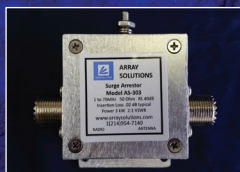
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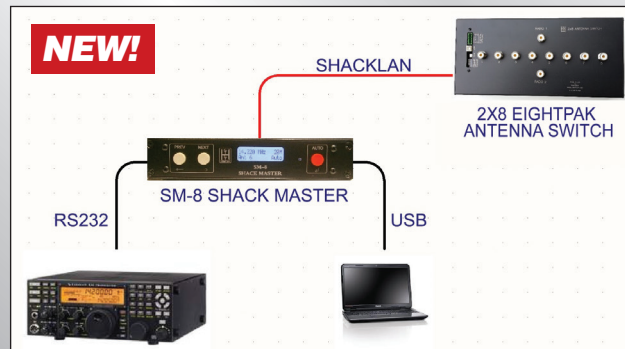
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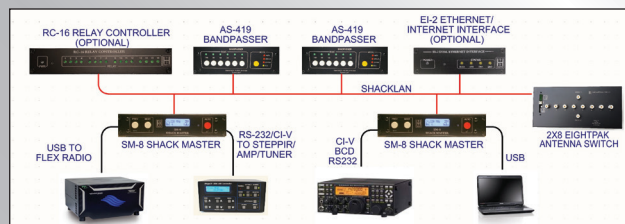
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A more complex system could be a SO2R contest station as shown.



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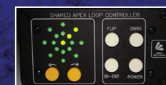
Capture the whole band or the whole HF spectrum at once with the Shared Apex Loop Array 2nd Generation. Can be remote controlled over the internet or in your station. 8 directions of directivity.



The Shared Apex Loop Array™ is a revolutionary receiving antenna that will change the way that you listen to the radio! The patented design provides performance in a size and over a wide range of frequencies that will please both the rag-chewer and DXer alike.

Three models to choose from:

- AS-SAL-30 - optimized for VLF, BCB, 1.8-10 MHz
- AS-SAL-20 - optimized for BCB, and 1.8-30 MHz
- AS-SAL-12 - optimized for 3-30 MHz



StackMatch

The original, not the imitations. For phasing 2, 3, 4 and even 6 antennas. Also it can be used to combine vertical and horizontal polarized antennas to diminish fading.



PowerMaster II



RF Power and SWR meter. Couplers for 3 kW, 10 kW or higher available for HF/6 m. VHF and UHF couplers for 1.5 kW. You can connect up to 5 couplers to the display to monitor RF power on different TX lines.



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Array Solutions' products are in use at top DX and Contest stations worldwide as well as commercial and governmental installations. We provide RF solutions to the DoD, FEMA, Emcomm, UN, WFO, FAA and the State Dept. for products and installation of antennas systems, antenna selection, filtering, switching and grounding. We also offer RF engineering and PE consulting services.

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IC-9700 | All Mode Tri-Band Transceiver

• VHF/UHF/1.2GHz • Direct Sampling Now Enters the VHF/UHF Arena • 4.3" Touch Screen Color TFT LCD • Real-Time, High-Speed Spectrum Scope & Waterfall Display • Smooth Satellite Operation



IC-718 | HF Transceiver

• 160-10M** • 100W • 12V operation • Simple to use • CW Keyer Built-in • One touch band switching • Direct frequency input • VOX Built-in • Band stacking register • IF shift • 101 memories



ID-5100A Deluxe

VHF/UHF Dual Band Digital Transceiver

• Analog FM/D-Star DV Mode • SD Card Slot for Voice & Data Storage • 50W Output on VHF/UHF Bands • Integrated GPS Receiver • AM Airband Dualwatch



IC-7851 | HF/50MHz Transceiver

• 1.2kHz "Optimum" roofing filter • New local oscillator design • Improved phase noise • Improved spectrum scope • Dual scope function • Enhanced mouse operation for spectrum scope



IC-705 | HF/50/144/430 MHz All Mode Transceiver

• RF Direct Sampling • Real-Time Spectrum Scope and Waterfall Display • Large Color Touch Screen • Supports QRP/QRPP • Bluetooth® and Wireless LAN Built-in



ID-4100A | VHF/UHF Dual Band Digital Xcvr

• Compact, Detachable Controller for Flexible Installation • DV/FM Near Repeater Search Function • Apps for iOS™ and Android™ devices • Wireless Operation with VS-3 & UT-137 Bluetooth® Headset & Module • MicroSD Card Slot



IC-7700 | HF/50MHz Transceiver

The Contesters' Rig • HF + 6m operation • +40dBm ultra high intercept point • IF DSP, user defined filters • 200W output power full duty cycle • Digital voice recorder



IC-7100 | All Mode Transceiver

• HF/50/144/430/440 MHz Multi-band, Multi-mode, IF DSP • D-STAR DV Mode (Digital Voice + Data) • Intuitive Touch Screen Interface • Built-in RTTY Functions

IC-V86 | VHF 7W HT

• 7W Output Power Plus New Antenna Provides 1.5 Times More Coverage • More Audio, 1500 mW Audio Output • IP54 & MIL-STD 810G—Rugged Design Against Dust & Water • 19 Hours of Long Lasting Battery Life • 200 Memory Channels, 1 Call Channel & 6 Scan Edges



IC-7610 | HF/50 MHz All Mode Transceiver

• Large 7-inch color display with high resolution real-time spectrum scope and waterfall • Independent direct sampling receivers capable of receiving two bands/two modes simultaneously



IC-2730A | VHF/UHF Dual Band Transceiver

• VHF/VHF, UHF/UHF simultaneous receive • 50 watts of output on VHF and UHF • Optional VS-3 Bluetooth® headset • Easy-to-See large white backlight LCD • Controller attachment to the main Unit



IC-R30 | Digital/Analog Wideband Xcvr

• 100 kHz to 3.3 GHz Super Wideband Coverage • P25 (Phase 1), NXDNTM, dPMRTM, D-STAR Mode • 2.3" Large LCD Display & Intuitive User Interface • MicroSD Card Slot for Voice & Data Storage • USB Charging & PC Connection



IC-7300 | HF/50MHz Transceiver

• RF Direct Sampling System • New "IP+" Function • Class Leading RMDR and Phase Noise Characteristics • 15 Discrete Band-Pass Filters • Built-In Automatic Antenna Tuner



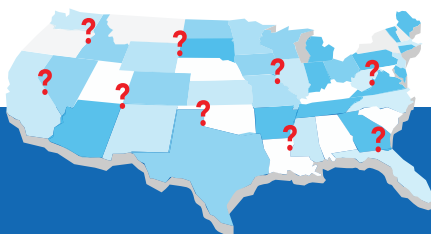
IC-2300H | VHF FM Transceiver

• 65W RF Output Power • 4.5W Audio Output • MIL-STD 810 G Specifications • 207 alphanumeric Memory Channels • Built-in CTCSS/DTCS Encode/Decode • DMS

ID-51A PLUS2

VHF/UHF D-STAR Portable

• RS-MS1A, free download Android™ application • New modes for extended D-STAR coverage • Terminal Mode & Access Point Mode allow D-STAR operation through Internet • DV & FM repeater search function • Dplus reflector link commands



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FTDX101MP | 200W HF/50MHz Transceiver

- Hybrid SDR Configuration • Unparalleled 70 dB Max. Attenuation VC-Tune • New Generation Scope Display 3DSS • ABI (Active Band Indicator) & MPVD (Multi-Purpose VFO Outer Dial) • PC Remote Control Software to Expand the Operating Range • Includes External Power With Matching Front Speaker



FT-891 | HF+50 MHz All Mode Mobile Transceiver

Rugged Construction in an Ultra Compact Body • Stable 100 Watt Output with Efficient Dual Internal Fans • 32-Bit IF DSP Provides Effective and Optimized QRM Rejection • Large Dot Matrix LCD Display with Quick Spectrum Scope • USB Port Allows Connection to a PC with a Single Cable • CAT Control, PTT/RTTY Control



FTM-400XD | 2M/440 Mobile

- Color display-green, blue, orange, purple, gray • GPS/APRS
- Packet 1200/9600 bd ready • Spectrum scope • Bluetooth • MicroSD slot • 500 memory per band



FTDX3000 | 100W HF + 6M Transceiver

- 100 Watt HF/6 Meters • Large and wide color LCD display • High Speed Spectrum Scope built-in • 32 bit high speed DSP /Down Conversion 1st IF



FTM-300DR | C4FM/FM 144/430MHz Dual Band

- 50W Reliable Output Power • Real Dual Band Operation (V+V, U+U, V+U, U+V) • 2-inch High-Res Full Color TFT Display • Band Scope • Built-in Bluetooth • WiRES-X Portable Digital Node/Fixed Node with HRI-200



FT-70DR C4FM/FM 144/430MHz Xcvr

- System Fusion Compatible • Large Front Speaker delivers 700 mW of Loud Audio Output
- Automatic Mode Select detects C4FM or Fm Analog and Switches Accordingly • Huge 1,105 Channel Memory Capacity • External DC Jack for DC Supply and Battery Charging



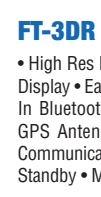
FT-991A | HF/VHF/UHF All Mode Transceiver

- Real-time Spectrum Scope with Automatic Scope Control • Multi-color waterfall display • State of the art 32-bit Digital Signal Processing System • 3kHz Roofing Filter for enhanced performance • 3.5 Inch Full Color TFT USB Capable • Internal Automatic Antenna Tuner • High Accuracy TCXO



FT-2980R | Heavy-Duty 80W 2M FM Transceiver

- Massive heatsink guarantees 80 watts of solid RF power • Loud 3 watts of audio output for noisy environments • Large 6 digit backlit LCD display for excellent visibility • 200 memory channels for serious users



FT-3DR C4FM/FM 144/430 MHz Xcvr

- High Res Full-Color Touch Screen TFT LCD Display • Easy Hands-Free Operation w/Built-In Bluetooth Unit • Built-In High Precision GPS Antenna • 1200/9600bps APRS Data Communications • Simultaneous C4FM/C4FM Standby • Micro SD Card Slot



FT-65R | 144/430 MHz Transceiver

- Compact Commercial Grade Rugged Design • Large Front Speaker Delivers 1W of Powerful Clear Audio • 5 Watts of Reliable RF Power Within a compact Body • 3.5-Hour Rapid Charger Included • Large White LED Flashlight, Alarm and Quick Home Channel Access



FTDX101D | HF + 6M Transceiver

- Narrow Band SDR & Direct Sampling SDR • Crystal Roofing Filters Phenomenal Multi-Signal Receiving Characteristics • Unparalleled - 70dB Maximum Attenuation VC-Tune • 15 Separate (HAM 10 + GEN 5) Powerful Band Pass Filters • New Generation Scope Displays 3-Dimensional Spectrum Stream



FTM-100DR | C4FM FDMA/FM 144/430 MHz Xcvr

- Power Packed System Fusion Transceiver • High Audio Output Power • Rugged Powerful Transmitter • Integrated 66ch High Sensitivity GPS • 1200/9600 APRS Data Communications



FT-60R | 2M/440 5W HT

- Wide receiver coverage • AM air band receive
- 1000 memory channels w/alpha labels • Huge LCD display • Rugged die-cast, water resistant case • NOAA severe weather alert with alert scan



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INSTANT SAVINGS

TS-990S | 200W HF + 6M Transceiver

- World's first dual TFT display • 200W output on all bands
- ±0.1ppm TCXO ensures both high stability and reduced power consumption • Triple 32-bit DSP's dedicated to main/sub receivers and band scope • Main receiver employs full down conversion, new mixer & narrow band roofing filters • Third order intercept point (IP3) +40dBm for highest level of RX performance (main receiver)

Call For Special Price!



\$40
INSTANT SAVINGS

TM-D710G | 2M/440 Dualband

- V+V/V+U+U operation • Built-in GPS • Built-in TNC for APRS & DX-Cluster operation • 50W 2M & UHF • 1,000 memories • Dual receive • Green or amber backlight colors • Latest APRS firmware w/new features • Sky Command II remote functions

Call For Special Price!



\$50
INSTANT SAVINGS

TH-D72A

2M/440 HT w/extended RX

- 5W TX, RX 118-524 MHz, VxU, VxV, UxU • APRS w/built-in 1200/9600 TNC
- Built-in GPS, Built-in USB, digipeater
- Echolink® compatible
- Mil-Spec STD810

Call For Special Low Price!



\$700
INSTANT SAVINGS

TS-890S | HF/50MHz Transceiver

- Receive performance on a whole other level from narrow bandwidth roofing filters that only full down conversion can provide • CW Morse code decode/encode possible with stand-alone unit • 150dB Blocking dynamic range (BDR) • Expanded touch operation scope • Kenwood Sky Command® II Support • Remote operation achieved without host PC Direct remote-control function (KNS)



\$25
INSTANT SAVINGS

TM-V71A | 2M/440 DualBand

- High RF output (50W) • Multiple Scan • Dual receive on same band (VxV, UxU) • Echolink® memory (auto dialer) • Echolink® Sysop mode for node terminal ops • Invertible front panel • Choice of green/amber for LCD panel • 104 code digital code squelch • "Five in One" programmable memory • 1000 multifunction memory

Call Now For Your Low Price!

TH-D74A

2M/220/440 HT w/D-STAR!

- D-STAR compatible • APRS ready w/ built in GPS • Color weather station information • Built-in KISS mode TNC • High-performance DSP voice processing • Standard compatibility for Bluetooth

Call For Low Price!



\$50
INSTANT SAVINGS



\$300
INSTANT SAVINGS

TS-590SG | HF/50MHz Transceiver

- Equipped with 500 Hz/2.7 kHz roofing filter as standard • ALC derived from TS-990S eliminating spike issues • Antenna output function (shared with DRV connector) • CW - morse code decoder function • Improved 1st mixer • New PFB key with multi-function knob • New split function enabling quick setting • LED backlight with selectable color tone



\$25
INSTANT SAVINGS

TM-281A | 2M Mobile

- 65 Watt • 200 Memories • CTCSS/DCS • Mil-Std specs • Hi-quality audio

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TH-K20A | 2M Handheld

- 2M 5.5W • VOX • CTCSS/DCS/1750 Burst built-in • Weather alert

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