**JOHNSON COUNTY RADIO AMATEURS CLUB, INC.**
P.O. Box 93
Shawnee Mission, KS 66201

# FEEDBACK

**JANUARY 2015**

## *Remote HF Operation for WW1USA - Herb Fiddick, NZØF*

The problem with special events is that they are tied to an event. While we often think the world revolves around ham radio, it really doesn't and special events tend to expose that reality. The series of WW1USA special operations in 2014 commemorating significant events in World War 1 is an apt case study.

The challenges started with the first event. Who knew that WW1 started on Field Day!? In reality, Field Day didn't get started until about 20 years after WW1. Organizing our first WW1USA event on a day that many hams set their clocks by, however, required "modification" to a number of paradigms and notions. The technical challenges weren't all that daunting, but it took skilled leadership from **Randy Schulze, KDØHKD** to persuade the Raytown Amateur Radio Club to get their heads around doing both Field Day and a Special Event at the same time.

The remaining summer events at Liberty Memorial gave us a rare opportunity to perfect our outdoor setup. By the time JCRAC took over operation of WW1USA in September, we had the technical detailsfinely tuned and optimized. That event yielded more contacts and created less stress than either of the previous two.

The last 2014 event for WW1USA presents some new challenges for the team. This event commemorates the Christmas Truce – a spontaneous cease-fire and celebration of Christmas that brought combatants together in the middle of the battlefield. It was a significant event in WW1. However, the Christmas Truce happened on Christmas – not normally a time conducive to 31 continuous hours of outdoor ham radio operations in Kansas City.

The Museum was gracious in allotting space for our operations in a prominent location in the lobby, but we soon discovered that there is no way to get antenna feedlines out of the building and there could be a foot of snow on the ground that time of year which would make outdoor antenna setup interesting at best. So, hams did what hams do and a technology-aided solution was soon devised.

Operating an HF rig through a computer is not an uncommon practice within a shack – lots of us do that with programs like Ham

***See WW1USA on page 4***

## JANUARY MEETINGS

***January 9** – Planning 2015 Meetings*

***January 23** – Herb Fiddick, NØZF – The Role of the Club in the Life of a New Ham*

The Johnson County Radio Amateurs Club normally meets on the 2nd and 4th Fridays of each month at 7:30 PM at the Overland Park Christian Church (north entrance), 7600 West 75th Street (75th and Conser), west of the Fire Station.

Much of the membership travels to the Pizza Shoppe at 8915 Santa Fe Drive (a block west of Antioch) for pizza buffet and an informal continuation/criticism/clarification of the topics raised at the meeting ... or anything else.

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*A publication of the*
*Johnson County Radio Amateur Club, Inc.*

**Bill Gery, KA2FNK, President**

**Aaron Boots, AAØRN, Vice President**

**Ted Knapp, NØTEK, Secretary**

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* * *

**Chip ACØYF and Deb KDØRYE Buckner, Editors**

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Although he might have been motivated by the FEEDBACK's threat of publishing additional non-technical articles, the FEEDBACK chooses to believe that **Herb Fiddick, NZØF** has more altruistic reasons to share his plans for setting up remote operation of special event station WW1USA. This month, we see the plans. Next month, he has promised an after-action report.

Several hams commented on **Chip Buckner, ACØYF**'s "Homeowner Adventures", offering their own experiences and both both moral and analytical support for his battle against anti-ham homeowner restrictions.

Last month, **Bill McMillan, NØYUD,** asked for an article on baluns. This month, **Jaimie Charlton, ADØAB**--who very plainly grew up in a home with a younger sibling--has risen to the occasion.

As is frequently the case, **Tom Wheeler, NØGSG**, gives us a witty exposition of his skills as a technical sleuth to unravel the basket that is his "new" Kenwood TS140S.

***-- Chip and Deb***

## PRESIDENT'S CORNER

I hope everyone had a happy and safe holiday time. "Real winter weather" held off for us in the Kansas City area as 2014 ended. As 2015 dawns let us see what the new year brings.

It was good to see everyone at the 2014 Christmas party (non-mobile). Special thanks to entertainers, **Tom Wheeler, NØGSG**, **Jaimie Charlton, ADØAB** and the **Chip, ACØYF**, and **Deborah, KDØRYE, Buckner**. What did Chip say the name of the group was? The Wheeler Holiday Orchestra ... The WHO".

One club activity I failed to mention last month was the "Shootout". Thank you, **Lon Martin, KØWJ** for organizing the challenge.

As usual the first meeting of the year will be a planning meeting. Please bring your ideas for Club activities and programs to the January 9 meeting. This is a good way to share your experiences and learn more about the ever-expanding world of Amateur Radio.

For 2015 Field Day we are planning to return to the Shawnee Mission Park. The location has been very good for providing exposure to Amateur Radio. The Johnson County Parks Department has been very supportive.

***– Bill Gery – WA2FNK***

## Johnson County Radio Amateurs Club

The December meeting of the JCRAC is a holiday party. This year, in addition to the traditional potluck, "The WHO" made its first Kansas City area appearance. JCRAC President **Bill Gehry, WA2FNK** asserted that the group was there to entertain the club, **Chip Buckner, ACØYF** quickly contradicted him, pointing out that the group was there (1) to have fun, (2) to have enough fun that other people wanted to join in and (3) to demonstrate an unintimidating level of musicianship that would encourage others to dust off old musical instruments and come join in next year.

So, "The Wheeler Holiday Orchestra", consisting of Chip (synthesizer and vocals), **Jaimie Charlton, ADØAB** (banjo), **Deborah Buckner, KDØRYE** (synthesizer), and **Tom Wheeler, NØGSG** (piano) entertained themselves with holiday music. Jaimie quipped that the level of musicianship was such that the group probably could have broadcast the event on the ham bands without running afoul of the FCC's ban on music transmissions.

The set began with special guest artist **Don Warkentien, WØDEW** keying the traditional "BENS BEST BENT WIRE", Tom responding on another key-board and the others joining the cacophonous pile up. (Mercifully, former FEEDBACK editor **Steven Martin, KØSLM**, has removed his video from Youtube.) Don left the stage, distributed lyric sheets and encouraged/bullied the hams and their guests to sing along.

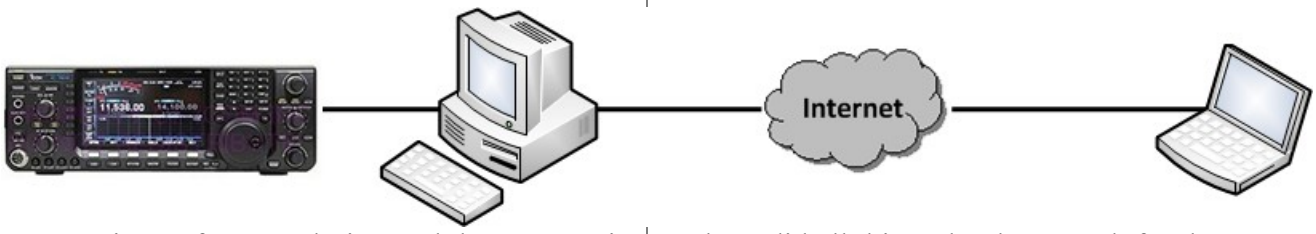
Throughout the set, Chip introduced songs, told a little bit about their history and challenged the guests to order the music from oldest to newest.

After the ... "show" ... several hams asked about Chip and Deb's gear. Chip and Deb were using MIDI (Musical Instrument Digital Interface) wind controllers to control a pair of synthesizers. Most people use keyboards to control synthesizers. People who want the extra expressive dimension of shaping notes using embouchure (for our purposes, mouth pressure on a mouth piece to adjust pitch) and breath pressure (to control amplitude) can use "wind controllers". It may be, however, that some people (e.g., Chip) use wind controllers simply because they cannot play a keyboard instrument.

## *WW1USA from page 1*

Radio Deluxe and others. Some, like **John Raydo, KØIZ**, have taken that to the next level by logging into their shack PC remotely and using technologies like Skype to transmit audio back and forth to allow completely remote operation. John has been doing this for years and has experimented with lots of different combinations of technology to perfect that mode of operation of his monster station in Colorado. There's lots of technology that can be combined to accomplish remote operation. The WW1USA team, however, was looking for a more standardized, commercial--and repeatable--setup.

At least a couple of commercial solutions to remote operation exist. Icom has its RS-BA1 remote operation software and that became a natural first choice since Icom is a major corporate sponsor of WW1USA. The RS-BA1 works with any Icom rig that has a CI-V connection.



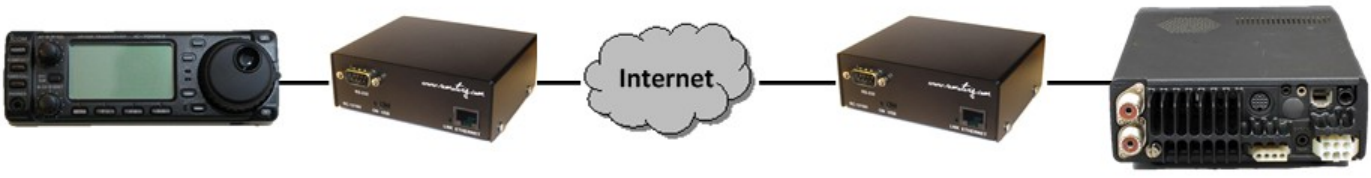

The RS-BA1 is a software solution and the remote site needs only a computer. That can be a benefit, as the remote setup is fairly simple. However, the resulting operation doesn't look much like ham radio – no wires, no knobs. Depending on the Icom rig you're using, a direct USB connection to your shack computer may be all that is needed to pass both CI-V commands to and from the radio as well as transmit and receive audio. The RS-BA1 software manages the connection to the computer and allows input and output of audio to/from whatever you want to hook up to your remote PC.

The RemoteRig solution incorporates two "black boxes" that translate TTL commands between the radio and its removable faceplate into packets that can be transmitted over the internet. Depending on the radio model, separate audio connections for transmit and receive audio may also be made to the "black boxes" and packetized for transmission over the internet. Because of the wide variety of radios this application is suited for, setup can be a bit more complicated than the Icom RS-BA1 solution. However, once it's set up, it's very portable and results in an operation that looks like a ham radio at the remote end.

Both solutions can deal with a variety of internet connections and connection quality. Packet sizes, buffering, and other settings are available to compensate for poor or high-latency internet connections.

So, how did all this technology work for the WW1USA event? You'll have to read next months' Feeback to find out. Deadlines for publication made it impossible to provide a full report on the actual operation.

One word to the wise, however, related to either of these solutions – you will find yourself deeper into your network setup and stretching your grasp on router setup and configuration and internet technology than you may be prepared for. If everything works on the first try, you'll be lucky. If it doesn't, make friends with a good IT guy.




The other option employed for the WW1USA operation was a product called RemoteRig by Microbit. It is more of a hardware solution and works well with radios that have removable faceplates, like some popular Icom and Yaesu rigs.

**A Hambone and Elmer Story - Jamie Charlton, ADØAB**

# *Shocking New about Common Mode Current*

It was a cold, bright, winter day. A 100 watt sun shown in a cloudless Kodachrome sky while a gossamer layer of snow was unsuccessfully trying to cover the remnants of a Kansas Fall.

Inside, the Christmas gifts were already being neglected by everyone except the tall fir in the corner that attempted to cover them with drooping branches and dropped needles. The blazing fireplace and the aroma of leftovers would seem to give an air of peace and serenity to Hambone's home, but that was not the case.

"I did not touch your stupid rig," shouted little brother Dude as he jumped to put an overstuffed, brown, leather recliner between him and Hambone who was in hot pursuit.

"Yes you did! You're always messing with my stuff and you always screw it up! I'm gonna get you!" retorted Hambone as his unsuccessful lunge at his younger brother landed him belly-first in the recliner.

"Hey, what's going on here?" asked Elmer, nicely tanned and recently returned from his visit to San Diego. "You guys should be happy with all the cool gifts you got," he added as he tried to position himself as a diplomat mediating a truce between to two nations who have been squabbling since the big bang.

"Dude wrecked my rig!" shouted Hambone. "He did something so now whenever I try to use that new Sound Fin mic Dad gave me I get a shock on my hands or lips. It's supposed to light up red when I'm on the air, not shock me whenever I talk. It started right after I caught him playing with my rig."

"That's not so good," soothed Elmer, trying to calm everybody down. "What did Dude do to cause this shocking problem?"

"I didn't do anything!" shouted Dude, keeping the leather recliner, that now contained Elmer, between himself and Hambone.

"I don't know, but I never got shocked before."

"I see," replied Elmer, relishing his new role. "Could it be that you made some changes to your station? Other than hooking up your new mic, I mean."

"Nope, the only change is the new mic, and whatever Dude did."

"Wait, Hambone, you put up that 40 meter dipole antenna you built just before Christmas. I helped, remember?"

"Dude! Are you saying my homebrew antenna is shocking me?"

"Could be, you know you're not that good at building things. Maybe it's reflecting power back and shocking you. Remember that light flasher you tried to…"

"Yeah, yeah," interrupted Hambone, "but that can't be the problem. I checked the VSWR with my analyzer and it showed no more than 1.2:1. That means almost NO – REFLECTED – POWER, Dum Dum Dude. Isn't that right, Elmer?"

"Well, yes, but that may not be the whole story. You may recall from our previous discussions that a VSWR of 1.2:1 results from a reflection coefficient, k, of only about 0.1. Since reflected power is proportional to $k^2$, only about 1% of your power is being reflected back to the rig. That's way too little to burn you and besides, it's all inside the coax. But there are a couple of other things that could cause the problem."

"Like, what, Elmer? What?"

"Well, Hambone, assuming you've already eliminated the possibility of power line shorts and things like that, I think you might have a case of the *dreaded common mode current*."

"Oh no, not that," moaned Hambone. "But wait, what is common mode current?"

"It's RF current that flows over the outside of your coax. It travels on the outside of the shield (under the insulation, of course) from your antenna all the way to your transceiver. Since the case of the transceiver is connected to your coax shield at its antenna connector, and your mic's metal housing is also connected to the case at the mic connector, they are all at a moderately high RF voltage that results from this common mode current trying to get to ground." explained Elmer as he leaned back in the recliner.

"So, where does this current come from and why is it on the outside of the coax?" asked Hambone, pausing in his pursuit of Dude who was now standing at a safe distance chuckling at Hambone's change of attitude.

"First, remember that your antenna doesn't begin and end outside. Your whole rig and everything else can be part of your radiating system. Usually, all the RF currents and voltages balance out, but sometimes they

***See Hambone on page 6***

***Hambone from page 5***

don't and that's when you see funny things happen, like shocks from your microphone."

"But Elmer, my dipole is a balanced antenna and I cut it very carefully so both sides are exactly the same length," replied Hambone.

"True, but remember, your coax is close to your dipole and can act as a receiving antenna and actually pick up some of your RF and bring it back into the shack. In fact, the house wiring picks up RF, too. That's why the stereo sounds funny when you transmit. But I don't think that's your problem."

"Then where did he screw up?" asked Dude.

"In this case, I think it arises because you are driving a balanced load–your dipole antenna–with an unbalanced feed line."

"But I carefully trimmed the antenna so its VSWR is very low," replied Hambone.

"This is not reflected power, Hambone, it is the result of two things: a division of current where the coax shield connects to your dipole and something known as the *skin effect*. Let's talk about the skin effect first.

As you know, direct current, DC, travels through a wire. The larger the diameter of the wire, the more DC it can carry. A garden hose carrying water is often used as an analogy for this type of circuit. The larger the hose diameter, the more water it can carry. But, AC, alternating current, is different.

As the frequency of the AC increases, it has a tendency to travel on the outside of a conductor. More correctly stated, the depth of penetration varies inversely with the square root of the frequency. Even at the power line frequency of 60 Hertz, some of the current is already being carried on the outside of its conductors. That's why overhead power lines are often hollow tubes. There's no sense making them solid if little or no current will flow through the center.

At radio frequencies, the effect is so great that the RF current penetrates the wire less than a thousandth of an inch."

"So, what has all this got to do with my antenna?" asked Hambone whose eyes began to glaze over at the mention of a square root.

"I'm getting to that, be still and learn," replied Elmer.

"Try to visualize your coax and the RF current it is carrying at a point before it reaches your dipole. Before your RF current gets to the dipole, things are pretty simple. It is traveling up to your antenna on the center conductor and back down on the inside of the shield. Everything is nicely contained inside the coax. Careful trimming of your antenna has resulted in a very low VSWR so it is basically a one-way trip for the transmitter power going to the antenna. Unfortunately, things change at the antenna.

You connected the center conductor of the coax to one side of the dipole and the coax shield to the other side. It looks pretty simple. Two conductors, the center wire and the shield of the coax, connect to the two sides of the dipole. But looks can be deceiving, especially where RF current is concerned. The RF current flowing on the center conductor has only one place to go and that's to its side of the dipole. But the shield connection is different.

At first, the coax shield seems to be just another conductor that should be connected to the remaining half of the dipole. But it's not. Because of the skin effect, it is actually *two* conductors – the inside of the shield and the outside. The current you want to go to the dipole is flowing on the inside of the coax shield and it will flow into the dipole. But, at the point where you connected the inside of the shield to your dipole, you also connected the outside because they are inseparable. So, at this point you actually have two paths for your RF current to flow: Into the dipole and on the outside of the coax shield."

"But, why doesn't it all go to the dipole?" asked Hambone.

"Simple," replied Elmer. "At the end of the coax there isn't only RF current, there is also RF voltage that is 'pushing' the current into all available paths. One of those paths is the leg of the dipole, but the other is the outside of the shield – skin effect, remember? Further, the amount of current that flows in each path is *inversely proportional* to its resistance or, more correctly, impedance. That is, the lower the impedance of a path, the more current flows in it.

In your case, because of the length of your coax and your antenna configuration, the outside of the shield presents a low enough impedance to allow a significant RF current to flow back to the outside of your rig, through you and to the ground. This current is called common mode current and is causing your RF tingles.

***See Hambone on page 9***

# Basket Cases: A Kenwood TS-140S - Tom Wheeler, NØGSG


As many of you know, I have a weak spot for basket case radios. These are often the radios that you find at hamfests, each with a seller that swears "It worked fine when I last checked it, but that was a long time ago."

I was offered a good deal on this radio by a local seller, who was very honest. The set would turn on just fine, but after it "warmed up" the display and controls would stop working. Another basket case to grace my bench!

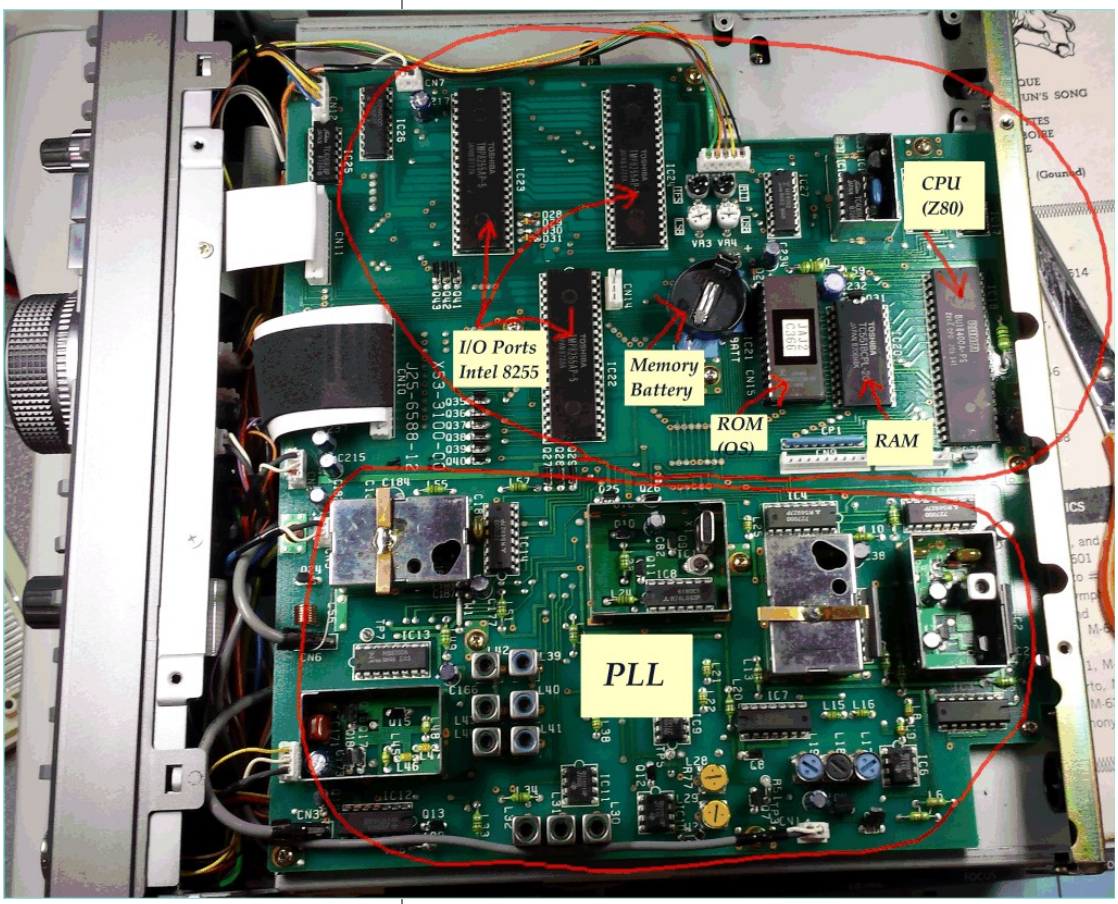
The TS-140S, sold in the early 1990s, is the successor to the TS-430. It's intended as an entry-level 100W HF unit, and has very solid performance.

It has full microcomputer control, 100 memories, and solid-as-a-tank construction typical of Kenwood products from this era.

This particular example was very clean inside and out. However, it would be nothing more than a fancy paperweight without some troubleshooting.

Likely, this unit had one or more issues on the digital control board, which contains the microcomputer and phase-locked-loop (PLL) circuitry. And like many Kenwoods of this era, the microcomputer is based on the Zilog Z80 CPU. Yep, it's the same chip used in early personal computers such as the infamous TRS-80 Model I!

The control unit is shown below, with the important components marked.




Troubleshooting a microcomputer with an intermittent problem can be a very difficult task. In modern radios, the CPU, RAM, and ROM tend to be on a single IC chip, and this makes intermittents rare in these newer sets. In older radios, these parts are separate on a board. For the computer to run correctly, it needs the following:

***See BASKET on page 8***

***BASKET from page 7***

- Clean +5V power supply voltage on its Vcc pin, and a correct system clock signal.
- Access to the operating system code in the Read Only Memory (ROM)
- Access to read and write information in the Random Access Memory (RAM)
- Access to the various Input and Output locations in the radio, which are interfaced through the multifunction I/O port ICs, the Intel 8255s.

This radio had good 5V power and clock signals on the CPU and peripheral devices. However, pressing on the ROM IC could precipitate a crash. Most likely, there was one or more bad solder joints or a defective socket underneath the ROM. I thought it would be faster to pull the board and simply replace the socket under the ROM, rather than try any fancy measurements. This turned out to be a good choice, because it revealed several incomplete feedthrough eyelets that resided underneath the ROM socket.

- Feedthroughs are a common problem on digital boards. Under the microscope, it was evident that the copper "tubes" of many feedthroughs on this board were not solidly plated. Some had a corroded appearance. To correct this problem, I soldered a short length (0.100") of 30 gage wire-wrap wire through each hole to ensure that it had continuity. PC boards sometimes fail in this way 10 or more years after manufacture if the factory has not completely washed away all traces of etchant during the board manufacturing process. It's common in most consumer equipment. Other strange failure modes exist as well--for example, shorts between traces can develop within the inner layers of PC boards that are impossible to see--these shorts are again due to residual etchant acting on the copper within the board.

After repairing the board, the radio ran much better! It would no longer crash when I pressed on the board, ROM, RAM or CPU chips. But it would still randomly check out from reality, about once every several hours. This was not acceptable!

- I suspected that the ROM (an 27128 type Eraseable Programmable Read Only Memory) was aging poorly. Very bad news, because Kenwood's proprietary operating system code is contained in this IC. The data from the EPROM needed to be recovered!

To recover data from an EPROM, an EPROM programmer is needed. Fortunately I had one in the closet, but it required a PC dating back to the early 1980s for it to run on! Thanks to the generosity of Frank Neal, N8FN (SK), I had just such a computer (a Toshiba T3200SX) sitting in the closet as well, just waiting for the day when it would again be gainfully employed. I carefully loaded my old MCT Technologies EPROM programming software onto this computer, then read several archived EPROMs from other devices to verify that it was working as advertised.

Getting the EPROM from the TS-140 to read out took several evenings. The first time I tried, the EPROM simply read all blanks (0xff, 0b11111111, 255) in all the memory locations. Not good! So I tried different things to get it to work…and finally found out that it was "happier" when I gently heated the chip with a hair dryer. Kenwood printed the checksum "C366" on the label for the IC, and I was overjoyed when the EPROM programmer suddenly proclaimed the same checksum. We have the data, huzzah! This data was immediately backed up to a floppy disk (no flash drives or USB on the old Toshiba).

I now lacked a new 27128 EPROM to program the recovered data into. Bill Brinker, WAØCBW, happened to have a few extras in his parts bin, which he gave to me. After erasing Bill's parts, I successfully programmed one with the TS-140's ROM image data.

With the new EPROM in place, the TS-140 was solid again. It ran for more than a week 24/7 on the bench without a single crash or hiccup. Success - another notch on my rifle barrel!

***Conclusion***

I spent about four hours working on this radio. Online, I could have bought one for a few hundred dollars and would have had the same result - - a working radio - - but not the same outcome. I always want to know why something doesn't work, and this experience added to my knowledge. More importantly, it's simply fun to dig into something and make it whole again.

Basket case radios are a great place to start. After all, if it's a basket case, you can't make it any worse, and you are sure to learn something valuable each time you delve into one. Many baskets cases are easy fixes. Don't be afraid to go for one if you get the chance!

## *Hambone from page 6*

It is all explained in the *Radio Handbook* I gave you for your birthday, if you get it, I'll show you where."

"I'm not sure where it is," mumbled Hambone.

"I'll get it," chimed Dude, "It's under the short leg of the workbench where you put it to stop a wobble." Thrilled that he one-upped his big brother, Dude ran off to get the book.

"So, how can I stop this current?" Asked Hambone, anxious to change the subject.

"That's simple, too," replied Elmer. "According to Ohm's Law, all you have to do is to raise the impedance of the path that includes the outside of your coax shield and the current in it will decrease. The simplest way is to place some inductance in that path. You can do that by making a coil of eight to ten turns of your coax about seven inches in diameter and placing it right at the connection to your dipole. This added inductance raises the impedance of the 'outside of the shield path' so less current flows on it. You might have to experiment to find the best diameter and number of turns. Commercially, this is sometimes called a 1:1 balun or RF isolator, but it is really just an inductor or choke.

Personally, the coax coils I've made seemed to work better at some frequencies than others, so I'm using commercially made RF isolators and actual baluns on my antennas. They run about $20 to $50 depending on power."

"Elmer, what's a balun?"

"It's short for *bal*anced to *un*balanced. It is a transformer designed to operate at RF frequencies and convert back and forth between balanced and unbalanced terminations. Besides stopping common mode current, baluns can also convert impedances. The numbers tell the *ratio of the impedances* the balun converts. This is NOT the same as the *turns ratio* which is often specified in audio and power transformers. For example, a 1:4 balun can convert between 75 ohm coax (unbalanced) and 300 ohm twin lead (balanced) circuits. Technically, the RF isolator we described, should be called an 'unun' because it is unbalanced in and unbalanced out.

There are a lot of balun designs and it's easy to build your own. But, designing an efficient and effective balun is more complex than it appears, so it is better tobuild your first baluns from instructions. Once you see how they work, you can design your own."

"Well, Elmer, can you help me make an RF isolator so I can get back on the air?" asked Hambone.

"Better yet," replied Elmer sensing a mini-project in the making, "I have one in the basement. It looks like a piece of plastic pipe with coax connectors on each end. But inside it is full of ferrite cores with a single piece of coax running through them. It's lucky you used a coax fitting up on your dipole. That'll make installing this unun isolator easy."

- - -

"WOW Elmer, the shocks are gone!" shouted Hambone.

"Yes they are." Crooned Elmer, feeling very pleased with himself.

"Oh hey, it's time for my CW net to start," said Elmer, excusing himself. "We can talk more about this stuff later if you want. But right now I have to get on the air. Have you noticed the RF chokes on my feed lines, they got rid of the RF in my shack, too."