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- Tuesday 3805 kHz at 8pm CST
- Thursday 3805 kHz at 8pm CST
- Friday (West Coast) 3895 kHz at 10pm CST
- Sunday 10m AM 29.050 mHz at Noon CST
- 1<sup>st</sup> Wednesday AM 3880 kHz at 8pm CST

Sunday for Technical, Buy, Sell & Swap  
Tues., Thurs., Fri., & Sunday for Ragchew

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## In the News

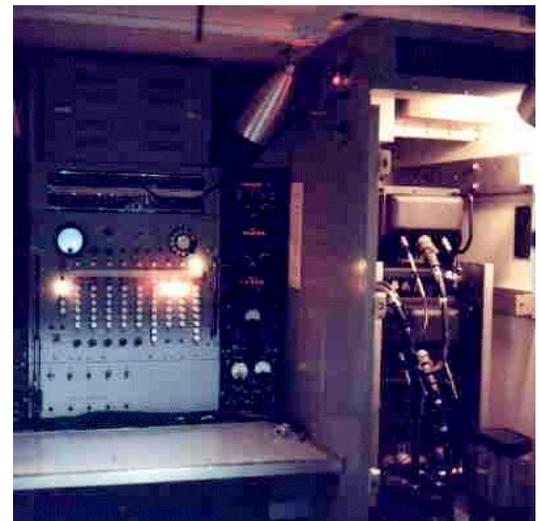
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- AG5Y Larry SK
- Cedar Convention
- Election Notice

## The Genesis of Military SSB at Collins Radio Part II by Scott Johnson, W7SVJ

### Forward

The first installment of this series introduced several equipments that composed Collins' first generation of military and commercial SSB communication gear. This installment will give a brief overview of the circuit details and functioning of the equipment, and will discuss common service procedures and problems. It will

since it is really a family of equipment, yet was never referred to as such. Together, these systems provided the backbone of the Strategic Air Command's first worldwide SSB network, from the late fifties until well into the seventies. The TRC-75 vehicular set was installed in USMC and USAF jeeps (MRC-83 and 87), and RAAF Land Rovers, and was in active service until at



**Figure 1. TSC-15 shelter variant of the TRC-75 shown left hand and right hand views. 2 receiver/exciters are on the right hand side. The PA, antenna coupler and control occupy the left**

also discuss a few of the less common options, accessories, and modifications. I will refer to all equipment with its military nomenclatures, keeping in mind that there are Collins commercial nomenclatures for most units as well. Both the URC-32/KWT-6 series manually tuned fixed station transceivers, as well as the ARC-58/TRC-75 (Figure 1) series aircraft/vehicular remote controlled, automatically tuned, transceivers will be covered. I will again refer to the equipment family collectively as "URG-0",

least the early nineties. TRC-75's were rumored to have been deployed to the Middle East in the first gulf war. This seems to be supported by the fact that the last few TRC-75's to show up as surplus had been hastily painted in desert camouflage. The TRC-75's watertight case was designed to put an existing radio (the ARC-58) into an existing vehicle (the M38A1). There is very little extra room inside the case for the radio components, and very little extra room inside the vehicle for the TRC-75 case. Many of the



## From the Editor's Desk

by Bill Carns, N7OTQ and Co-Editor Joe Nyberg, WILJN

The quarter has flown by and what a quarter. Personally, I have been consumed by trying to get my building finished, get the shack set up and start installing some equipment. As usual, I completely underestimated the size of the job. It was the original intent to be in the building by April of this year, but now it is looking more like December, if I am persistent and lucky. Being retired is wonderful but, so far, no reduction in work load. Hi!

This quarter was a strong one for the Collins Collectors Association. The web site continues to improve. The reflector archive access problem was solved and Butch Schartau, KOBS, and member of the BoD of the CCA, put on quite an event at Cedar Rapids this past month with over 40 CCA members in attendance. This CCA convention was held in conjunction with the 75<sup>th</sup> anniversary

celebration of the incorporation of Collins Radio in 1933. Butch has written a brief description of the anniversary and CCA agenda and it is printed here in this edition of the *Signal* along with a number of related pictures.

A feature article by Smitty Schuneman, W0DRU, will appear in the Q4, 2008 issue, along with more pictures of the events and attendees.

Our thanks go out to the Collins Radio Amateur Radio Club, W0CXX, for organizing the Collins anniversary events and station operation. It was superbly run, even with the difficulties brought about by the flooding during the previous months.

After a year of expansion in both size and scope, the *Signal* is settling in for the long run and, after doing battle with the budget

boogy, it looks like it will generally be about 16 pages, along with a periodic fun surprise insert. The reaction and feedback from around the world continues to be outstanding. Please keep your contributions and ideas flowing and we are looking forward to another great year.

As you know from comments in this column over the past several issues, the CCA and the editors of the *Signal* magazine are intent on increasing the involvement and visibility of our international contingent - which is significant. In this vein, we have appointed a foreign correspondent to the volunteer staff of the *Signal*. We would like to welcome Michael Lyman, W0JAM/DO1LMA, of Munich, Germany, who will cover Europe. Michael is an ex-pat living in Germany and shares our vision of more involvement

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### Election Time—Let's Talk

Elections are coming over the next quarter and, of course, I would encourage everyone to get to know the candidates and to vote. Our election process, however, is hampered by a lack of communication (ironic) about the candidates, and often by there being very little information out there about the candidates beyond a short bio put together for the moment. Often, just showing up on the net and getting your name and call out there is enough to get you elected.

I would ask everyone to jack up the activity here. Is the candidate you are considering already active - I mean contributing - to the CCA? What level of commitment do they have to the Collins passion and preservation of history and equipment? Can they travel, and are they willing to travel, to at least one physical CCA event a year? Do they show an interest in accepting and carrying out one of the internal tasks that fall upon the Board of Directors? In short: Are they qualified and passionate?

This is not a commentary that is driven by any dissatisfaction with the progress that has been made over the last term. The progress has been tangible and certainly down the road promised during the last elections. But, in looking at our election process, I think we could do better. We now have a member's only area Forum on the website that facilitates more discussion. Let's use it. I encourage candidates to get in there and make comments, share visions and discuss proposed directions. I encourage the members to ask candidates questions in the open Forum, so that we can all see the answers. Keep it constructive, but let's not be afraid to ask some good questions.....Bill

## The Genesis of Military SSB at Collins Radio (Cont'd)

“features” and shortcomings of the TRC-75 are explained when you see the radio installed in the vehicle. The radio and power supply box take up all

the hood. How cool is that! I just had to build one.

Both the URC-32 and the KWT-6 make excellent stable, and usu-

this equipment, and while sometimes “collected”, they are often not put on the air. You are encouraged to take that big leap and get more of these on the air.

SP-109  
Transceiver KWT-6 Type 5

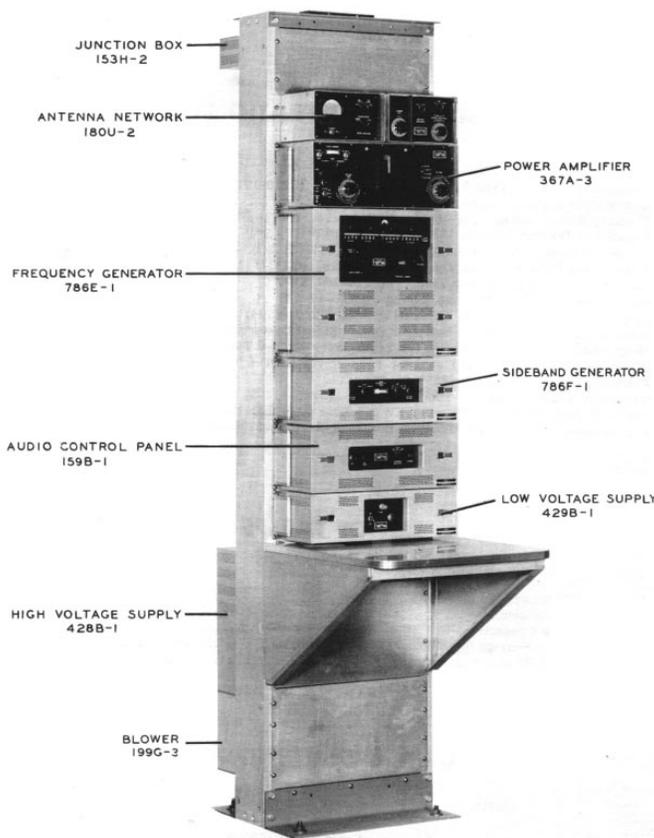


Figure 2 - KWT-6, Type 5 with desk and manual antenna tuner

the space behind the driver & passenger, the antenna mount goes where the M38A1 jerry can mount was, and the original MRC-83 28 V, 150 Amp Leece-Neville alternator takes up almost all available space under

ally very reliable, amateur rigs, especially when they are gone thru once very thoroughly and then treated with some good preventative maintenance periodically. Unfortunately, many collectors are intimidated by

### Frequency Generation

The frequency generation scheme can be considered to be a technology bridge between the earlier PTO tuned sets and later phase locked loop designs. The frequency synthesis scheme in the URG-0 family was continued in the 618T airborne transceiver, as well as family variants. The 618T was a generation newer, and made more use of semiconductors, but the principles were very similar. It would be very difficult to fully describe the frequency synthesis in this article, so I will just touch on the salient points.

1. The reference signal generator, SG-179, (early sets, proportional oven controlled crystal oscillator) or SG-179A (later sets, temperature compensated crystal oscillator) produces a stable 100 KHz and 2.4 MHz signal from a 3 MHz crystal. The crystal frequency is mixed and divided to arrive at the two output frequencies.
2. The amplifier/frequency multiplier, AM-1579, triples the 100 KHz reference signal for injection into the transmit balanced modulators, the receive product detectors, and supplies a carrier for the transmit mixer.
3. The electronic control amplifier, AM-1524, contains the TGC amplifier as well as the VOX detector/amplifier.

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## Genesis of Military SSB (cont'd)

4. The frequency divider, CV-466, divides the 100 KHz reference by 25 to generate 4 KHz for the spectrum generator, and divides the 4 KHz by four and delivers the resultant 1 KHz to the AM-1529 for frequency step selection.

5. The mixer-oscillator CV-465A (here's where it gets complicated) is responsible for generating a variable 2.000 to 3.995 MHz in .5 KHz steps. In addition, one of four discrete frequencies generated in the sidestep oscillator (2400, 2399, 2398, and 2397 kHz, all derived from the standard) can be mixed with the interpolation oscillator to give a tuning range of 2000.000 to 3999.875

kHz in 125 Hz steps. This corresponds to the first (band A) of four bands used to cover the 2-29.999 MHz range, and in fact this output is applied directly to transmit low level stages, bypassing the mixer. Tuning these frequencies is accomplished by a two speed servo system in the ARC-58/TRC-75, and manually in the URC-32/KWT-6. After the mechanical motion ceases, the electronic stabilization circuitry locks up the CV-465 PLL. The other three bands use a combination of additive mixing and multiplication to cover the remainder of the HF band. Band B is 3.700-7.699, band C is 7.700-15.999, and band D is 15.700-29.999 MHz. The 1 KHz steps are produced in an interesting manner. The 1 KHz signal triggers a multivibrator that produces a spec-

trum of 1 KHz pulses, which are mixed with the 2.4 MHz and mixer crystal frequencies to form a 455 KHz signal that is filtered by a mechanical filter. The output is fed back and mixed with the master oscillator frequencies to produce an error voltage in the discriminator that is applied to the saturable reactor or varicap (This depends upon the model or mixer-oscillator. Earlier units pre-date the varactor tuning diode.) in the master oscillator which effectively cancels the drift from the crystals, and results in an output frequency stability that is equal to that of the reference signal.

transmit driver which provides a nominal 200 mW signal to drive the PA. The AM-1528 RF deck has the largest & most complex slug rack that I know of, and it is driven by a 400~servomotor to boot.

### Frequency Setting

Frequency setting is controlled manually in the URC-32/KWT-6 series, with only the band select being motor driven (one of four bands is selected by a DC servo when the band select knob is moved). In the ARC-58/18Z/TRC-75 series equipment, remote tuning is accomplished by several resistive bridge type follow-up DC servo loops. The tuning information is generated by the control head, and the motors are driven until the bridge is in balance.

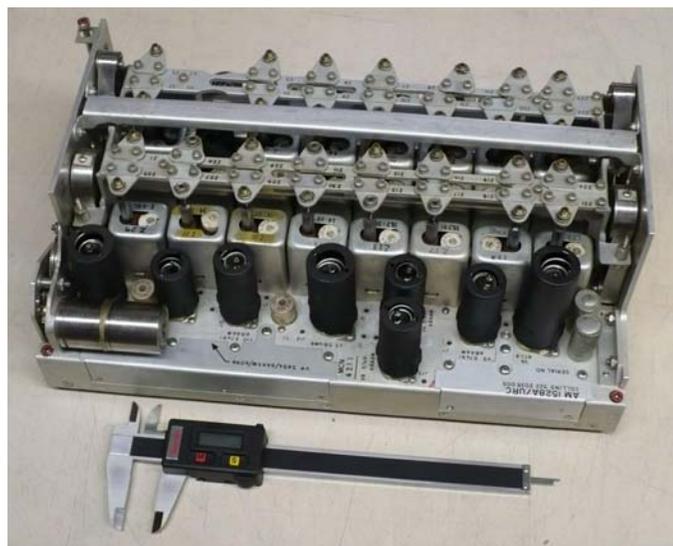
Radio set control C-3141 is the means of frequency setting and mode control in the ARC-58/18Z and TRC-75 sets.

In the URC-32/KWT-6 sets, frequency setting is manual via a band switch and a crank type knob that sets the frequency to within 1 KHz. Later sets also had a 100 Hz step oscillator module which allowed frequency setting to 100 Hz.

This 100 Hz upgrade module is highly desirable for amateur band usage.

### Sidband Generation

Sidband generation takes place in the balanced modulator, MD-286. The module con-



**Figure 3. AM-1528A RF tuner used in the ARC-58/TRC-75. The URC-32/KWT-6 tuner is similar but manually tuned**

6. The amplifier-mixer (RF tuner) AM-1528A (Figure 3) contains the slug racks and mixers necessary to produce the transmit RF frequency and the receiver LO injection frequencies. In addition, the module also contains the receiver RF amplifier and tuned circuits, and the

## Genesis of Military SSB (Cont'd)

tains two ring type diode modulators that mix incoming audio with the 300 KHz reference frequency to generate a DSB suppressed carrier signal. Each modulator feeds a mechanical filter which filters the unwanted sideband. The resultant SSB signal is then fed to the transmit LF mixer via the TGC/VOX amplifier AM-1524. USB, LSB, or DSB operation is possible, depending upon the emission mode selected on the control unit.

### Receiver IF and Detection

The 300 KHz receiver IF signal is derived from the receive variable IF amplifier and is routed to three separate IF amplifier/detector modules:

AM-1523 is the AM channel amplifier/detector, and consists of three stages of IF gain, a mechanical filter, a diode detector, and two audio stages, as well as an AGC amplifier stage.

AM-1526 is the LSB channel amplifier/detector, and consists of two IF amplifier stages, a mechanical filter, a product detector stage, two audio stages and an AGC detector/amplifier stage.

AM-1527 is the USB amplifier/detector, and is identical to the AM-1526 with the exception of the mechanical filter center frequency.

The audio output is selected by control relays and routed appropriately. ISB (simultaneous lower and upper sideband) operation is possible, because of the separate IF modules.

### Power Amplifier

The power amplifier is a straightforward (from a Collins-centric point of view!) design, utilizing two parallel 6CL6's driving a pair of 4CX250B (in the URC-32/KWT-6) or trio of 4CX250R tetrodes in the ARC-58/TRC-75, for a nominal 500W PEP output in the URC-32 and 1KW PEP for the ARC-58/ TRC-75. If one spends much time looking at the output network in the URC-32, and is familiar with the KWS-1, the family resemblance will be obvious. The PA is manually tuned in the URC-32, and servo tuned in the ARC-58. Chopper-type servo amps AM-1733 and AM-1525 are used to tune the driver and PA plate circuits, respectively. In the TRC-75, the entire automatic tuning process in the T-730 1 KW PA, and the CU-749 antenna coupler, is orchestrated by a handful of 28VDC relays and by a motor-driven wafer switch in the C-2848 antenna coupler controller.

### Antenna Matching

Antenna Matching in the URC-32 is handled by a remotely manually tuned coupler SRA-22. The coupler elements are slewed electrically by lever switches, whilst monitoring the reflected power on a Breune Coupler- type wattmeter located near the top of the rack. Most KWT-6 variants rely on an internal coupler/wattmeter unit CU-737. This is a manual internal coupler. The ARC-58/TRC-75 utilize a fully automatic remote coupler system, which in the case of the TRC-75 is the C-2848. This module contains a phasing servo amp, a loading servo amp, a power supply and the related

control circuits. The antenna coupler unit itself is a CU-749 which consists of a variable inductance and a variable series capacitance. The TRC-75 also has an external loading coil unit RF-111 to match the relatively short whip at low frequencies. The ARC-58 coupler system is similar, but the coupler proper is pressurized for operation at high altitudes.

### Power Supplies

The power supplies for the URC-32/ KWT-6 were covered in the first installment, so I will limit this discussion to the ARC-58/ TRC-75. The low voltage power supply module in the receiver/exciter R-761 is the PP-1574 and supplies +250 V, +130 V, +28 V, and 6.3 VAC from a 115 VAC, 400 Hz input. The 250 V is used in the RF translator and the 130 V in almost all modules. The 28 V supplies the transistor circuitry and the 6.3 VAC is used for tube heaters.

In transmitter T-730, an integral power supply produces +2000 V for the final amplifier plate supply from a 115/208 VAC 400 Hz three phase input. There are also +400 V, +27.5 V and 6.3 VAC supplies, and a -40 to -80 V bias supply. The 400 V supplies the 4CX250B screens and driver plates, the 27.5 VDC supplies the relays and servo amplifiers, and the bias supply supplies operating and cut-off bias for the finals. Prime power for operation of the ARC-58 is from the aircraft 400 Hz AC electrical supply, and in the TRC-75, the power is supplied from either a 28 VDC

## Genesis of Military SSB (cont'd)

to 115 VAC 2.5 KVA inverter PP-2352 (operating from the vehicle alternator), or a PU-454 Generator unit towed in a trailer behind the vehicle.

### Variants

Several KWT-6 variants exist in addition to the standard transceiver version:

1. A single receiver
2. A single exciter
3. A dual-diversity receiver with two RF translator chassis & two IF translator chassis.
4. An automatically-tuned (remote) version which used ARC-58 components and had a built-in 400 ~ motor-generator

### Interesting Observations and Service Notes

The KWT-6/URC-32 receivers will tune down to 1700 kHz but the PA will only tune down to 1980 kHz or so (not so with the TRC-75/ARC-58, as the discrete servo tuning steps limit the coverage to 2-20 MHz). You can bet this really ticked off the hams on the design team, but I suppose the PA deck would have been larger if it was given 160M capability.

I have had very few failures in my URG-0 equipment, most failures have been traced to dirty connections—usually the PC edge connectors on the modules, bad capacitors (electrolytics, and even some micas in few cases). Others have reported semiconductor failures, but I have yet to see a transistor failure in any modules. I have replaced a few weak subminiature tubes in IF modules as well. By far the most time consuming task is

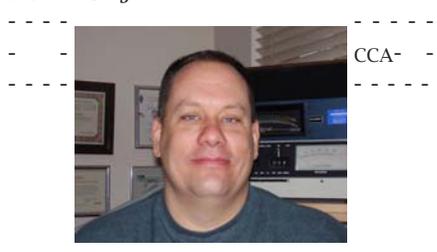
cleaning and lubricating the slug racks and gear trains. As in all Collins gear with slug rack, the followers on the slug rack must be free and have very low friction to track properly. In the KWT-6/URC-32, proper airflow is a must. Cooling airflow can be adjusted by monitoring pressure in a subassembly with a manometer and then sliding the airflow plate on the back of the assembly to provide proper back pressure.

### On the Air with a TRC-75

In the third installment of this series of articles, I will attempt to go into the nitty-gritty details one needs to know to successfully install and operate the TRC-75. I am, at the time of this writing, finishing the complete restoration of a Willys M38A1 jeep which will be configured temporarily as a MRC-83 radio jeep with the TRC-75 and 150A charging system installed. I say temporarily, since this jeep will ultimately be configured as an early USAF Forward Air Control jeep with an all-Collins line-up of HF, VHF, and UHF sets. Stay Tuned!

I want to again thank Dave Ross, N7EPI, for information relating to the TRC-75 and TSC-15. We will be collaborating on the remainder of this series on Collins military SSB evolution.

de W7SVJ



## From the Editors' Desk (Cont'd)

of the non-U.S. members. He will periodically be contributing a European perspective and helping with communication. We are also looking for an Asian correspondent to serve a similar function for the Pacific Rim. Anyone interested should contact this editor.

We hope that the additional involvement of Michael, as well as the material contributed, will be of use and interest to all of you and also lead to some get-togethers and net activities offshore.

Finally, a comment about the nets. The propagation continues to be almost laughable at times with some of the worst QSB on 20 meters that I have ever seen in almost 60 years of being a ham. In spite of this, both the 75 meter and 20 meter nets continue to be well attended and the check in rate is good. We are still (read that "Help") looking for a permanent 20 meter net manager so, if you are involved in the nets, a good communicator, and interested, please give me a call or an email. It is not that much work (it just takes a little time each week - so retired is better) and it is great way to be involved and contribute to the CCA.

That's it for this quarter. I want to apologize for the lateness of this issue. Life grabbed several of us by the horns. We will be back on track next quarter. Stay in touch and, as I said, keep those article ideas and comments coming. Have a great quarter and see you on the nets.....de Bill, N7OTQ

----- CCA -----

## Collins 32V-1/2/3 Transmitters – An Update on Production Quantities by Rod Blocksome, K0DAS

Several years have passed since I did the original surveys and analysis of serial numbers. But I have continued to collect bits of information along the way. Recently, several inputs have helped clarify the 32V series production quantities.

Several newly reported serial numbers have now very closely established the change over from 32V-1 to 32V-2. The serial numbers for the 32V-2 did not start over at 1 but rather continued from where the 32V-1 left off. 32V-1 serial 926 is currently the highest number found; while 32V-2 serial 929 was recently identified. We now know within 2 transmitters where the change took place. We will know for certain if and when either serial number 927 or 928 appear.

Additionally, the new highest serial number found on a 32V-2 is 2450. Likewise, the highest serial number on a 32V-3 found to date is 1535.

The following table summarizes the best information I currently have on these transmitters:

<u>Model</u>	<u>Top Level CPN</u>	<u>Serial No.</u>	<u>Quantity</u>
32V-1	520-2906-000	1 to 250	250
32V-1	520-3769-000	251 to 400	150
32V-1	520-4264-000	401 to 927	527
32V-2	520-4659-000	928 to 1325	398
32V-2	520-4729-000	1326 to 2450	1125
32V-3	505-3691-005	1 to 1535	1535

This would indicate totals for each model as:

32V-1 = 927

32V-2 = 1523

32V-3 = 1535

Total 32V series = 3,985 transmitters produced

A couple of interesting variations have also surfaced. 32V-2 serial 1652 has front panel lettering engraved rather than the usual silk-screened lettering. 32V-2 serial 2205 has a front panel painted with olive drab wrinkle paint instead of the normal St. James gray wrinkle.

So there you have it. Does anyone have 32V-1 or 32V-2 serial numbers 927 or 928? Or, do you have any other unusual variations that appear to be factory? Is there a 32V-3 out there with a serial number higher than 1535? I'll be interested to hear from you. In the meanwhile, good luck collecting Collins equipment.

Rod Blocksome, K0DAS, [rkblocks@plutonium.net](mailto:rkblocks@plutonium.net)



### Author Information

Rod Blocksome is a 40 year employee with Collins Radio and currently works for Rockwell Collins in Cedar Rapids. He received his BSEE degree in 1968 and a MSEE in 1973. His major design engineering project responsibilities have included the HF power amplifiers for the HF-8021 3kW, HF-8022 10 kW, and HF-8023 1kW (solid state). He also was lead development engineer for the HF-8151A (AN/FRT-96) 10 kW transmitter, the MF-8022 (a 16 kW auto-tune medium frequency PA) and the TV-8022 (a 45 kW PEP manual tuned television transmitter). Rod has become a significant contributor to our CCA and is particularly interested "in the production history of the Collins equipment and the anecdotal stories of how certain things happened and the Collins engineers who made them happen."

Rod says he was not a Collins collector until he gave Bill Wheeler and Jay Roman a museum tour back in the early 90s. Quote: "I did not realize at the time that it was contagious." We are fortunate to have him.

Rod has been a licensed ham for 48 years, getting the Novice call KN0DAS in 1960 and upgrading to (conditional) General (Now K0DAS) about 6 months later. He has since

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5T5KPO – Collins in Action in Mauritania

by Alfred “Fred” Carlson, WA7UHR

“CQ CQ CQ — This is Five Texas Five Kilowatt Pacific Ocean, 5T5KPO calling CQ and by”, was the call that rattled across the 20 meter phone band in early July of 1973.

The Kitt Peak National Observatory of Tucson, Arizona, had sent a team of scientists, engineers and technicians to Mauritania, Western Africa along with an Aerobee sounding rocket and necessary support equipment including a Collins KWM-2, 30L-1, 312B-4 and a Wilson TA-33 beam antenna on an expedition to study the Solar Eclipse of 1973.

The call signs 5T5KPO (base station) and 5T5KPT (up range station) were hastily negotiated and issued by the Mauritanian ministry. These negotiations included the first ever, temporary, third party agreement awarded by Mauritania. At that time we were one of only five active ham stations in the country.

The radio station 5T5KPO was set up inside a sandstone cave carved into the butte by the French to support an anti-aircraft gun battery during WWII. The Kitt Peak group modified the gun emplacement and the cave making a launch rail for the Aerobee sounding rocket and a support facility.

An astronomical payload consisting of special cameras and

film were on board the rocket set to take pictures of the second longest Solar Eclipse in 1400 years.

Near the launch rail and located inside old shells of small storage sheds were two Onan Generators supplying AC power to the support ground electronics and the Collins station. Two sets of well used Collins KMW-2’s and a 30L-1 complete with carrying cases were provided by York University of Toronto, Canada. This equipment was tested and adjusted operational by WA7UHR prior to departure for Africa.

At the end of long, hot and busy days of rocket preparation and testing, some evenings would be spent by the author at the Collins station passing third party traffic and then jumping into the busiest QSO pileup imaginable. I spent the time at the microphone making contacts left and right turning the spare time into the greatest DXpedition - by accident - a ham could possibly dream about. Although conditions were not choice (blowing sand, extreme heat and humidity), the Collins station preformed for three weeks solid

without missing a beat, or a QSO. It was always there, always ready to pack a great signal into that TA-33 beam with a heading for the good ole’ USA!

Authors note: Thanks to Kitt Peak National Observatory and my many mentors for the opportunities and confidence they gave me through my 13 years of service.

----- CCA-----

Author Information

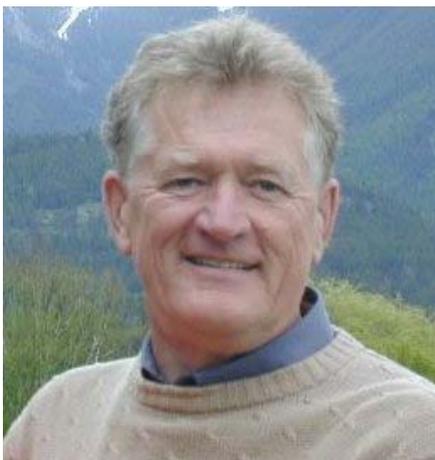
Fred Carlson is writing for us for the first time and comes to us as a man that has actually packed a CC-1.

He has been a ham for some 37 years and was first licensed as WA7UHR.

Fred started collecting Collins in 1973 with a RE KWM-2A after starting life with Heathkit RX-1 and HX-10 equipment. He is obviously a quick study and the KWM-2A remains his favorite.

He started radio life in the Navy as Radio Man Second Class as a telegrapher in 1960 and was lead RM at NBFK on the USS McCaffery. He also worked, following this deployment, with Kitt Peak National Observatory, General Telephone Northwest and Boeing in Seattle on the B-2, F-22 and other commercial projects.

He is now retired and living in Yakima, Washington. He also enjoys metal detecting, antiquing, fishing, photography and electronics repair and restoration.

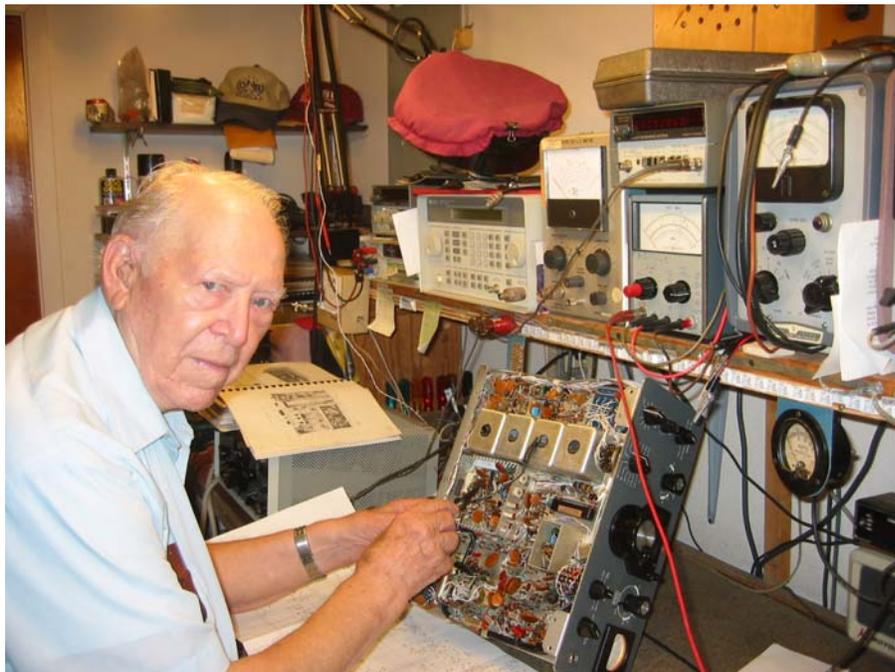




## Repair Notes on the 32S-3

By Bill Carns, N7OTQ

Recently I had the privilege of working on a somewhat troubled 32S-3 transmitter with Bud Whitney, the "Budster", K7RMT. After 2 years of moving (read that lots of forgetting), it took a while to get back in the swing of things. The first thing that I noticed was how Bud's test area was set up. Everything that you would need was at hand and he had some very clever little gadgets to make life easier as we worked on the transmitter. It is definitely an S-Line repair area.



**"The Budster", K7RMT at the Bench**

Note the HP-410B & C

It is a little crowded for A-Line which explains Bud's reluctance to work on these, but it sure is long on convenience for S-Line. All the usual cast of characters were present with a HP 410C, DVM, frequency counters and a good Tek 465 100 MHz bandwidth scope.

The 32S-3 had come in not working and Bud had already found a culprit capacitor in the RF deck requiring a full disassembly and replacement. After a brief period of good functionality, the bottom fell out. Nothing.

I was over at his house that afternoon and we set to work on it and it was a diagnostician's nightmare. It turned out there was an audio intermittent, a second mixer injection oscillator intermittent (very sensitive requiring much scope work and a lot of caressing in the right places), a broken feed cable

down to it's last strand of wire, a bad cap under the second mixer shield can and a very noisy RF amplifier gain control.

Patience and watching several test points with both counter, DVM and scope finally led to repairs and brought the beast to its' knees. We had reliable drive. The audio problem was a very dirty microphone jack and a bad coupling cap, the cable was rebuilt, the intermittent switch contact in the oscillator deck was reformed and the guilty misrouted cable moved out of harms way, and the coupling cap in the 2<sup>nd</sup> mixer output was replaced along with rerouting some suspect (very close to contact) bare wires. That was it.

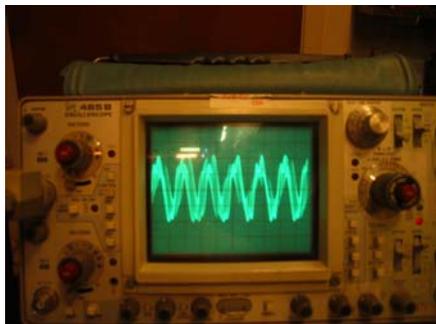
Bud followed with the standard alignment and we had a good working transmitter that has been running for several days with no problem.

A challenge, but fairly standard. What prompted me to write this article was some of the lessons learned and the fact that in diagnosing the transmitter, we noticed some errors and omissions in the manual (7<sup>th</sup> edition, 1969). Under the measurement conditions stated in the manual you can not get the measurements that are quoted in Table 4-1. In addition, some of the quoted voltages in the table did not agree with the rig, and some investigation led to the conclusion that after Collins made a running production modification to the V6 bias and screen resistors to jack up the performance of the stage, the 4-1 voltage table was never updated. The schematic was.

Cont'd Pg. 10

## Service Line (Cont'd)

Very quickly, in the lessons learned area, it was invaluable to have both a scope and the HP 410C, as well as the frequency counter in action at the same time. An intermittent is always a big problem to diagnose, and being able, on the mixer for instance, to see if the plate output contained both the VIF and the mixer products required both the scope and the AC VTVM in use at the same time. By the way, here is a little trick - When we were investigating the balky 6.5 MHz injection oscillator, the frequency counter probe was loading down the oscillator too much and we switched to a 10X scope probe which almost totally eliminated the problem. Trying



**2nd Mixer Output Showing Complex Harmonic Content from the VIF and the Resulting Mixed Product.**

to do this diagnosis of the mixer and the missing (at times) oscillator with just a AC VTVM would have grossly increased the time to solve the problem. The AC VTVM, on the other hand is a good high impedance measuring tool for directly reading RMS voltages which are quoted in the set up AC table in Section 4 of the manual.

One of the other tricks that I

like to use is to walk away from the job when you think you have found a problem requiring repair or rebuild. Take a moment with the schematic and try and figure out if you are on solid ground and how to confirm the failed component with some other kind of measurement. This has saved me many a needless teardown, and often finds faulty thinking. It also helps you understand the radio better.

In the course of finding the cause of the problems mentioned above, and figuring out why the bias readings on V5 and V6 were grossly different than the book Table 4-1, we made notes on the measured nodes and also repeated these and added to them once the transmitter was running well. These results are summarized in an insert with this issue. In addition a photo of the plate wave form under drive is shown for the second mixer - helpful if you are trying to diagnose a misbehaving mixer.

First, the grid bias reading in Table 4-1 (Quiescent Tube Pin Voltages and Resistance Table) for V5 (pins 2 and 7) will not read anywhere close to the table correct values until you push the PTT switch somehow. We used the manual PTT position up in the VOX setup area). The reason for this is that the early stages of the transmitter are left running continuously, along with the PTO, for stability. V5 is the cut off point and when the PTT is not activated, the 100K resistors that set up the grid bias are lifted off ground and the grids set up at about - 30.0 Volts DC and are therefore totally cutoff.

Pushing PTT gives you measurable values. It is common for these voltages to vary, particularly the grid voltages. They just should not be off-the-wall wrong, and you have to know a little tube theory and use your common sense when evaluating differences. This stage is a good example. The grids are at approximate ground (pin 7 at - 0.2 Volts and pin 2 at 0.0 Volts) - not as negative as the table - but the positive cathodes were slightly lower in voltage by about 27 % indicating that less current was flowing in the tube in the radio under repair than in the Collins test radio. Go figure. The stage, however, works well now and all components involved in the setup of the currents tested in tolerance. And, No, there are no grid coupling capacitors connected back to plate voltage that could be leaking and pulling up the grid voltage.

The data in the table is way wrong for V6. In the later 32S-3s, the screen resistor was significantly reduced to 4.7 k Ohms and the grid resistors changed. This change is not reflected in the table in the 7<sup>th</sup> edition manual that accompanies the changed schematic. They are running this tube much hotter than in earlier versions of the 32S-3 and the grid voltage on the tube, while close to the original value ( -1.1 Volts) results in the cathode being up around 3.0 volts, giving the tube a lot more headroom. In addition, the screen voltage measured was 263 Volts in place of the table 160 Volts. This was measured with

Cont'd Pg. 11



## *Service Line* (Cont'd)

a quiescent plate voltage on pin 5 of 275 volts.

Finally, Gayle Lawson of Collins made an excellent suggestion that we all start documenting measured performance values at key test points (All grids and plates if you have the time and equipment), and submit them to Gayle or myself so we can start putting together a trouble shooting AC compendium of

test values for well set up radios— both transmitters and receivers. Gayle sent me a table for the 32S-3 that he measured, I think for this occasion. Thank You Gayle, and I have added my numbers for the radio we worked on to this chart. In addition, I also added RF measured values. These should be helpful.

All of these measurements are included in the 32S-3 data insert

enclosed in this issue.

That's it for now from the Service Line and we hope that these values and comments help you all when the occasion arises. The 32S-3 is one of our more common transmitters and one of my favorites. Keep 'em healthy.

de Bill, N7OTQ & Bud, K7RMT

----- CCA -----

## Operating on the 70K-2 PTO—The Heart of Your Collins S-Line by Ted Craven, W5USI

I began my career at Collins in the oscillator test and alignment department in the 1960's, working on quality control of the coils used in the permeability tuned oscillators. It was not long before I moved on to the military equipment final test department. A short time later I was asked to be the factory service representative for amateur and broadcast equipment. It was as the factory service representative that I became intimately acquainted with the KWM-2 and S-Line equipment.

That was many years ago. Today I am faced, like others, with maintaining my Collins in a time when equipment and parts have gotten so small that they are hard to see. One must ask, "What happened to the warm glow of our ham gear on those cold winter nights?"

The 70K-2 PTO is the heart of your Collins S-line and KWM-2 equipment. As with any surgery, care should be taken any time it is opened. Having the proper tools, the equipment to monitor the functions, test

equipment to allow proper recalibration and, of course, some level of understanding of how this centrally important part of your gear works is vital to successful surgery. It seems that many service bulletins, notes and outlines have been written for the equipment, but little is available about the 70K-2. There are several bits and pieces of information available on the internet about the servicing of the 70K-2, but little put together in a booklet. I have tried to fill that void

The actual repair of the 70K-2 involves the process of removing the electronics from the oscillator housing and successfully putting them back. There is a knack to getting the "guts" out without damage. Once out of the housing, then comes the fun part - replacing those components that affect the stability of the oscillator. I, like others, have come to the conclusion that the 0.02uf bypass capacitors, some of the frequency determining capacitors and the side band shift diode tend to get tired with age. As a matter of

course I replace: Bypass Capacitors C-306, 309, 310; Coupling Capacitor C-307; Frequency Determining Capacitors C-302 & 303; Grid Coupling Capacitor C-304; and Sideband Shift Diode CR-301. While it is true that lead placement and lead lengths may not be highly critical, I am of the opinion that there is a reason why Collins placed the parts almost identically in each oscillator. I recommend to any who tackle the repair, that those components replaced be positioned as closely as possible to the original positions.

Realignment and calibration can be accomplished back in the equipment from which it came. The process is somewhat difficult and requires patience. A test stand of some sort makes the process much simpler and quicker.

de W5USI, Ted

For a copy of Ted's excellent book on repair of the 70K-2 and construction of the test fixture, contact Ted at [W5USI@arrl.net](mailto:W5USI@arrl.net)

## CCA Cedar Rapids Convention—Fall 2008

by Butch Schartau, KOBS

This is a brief overview of our recent CCA Convention in Cedar Rapids hosted by the Rockwell Collins Radio Club. Our plans to hold a convention in Cedar Rapids were announced at the 2008 CCA Dayton banquet. The planning efforts were put in motion by myself and the Collins Radio Club led by Rod Blocksome, KODAS. As we all know, the June rains came and half of Cedar Rapids was under water and everything was put on hold. On June 19 we received word that the History Center was not flooded and we were good to go for the convention. Clearly, critical planning time was lost, but the Collins Radio Club went into high gear and as all know who attended the event, a terrific time was had by all.

Arlo Meyer, WOLBK, gave a very informative talk titled "Ham Radio at Collins Radio as I Saw It". Arlo was one of the two Collins engineers that designed the 30L-1. He also designed the mobile mount for the KWM-1, the first ever SSB transceiver. Arlo shared stories of his experiences during his many years at Collins, some of which will be expanded on in a future *Signal* article.

As part of the convention, CCA members and Collins Radio Club members brought unique, rare and prototype Collins ham gear. Many of these pieces of equipment were one of a kind that never got into production. There was a Rockwell Collins 55G-1 pre-selector, how many of you have you ever seen one?

I displayed my TCZ-1. This is

the Navy version of the famous ART-13. The companion autotune receiver, the R-105, was also displayed, both were operational using dynamotors. Both pieces were designed and built by Collins for the war effort. The Collins Autotune mechanism provided for 10 preset frequencies with a turn of a single switch.

Jim Stitzinger's WA3CEX Collins S-Line Van, was on display and operational at the Rockwell Collins site. The display at the plant site drew a large gathering of employees. Many of them had no clue what HF radio was about, let alone what vacuum tubes were. The van was also on display at the History Center and at the Cedar Valley Hamfest.

The History Center personnel opened their doors to areas of the museum that are normally not open to the public. We had the rare opportunity to see the Collins *Aerofoil Boat*. This "boat" was designed by Dr. Alexander M. Lippisch, a world famous German aircraft designer, that Art Collins hired after the WWII to provide technical knowledge for their avionics effort. The craft was powered by a 7.5 HP VW engine. Needless to say, the program "never got off the ground" other than a couple of hair raising test flights.

I put on what turned out to be a stimulating seminar troubleshooting a dead 74A-4. Even after lifting the lid and letting the smoke out, it still didn't work. I polled the participants for where to start the troubling shooting, given some basic conditions I had determined ahead of time.

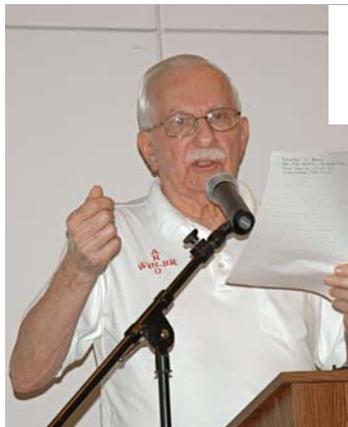
With the help of the group, we determined what stages were working and narrowed down the trouble spot to the 1st IF stage where we could not get a signal to go through. We had the advantage of having a working 75A-4 along side to make comparison measurements. When we got as far as we could get on the troubling shooting, we focused on the good 75A-4 and followed the manual on the alignment procedure.

Dale Svetanoff, WB9ENA, led an informative forum on troubleshooting the 75S-3B. The group asked a wide range of questions ranging from how to paint cabinets to how to repair the receiver. There was a healthy discussion about the design evolution of the 75S receiver series from the 75S-1 to the 75S-3B/C.

The Convention was capped off with a banquet followed by a presentation by Tom Vinson, NY0V. Tom reviewed the facts of Amelia Earhart's mysterious disappearance in 1937, the science behind locating her plane, and his adventures during two deep ocean search expeditions in a remote area of the Pacific. While this may seem to some as a departure from the "Collins" subject, we all know of Collins' deep involvement in propagation modeling and this technology is being used along with details of Amelia's last communications, to model where the aircraft had gone down.

All in all, both the technical discussions and the social aspects of the convention were a great

## Cedar Rapids Convention 2008 Photos



Arlo Meyer, W0LBK, gives presentation on "Ham Radio at Collins as I Saw It"

Richard Lorenzen, WA0AKG, and George Donovan, WB5WUX, viewing-prototypes on display



Butch Schartau, K0BS, and his ART-13 and R-105 powered by dynamotors, for Torry Mitchell, N9PY



George Donavan, WB5WUX, Butch, K0BS, Warren Amfahr, W0WL, Mike Piering, KB9LQ, George Mistic, KE8RN, Pat Rundall, N0HR, Joe Varas, K9OCO, Dirk Scholten, W8IQX and Joe Spinks, AA0KW, trouble shooting a dead 75A-4



Dale Svetanoff, WA9ENA, leads the Test and Troubleshooting Forum with members Butch Schartau, K0BS, Bill Wheeler, K0DEW and Dave Hallock, W0SS



Ted Craven, W5USI, at the operating position inside Collins S-Line Van. Ted was one of the original drivers and support staff of the van in the '60s.



Butch Schartau, K0BS, Jim Stitzinger, WA3CEX, Rod Blocksome, K0DAS and George Donovan, WB5WUX viewing and discussing more prototypes.

## W1AW Collins S-Line Desk Console

by Pete Zilliox, K5PZ/6

*Editors Note: Pete Zilliox, K5PZ/6, currently serving on your board, offered up the following pictures of his S-Line Collins Radio Operating Console that appears in many of the S-Line brochures.*

### Author Information



Pete Zilliox, K5PZ/6 works as a consultant in the Satellite Communication field and resides in California.

He was first licensed in February, 1965 as a Novice, WN2RNW, and started amateur operation with the classic Drake 2B and Heathkit DX-60 shown in the photo above. He first started collecting Collins equipment in 1977 when he acquired a KWM-2A.

Prior to his move to California from Dallas a year ago, he was most often heard operating either his KWM-2A/30S-1 combo or his KW-1 paired with his favorite Collins piece, a 75A-4 receiver.

He also collects Collins factory printing dies, ash trays and signs. His other hobbies include dirt biking and street motorcycling. Pete is actively looking for a photo of the W1AW console when it was installed at the World's Fair.

Pete is currently serving on the CCA Board of Directors and is also the Net Managers Advocate and the Membership Chairman.

*Pete also shared with us a picture of himself at an earlier operating position. Even then, he was highly organized.*

*Oh, one other comment just in from Pete at the last minute. He has informed me that this console was the latest purchase that he has made for his Collins collection. He made the purchase just after his recent marriage, thereby making this console community property. When so informed by his new wife Katherine, Pete asked which half of the console she wanted in the dire case of a future disaster. Her reply was that, should that day ever come, she wanted the top half. So folks, don't look for this rare item to come on the market - at least not in one piece.*

Very few of these consoles were made, and fewer survive. I personally know of only two that are in existence, but there may be more. This one was initially made for the Coca Cola pavilion at the 1964-65 New York World Fair and then donated by Coca Cola to the ARRL and W1AW where it was installed as an operating position for many years. When W1AW was upgrading to solid state, and no longer wanted to operate their S-Line station, the console was auctioned to a W1AW employee and then I was fortunate enough to acquire it from him.

## CCA BoD Election Notice

The three Board of Director elective positions currently held by Mac McCullough, W5MC, Peter C. Zilliox, K5PZ/6, and James F. Stitzinger, Jr., WA3CEX, are nearing the end of their current terms and are eligible for re-election. Current CCA members in good standing may be considered for these slots upon successful **Nomination**, and a seconding motion, **no later than November 31, 2008**. The election period will start with the mailing of the first issue of the Signal in February of 2009, and voting will be held over the following 30-day period.

**Note:**  
**Nominations will be received during October and November of this year, closing November 31, 2008. Our nominations chairman this year is Richard Kessler, W7SV. Nominations and seconds may be sent by mail to Richard Kessler, W7SV, 8596 East Bronco Trail, Scottsdale, AZ 85255, or by email to: [rjkarizona@cox.net](mailto:rjkarizona@cox.net).**

**Bios of all candidates will be published in the 4<sup>th</sup> Quarter 2008 *Signal* so that discussion and consideration of candidates can occur before the election in 2009.**

## **Cedar Rapids 2008** (Cont'd)

success and very well attended. As usual, we are looking forward to the next event in Cedar Rapids and more fun with the wonderful hosts at Collins.

Editors Note:

Torrey Mitchell, N9PY, has video taped most of the sessions at the convention and will make a CD copy of any of the sessions that he has for those that are interested. Contact him via email at [N9PY@arrl.net](mailto:N9PY@arrl.net).

----- CCA -----

### **Lawrence (Larry) Watson,** **AG5Y— AC94-10292**



Larry, of Bella Vista, Arkansas, was our 3rd Thursday 75 meter net control, a well known voice over the radio and a true gentleman. He died of a massive heart attack on June 30th of this year.

He retired as a trust officer with the Arvest Bank in Bartlesville in 1999 and moved to Belle Vista. In his retirement he was very active in his church, ham radio and radio control model flying.

He leaves his wife Carolyn, 3 children and two grand children. 73s Larry from the CCA.

### **Jim Guyton,** **K1QCF—AC96-00252**



Jim passed away September 21st at his home in Gouldsboro, ME. He was a constant presence on our nets until his health had started to fail several years ago and was close friends with many of our members. I know he will be missed by family and associates alike.

Jim served in the Navy actively for 23 years until retiring in 1977 to go on to an eclectic variety of semiretirement jobs including loan officer, lobster fisherman, operator of J & B Trap Company and then District Manager of the Long Pond Water Dis-

trict for 10 years.

He is survived by a large family of children, step children, grandchildren and great grandchildren.

He loved his morning chats on the radio, his family that surrounded him and his many friends.

Bud Whitney, K7RMT, a long time friend of Jim's, writes: Prior to falling ill several years ago, Jim was a very active Net Control, usually paired with Butch Schartau, and was one of our great Net Controls - running a real "tight" net. He also remembers that Jim was always ready to share his junk box with all who were in need. He closed his comments by adding that "We will miss his big signal and his warm heart." Thank you Jim for your friendship and your many years of service.

## From the President

The summer CCA Convention in Cedar Rapids, IA was well attended and a big success! It was through the work of many people that this event was such a hit. Kudos and thanks to all who made the event possible.

Speaking of CCA events, preparations are already being made for CCA activities at the 2009 Dayton Hamvention. Tony Sokol, W9JXN, has once again graciously agreed to be a co-chair of the activities. We are looking for volunteers to help in these activities, so if you are interested, please contact either Tony or me. At any rate, remember to mark your calendars for Friday, May 15th (banquet), and Saturday, May 16th, 2009.

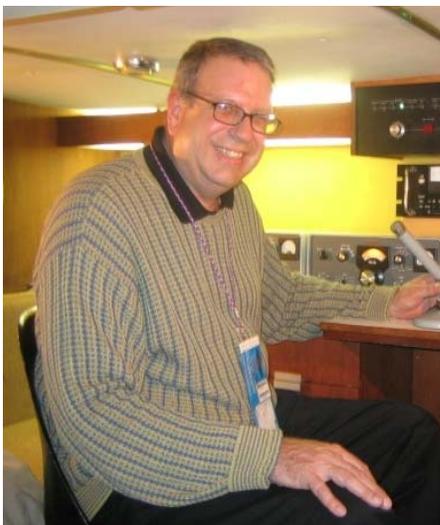
CCA board member nominations and elections have been scheduled so please look for an announcement elsewhere in this *Signal*. Many thanks to Dick Kessler, W7SV, for acting as the nominating chair.

We certainly live in interesting economic times, and the cost of publishing and distributing a periodical of the quality of the *Signal* (as well as general operating costs) is ever increasing. Over the next months, the CCA Board will be discussing the topics of cutting costs, increasing revenues, and other methods of balancing the CCA budget for 2009. These are always difficult topics in an all-volunteer group, but I have full confidence the Board and membership will continue the traditions of this first-rate organiza-

tion.

Last, but not least, thank you all for your kind words and support of the CCA. One of the most enjoyable aspects of our membership is the discussion about, and operation of, our beloved Rockwell Collins equipment, not only with longstanding friends, but also with the many new members of the CCA who are discovering the virtues of the radios and the company & people that built them.

Vy 73, Paul



### Notice:

**This issue contains your renewal notice and form for the coming year. Be sure and get your form in early and don't miss exciting issues of the *Signal* coming up in 2009. They will also continue to have other useful and collectable inserts for your enjoyment, compliments of your Board.**

## Rod Blocksome, KODAS, (Cont'd)

earned his Extra class license. His first rig was a home brew one tube crystal oscillator that would just light a flashlight bulb as a dummy load and a Wards Airline SW receiver which was soon replaced with a SX-71. His first piece of Collins gear used at home was a KWM-2, but he sites the 75A-4 and 51S-1 receivers as his favorites to operate. He also will tell you that his rig with the most "emotional attachment" is the completely original 75S-3C receiver that he home built out of all NOS and hand selected parts just several years ago.

He also enjoys photography, arm-chair astronomy, travel, reading history, serious participation in a search for Amelia Earhart's aircraft, and weak signal VHF/UHF/Microwave work (e.g. tropo scatter, meteor scatter, and moonbounce). In the course of his travels he has also held KODAS/KH6, KODAS/KH2, VK2IHY, and T30CXX

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