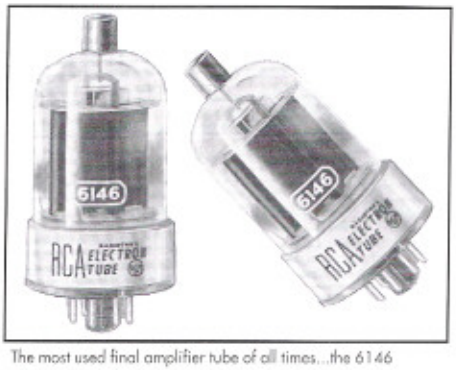
The SIGNAL

Collins Collectors Association

Issue Number Twenty Nine | Official Journal of The Collins Collectors Association | First Quarter 2003

The 6146 Family of Tubes

by Glen E. Zook, K9STH



The most used final amplifier tube of all times...the 6146

Probably the most used tube of all times in the final amplifier of "boat anchor" transmitters is the 6146. From the early 1950s until at least the 1980s, the 6146 found its way into virtually every manufacturer's line of transmitters. In fact, during the early 1960s RCA had a series of advertisements on the back cover of QST that listed a different manufacturer's equipment that used the 6146 each month.

There are actually three distinctive variants of the basic 6146: The 6146, 6146A, and 6146B. It is unfortunate that the 6146B was called the 6146B for it is really a different tube from the first two. Primarily the difference between the "plain" 6146 and the 6146A is the makeup of the heater ("filament"). The 6146A has what RCA calls the "dark heater". This "dark heater" is supposed to be more resilient to vibration, work well at a larger "range" of voltage, etc. Otherwise, the 6146 and the 6146A are the same tube.

In mid-1964 RCA introduced the 6146B with the "claim" of 33.33 percent higher power input than the 6146 / 6146A. Also, it was "claimed" that the 6146B could be directly substituted for the earlier tubes. The 6146 / 6146A had a maximum rated power input of 90 watts for CW and SSB operation and the 6146B had a rating of 120 watts for the same emissions. You can see this in the attached copy of their ad from the September 1964 issue of QST.

Many amateurs are aware that the military "ruggedized" version was designated the 6146W (I will get to these tubes a bit later). However, RCA also introduced in the early 1960s the 8298 tube for use in commercial mobile equipment. The 8298 is just a "heftier" 6146A. Motorola, General Electric, and quite a number of other commercial FM equipment manufacturers used these tubes in all sorts of FM communications equipment for both low band (30-50 MHz) and high band (150.8 - 172 MHz). When the 6146B was introduced, RCA "announced" the 8298A commercial equivalent of the 6146B. In fact, most of the RCA 6146B tubes were "cross branded" with the 8298A number in addition to the 6146B.

Those companies who were manufacturing 6146 series tubes for the military changed from the "plain" 6146 to the 6146A to the 6146B as the military decreed. However, all of the tubes manufactured under military contracts were known as 6146W and, to my knowledge, nothing was done towards marking the tubes as being equivalents of the 6146, 6146A, or 6146B. The only way of telling is from the "date code" which is printed on each tube. Different manufacturers changed tube types at different times. Also, I know of no "master list" telling on what date a particular manufacturer changed from the 6146 to the 6146A to the 6146B. The only "sure" way to know if a particular 6146W is of either the 6146 or 6146A type is to look for a "code date" of before 1964 since RCA introduced the 6146B in the middle of that year. However, some manufacturers did not start manufacturing 6146B equivalent 6146W tubes for at least a year after RCA introduced the 6146B.

RCA "claimed" that the 6146B was directly interchangeable with the earlier members of the 6146 family. Unfortunately, this did not hold true in most cases. Collins, Heath, and probably other companies, at first issued various documents saying that the use of the 6146B in their equipment was "fine". But, this soon proved otherwise!

For example, when the 6146B was used in the Collins 32S-1, 32S-2, 32S-3, 32S-3A, KWM-2, and KWM-2A it was discovered that the components in the neutralization circuitry "burned up" in a very short amount of time. Thus, Collins had to retract the statement that it was "OK" to use the 6146B. Then, due to the fact that the United States military establishment wanted to "standardize" on the 6146W equivalent of the 6146B, the neutralization components had to be redesigned to allow the 6146B to be used. Fortunately, these changes did not affect the use of the earlier 6146 and 6146A in those transmitters manufactured to use the 6146B. All three types of tubes may be used without any problem in these transmitters.

Replacing the 6146 / 6146A tubes with 6146B types often results in spurious emissions, parasitic oscillations, etc. This is due to the fact that there are different bias requirements, different inter-electrode capacitances, etc. of the 6146B versus the other two. It is often difficult to neutralize 6146B tubes when used in place of the 6146 / 6146A. If neutralization can be achieved, often it lasts for just a few minutes before the tube(s) goes into oscillation.

If one insists on trying the 6146B tubes in place of the 6146 / 6146A types, the very first thing to do is to neutralize the final amplifier. If it will not neutralize, then the 6146B tubes should immediately be replaced with the older type tubes. If it does neutralize, then the neutralization should be "watched" for several hours (even days) of operation. If the neutralization changes, then the 6146B tubes again should be replaced with the 6146 / 6146A series. If the neutralization remains constant after several days, then use of the 6146B is fine in that particular transmitter.

I have, in my shack, a number of transmitters that use the 6146 / 6146A type of tubes. These include Collins 32S-1, 32S-3 (earlier model before the neutralization was changed); Heath Apache, DX-100, DX-35, SB-401, SB-110, Seneca; Johnson Pacemaker; and other transmitters as well. Every one of these is much "happier" with the 6146 / 6146A family of tubes. In addition, I have owned transmitters like the Knight T-150 and T-150A that use the

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The 6146 Family of Tubes

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by Glen E. Zook, K9STH

6146 tubes. Frankly, these transmitters were much happier with the 6146 / 6146A tubes. There is another 6146 family tube that is "superior" for operation at least through 10 meters. That is the 6293. This tube was designed for "pulse" service and is rated at 1-Kilowatt pulse power input. The primary difference between these and the "normal" 6146 is that the plate is much "heavier" in its construction. Back in the late 1950s and early 1960s we would almost "kill" to get our hands on a pair of these for our DX-100s, etc. The 6293 outlasts the 6146 in "normal" service by at least 5 times and often more than 10 times the life of the tube. These tubes "show up" at hamfests, swap meets, etc., from time-to-time. If you see some of these, definitely "glomp" onto them!

The 12-volt equivalent of the 6146 is the 6883, the equivalent of the 6146A is the 6883A, and the 6146B is the 6883B. Now, there are the tubes that were manufactured for FM commercial service. These series go as follows: 6883, 6883A / 8032, 6883B / 8032A / 8552. Again most of these are "cross branded" with all of the tube numbers that are equivalent.

From 1970 until late 1979 when Motorola went out of the reconditioned equipment business, I owned the Motorola reconditioned equipment center for the south-central United States. We reconditioned Motorola FM equipment for 14 states, everything that Motorola sold reconditioned that was exported, and everything that was sold to the United States Government (this was the height of Viet Nam and the Government did buy reconditioned equipment!).

At that time, the Motrac series of mobile equipment was very popular. Depending on the model, these normally used one, or two, of the 6883A / 8032 tubes. It was only in the very "latest" models (HHT "E" series, LHT series, and MHT series) that Motorola had redesigned the equipment to use the 6883B / 8032A / 8552 tubes. Around late 1976 or early 1977, Motorola decided to eliminate some of the tube types that they were "stocking" at the Schamburg, Illinois, parts depot. Thus, they started shipping 8552 tubes in boxes that were marked as 8032. The Motrac is unique in the fact that you cannot see the tubes when they are in operation (they are enclosed in a metal "heat sink"). In fact, it is difficult to even "tune" a Motrac when the heat sink is not in place.

We went through from 50 to over 100 of the 8032 type tubes per week and within days were "down" to using the 8552 tubes in the 8032 boxes. Within a very few days of starting to use the 8552 tubes we started receiving complaints that virtually every Motrac unit that was received by customers arrived with one, or both, tubes broken. Prior to this we had never had a single complaint. Upon investigation we found that the 8552 tubes had so many parasitic oscillations that they were getting so hot that the glass envelope was being annealed! This was happening within a minute, or two, of tune-up and final quality control. When the radio was subjected to normal vibrations of shipping, the glass envelope of the tubes was being shattered.

This was reported to Motorola. At first they refused to believe us saying that we must have gotten a "bad" shipment of tubes. But, within a couple of weeks they received over 1000 complaints from their service stations about exactly the same problem. It cost Motorola one "heck of a lot" of money to pay the warranty claims because they had tried to "cut costs" by eliminating the earlier type of tube. They had to re-box all of the 8552 tubes that had been put into 8032 boxes and get in a "rush" shipment of 8032 tubes.

The whole problem stemmed from the fact that the "B" series of tubes is not the same as the "plain" and "A" series. The parasitic oscillations were caused by the different bias requirements and by the "fixed" neutralization of the driver and/or amplifier tube in the Motrac. There was no practical way to change the circuitry to handle the "B" series tubes. Also, making such a change would void the "type acceptance" of the units.

In a "practical" sense, it is "OK" to mix 6146 and 6146A tubes since the primary difference is in the design of the heaters. But, NEVER mix 6146 / 6146A tubes with a 6146B! This is really "asking for trouble".

Also, in a number of transmitters and transceivers (especially the Heath SB-Line) the heaters ("filaments") of the pair of 6146 tubes are in series. In these units it is very easy to change the heaters from series to parallel and substitute the 6883 / 6883A / 8032 tubes. The 12-volt equivalent tubes are often available for "pennies" because of the vast number that were used in the commercial FM market. I have done this with my Heath SB-110A and it works "like a champ". If you every want to change back, it is a very simple operation to do so.

I know that there are amateurs who say that they have used the 6146B tubes in place of the 6146 / 6146A without any problems. I can definitely believe that. But, I have seen way too many examples of the 6146B causing problems in relation to the cases in which the substitution has no effect. As I said before, neutralize and keep checking the neutralization for several days if you do replace your 6146 / 6146A tubes with 6146B types. Otherwise, you can find yourself with TVI, "burned out tubes", and other damage to your transmitter.

You must be VERY careful when dealing with the various tubes of the 6146 family, otherwise you just might be in for some very interesting problems. Substitute if you must, but, be aware that you are "treading on thin ice".

The Collins Knot!

by Jim Riach VE3DSR/VA3CCA

Having worked at Collins Canada for a number of years designing and building prototypes in engineering I think I must have tied thousands of the Collins knots. I thought I had forgotten but after a few tries it came back. Just like riding a bike, you never forget. If anyone wants to try here goes.

Put a pencil or something in a vice and have it pointing towards you. Take a piece of string or lacing cord with each end in each hand and hold it over the pencil.Loop the left hand around the pencil loosely and behind the right hand end and then continue around the pencil until both ends point to the right. Cross the one on the bottom, ie the left hand end, over the right hand end and then go under the "X' that is formed by the crossing above the pencil. The string should always be loose on the pencil to work it easily. Now by pulling the two ends you have a granny knot covered by a loop. This is the infamous Collins knot!

The proper lacing cord is flat and Collins standards did not allow any twist in the cord and for that matter any crossovers of wires in the harness. Fussy fussy but effective. They also preffered to tie individual knots rather than lacing because this would allow for easier repairs without disturbing the cabling. The knot is tied next to the previous knot, tied snuggly then slid down the cable to keep the wires in the same order.

Have fun trying to tie it. It is easier than it sounds. HI!

CCA Awards Banquet

The CCA will sponsor a multitude of special events at the Dayton Hamvention 2003 to be held May 16,17, & 18. This includes our Annual CCA Awards Banquet on Friday night the 16th. CCA members can make banquet reservations via the CCA web site or with the reservation form to be included with the next issue of the Signal in April. Please don't wait, banquet space is limited and fills quickly. Make hotel reservations at the Holiday Inn Fairborn by calling 937-426-7800. Be sure to tell them that you are a CCA member to get the $99 rate. The dinner will be superb and there will be hospitality rooms on Thursday night the 15th and Saturday night the 17th.

NET NEWS

Peter, VE3KWM Net Manager - Dean, KA6BGW Asst. Net Manager

Hi Everyone: All the nets are doing extremely well at this time of the year. Everyone's freezing in the east and mid west but band conditions have been outstanding. We've just come out of our third theme week featuring the Gold Dust Twins with the strongest showing ever. When the final tally is in I expect we'll have logged between 40 and 50 of these much prized stations. Tony, K1KP, has undertaken a survey of KWS-1s and is collating data from the nets as well as from a survey sent out on the Reflector. If you haven't responded yet I know Tony would appreciate hearing from you. Thanks, Tony.

We look forward to seeing the results of your survey. By the way, for those of you who haven't yet visited the Collins Archive section of the CCA website you'll find some earlier surveys conducted by Rod Blocksome, K0DAS, on a variety of radios including A line receivers, scarce S Line units, KWM-2s and 2As, the V series transmitters, the 75A-4 and others. The new KWS-1 survey will add to this outstanding compilation which offers fascinating production information plus a unique insight into the relationship between serial numbers and production dates.

The next theme week in late February (25,27,28) and will be devoted to restoration and troubleshooting topics. We'll be rounding up some of our technical and restoration experts to be on the air to answer questions and offer their tips and insights.

10 METER AM NET: The 10 Meter AM net continues to flourish with Pete, K5PZ, Russ, WQ3X, and Bill, N6PY, continuing to do a great job anchoring the net which meets every Sunday at 1800 Z on 29.050. See the separate column from Pete, K5PZ, in Dallas, for all the details.

FIRST WEDNESDAY AM NET: Larry, WA9VRH, our Archive Manager, continues to co-ordinate the 1st Wednesday AM net which runs on 3.880 and starts at 8PM in each time zone beginning in the East and moving West. This net, like the 10 Meter AM net continues to attract a large volume of checkins. Next one is Wednesday, February 5th. Thanks to all the net controllers who pass the baton from Coast to Coast on this popular net. If you haven't checked in yet, please drop by. We encourage Collins AM gear of course but you don't have to be running Collins to check in. In fact a lot of the fun is hearing all the wonderful combinations of receivers and transmitters in this classic mode that refuses to die!

TUESDAY AND THURSDAY NIGHT NETS: The 3.805 and 3.875 nets have enjoyed increased participation over the winter months with reminders posted to the Reflector helping to boost the numbers. Remember that the 3.875 net sometimes has to QSY down to avoid AM QSOs and the like. It's never too far off our home frequency so should be easy to find.

NEW ASSISTANT NET MANAGER: I'd like to welcome Fred, W1SKU, who joins Dean and I as an additional net manager to help with the nets. Fred's been very active on the weeknights nets and puts out a tremendous signal from his fine station in Oakland, Michigan. (Check out Fred's QRZ listing to see his impressive station!)

SUNDAY NET: Our flagship net is doing amazing business on Sunday afternoon. Propagation has been excellent with only a few contests to make life difficult for the controllers. I went through my logs and totalled approximately 680 individual stations logged over the last few years! I've also noticed that there are lots of new stations checking in, as well as those whose call signs have become very familiar to us all. This mix of the new and old is very encouraging because it means we're growing and attracting more and more participants to the nets. It would be nice to see even more of course, and we encourage any of you who haven't dropped by on Sunday afternoon on 14.263 to do so. We also want to encourage DX checkins in order to help make this a truly worldwide organization that can do it's small bit to promote "more perfect communications" and fellowship around the world.

The Sunday net continues to meet on 14.263 at 2000Z with the first hour devoted to buy/sell/swap followed by general checkins by call district: 1,2,3,4,5,8,9,0,6,7. A special thanks again to Dutch, WB7DYW, the 'voice of the earlies' who on most Sundays is there to pick up the frequency following the Family Motor Home net.

I'd like to welcome Steve, W9BDN, to the controller ranks. Steve joins Dutch in the 4th Sunday slot. Steve is in Illinois and has a strong signal beamed out from his new antenna.

QRM - The CCA policy regarding QRM is to ignore it completely. We've found that the best defence is to deny the QRMers the attention they're seeking. If you experience what you believe is deliberate QRM on the nets please let us know and we'll look into it.

Join Us on the Air!

- Sunday 14.263 mHz at 2000Z
- Tuesday 3805 kHz at 8pm CST
- Thursday 3875 kHz at 8pm CST
- Friday (West Coast) 3895 kHz at 10pm CST
- Sunday 10m AM 29.050 mHz at Noon CST
- 1st Wednesday AM 3885 kHz at 8pm CST

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

Subscribe to the Collins Reflector...a FREE e-mail mailing list of over 1200 Collins users and collectors! Visit the CCA web site for complete information!

Visit the CCA web site at:
www.collinsradio.org

The **Signal** is published quarterly by The Collins Collectors Association

The Signal
Editor - We need a new editor!
If you would like to help, contact us!
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At The Mic

Peter Lower, VE3KWM

We call ourselves a 'collectors' organization but we do far more than collect. In fact the only reason we collect these great radios is to restore them to as close to original condition as possible, to operate them on the air and to preserve them for future generations. The hard truth is that these radios will outlast us all and it's part of our mission as members of the CCA to keep them up and running in order pass them on to the next generation of Collins Radio users.

With almost 1000 members, the CCA continues to attract new members as more and more hams discover the unique challenges and pleasures of acquiring and restoring Collins amateur radio equipment and using it on the air. Once you've had someone comment on your terrific audio and ask you what you're running and you get to say, "a Collins S-Line" or "a KWM-2", then listen as you hear their jaws dropping -- you're hooked! That's why we always say "you don't have to be running Collins to check in". We're pretty confident that once they've heard what a Collins radio sounds like, they'll be looking for one of their own.

From my first checkins to the Collins Users Net on a not too pretty KWM-2A to today on a much nicer KWM-2, I've derived enormous enjoyment from my association with the CCA. Listening week after week to people like Warren Hall, K0ZQD, and Bud, K7RMT and Butch, K0ZQD and Bill, N7OTQ (and many more) answer technical questions on the Sunday net while making notes madly so I could refer to them later. Sitting in a dingy basement room off the kitchen in the old Radisson Hotel in Dayton listening to Floyd, W8RO and Chuck, W4HHG talking about 390As as the staff closed the place down around us. Great radios, good fun and good friends. That's what's at the heart of the CCA experience for me. I hope the year ahead provides more of the same for all of us.

Speaking of Dayton, plans are afoot for another gathering this year at the Fairborn Holiday Inn. Tony, W9JXN, is our Dayton chair this year and he already has Ted Craven (author of 'Art Collins: Radio Wizard') booked to speak at the Banquet. Tony will be looking for more volunteers to help and will post updates to the Reflector as information on hotel reservations and Banquet tickets becomes available. Let's make this the biggest Dayton gathering ever.

As I mentioned in Net News the nets are doing very well, particularly at this time of year when band conditions are optimum. I want to encourage more technical queries and discussions on the nets as I believe they are central to our enjoyment of our radios. This includes the Sunday net. To that end we're putting together a CCA 'technical advisory group'. This resource group will help the Signal editor find and vet articles for the Signal and will also provide a knowledge base that I hope will encourage more troubleshooting and restoration questions on the nets.

Lots of help is needed on the Signal so if you've got ideas please let me or Sandy know.

That's it for now. Thanks for the bandwidth and the opportunity to say hello. I welcome and encourage your participation in the CCA and it's activities. Volunteer power is our only source of energy so don't hesitate to pitch in on anything that interests you.

CCA 10M AM Net!

by Pete Zilliox, K5PZ

Here is some CCA 10 Meter AM Net information that may be of interest to the members. The first official CCA sponsored net held on December 16, 2001. Our East Coast Net Control Station, Russ, WQ3X set up the logbook as a Microsoft EXCEL file. The EXCEL format allows us to quickly search names, calls, and check on the number of check-ins a specific fellow has to date. Other data is collected including the city locations, type of AM transmitter and receiver that each station is using, as well as other general comments.

I've compiled a brief set of statistics of interest from the log:

- There has been 58 official Net Sessions so far
- In the last 57 Sessions, we had a total of 2629 check-ins
- So, we average of 46 check-ins per session
- 65 Stations received 10 on 10 Certificates
- 11 Stations have their 10 on 10 Certificates in print queue (as of January 23, 2003)
- There are 60 DX stations in the Log
- Bill, N6PY has the most number of check-ins at 49
- There are 577 call signs in the log

That's it for now. Come Join the fun!

Why is the Signal late?

The CCA is an all-volunteer, non-profit organization and the Signal is produced by unpaid volunteers. We can't produce a newsletter without *content*. **This issue was delayed four weeks because we had nothing to print.** Please contribute Collins-related technical articles, hints n' kinks, & photos! We desperately need your support. Send contributions to kw6kw@attbi.com.

Theme Weeks 2003

Peter Lower, VE3KWM Net Manager

Theme weeks run on the Tuesday, Thursday and Friday nets.

GOLD DUST TWINS Week -Jan. 21,23,& 24.

KWM-1 DAY - SUNDAY, Feb. 9.

RESTORATION AND TROUBLESHOOTING Week -Feb. 25, 27, & 28.

KWM-380 Week - Mar. 11, 13, 14.

A-LINE AND J-SERIES Week - Apr. 15,17, 18

SPECIAL AM NIGHTS TO BE ADDED!

NET CONTROLLERS:

Our thanks again to all the Net Control Stations who do such a tremendous job of running our nets. I hope you're all enjoying the recent doubling of salaries! :-)

NET TIMES AND FREQUENCIES:

SSB

Tuesday, 3.805 at 8 Central
Thursday, 3.875 at 8 Central
Friday, 3.895 at 8 Pacific
Sunday, 14.263 at 2000Z

AM

1st Wed. of each month, 3.880 at 8PM local
Sunday, 29.050 at 1800Z (12 noon Central)

Hope to hear you all on the nets. 73,

Peter, VE3KWM, Net Manager
Dean, KA6BGW, Asst. Net Manager
Fred, W1SKU, Asst. Net Manager

In the Shack

Tony Sokol W9JXN - New member of the CCA Board of Directors and this years CCA Dayton Chair person including the CCA Annual Awards Banquet in Dayton.

Please send us your shack photos for future issues. Email them to kw6kw@attbi.com.