Basic Trouble Shooting

Post War 70-xx PTO Drift Problem

by John Bess, WA5VVT

Beginning in June, 1949 Collins Radio Company began developing two receivers, the R-389 and the R-390. This was a three-year effort and took approximately 30,000 engineering man-hours implemented with laboratory technicians and drafting help. The delivery schedule for the working prototype units was as follows:

R-390 No 1. January, 1951
R-389 No 1. March, 1951
R-390 No 2. September, 1951
R-389 No 2. February, 1952
R-390 No 3. February, 1952
R-389 No 3. May, 1952.

The final engineering report was due in August of 1953. The report was issued on September 15, 1953. Contained within this report that was not "Declassified" by the military until May 8, 1985 is some insight to the PTO drift problems we are experiencing in the Collins gear that we have all come to love. Page 64, Section 4.2.7 R-389 Variable Frequency Oscillator contains the first clue. Section 4.2.7.1 Design Problems and Solutions, second paragraph "FerriteDevelopment" states: "The high permeability of ferrite was the outstanding reason for its usage. At the time of the choice the Temperature Coefficient of the available ferrite was quite bad. As work proceeded a method was worked out to partially compensate the poor T.C. This method involved use of differential expansion properties of materials. This device was no more than developed when a new shipment of ferrite was received that was of opposite T.C. polarity. Since this indicated it was possible to cross over a zero T.C. reference, serious work then began to secure a product with nearly zero T.C. It was also recognized that the device that had been invented would not perform satisfactorily if the T.C. changed polarity."

Page 69 of this report, Section 4.2.8 "R390 Variable Frequency Oscillator" Powdered Iron Cores. States: "The powdered iron core aging problem was attacked in two different ways. First, the intrusion of moisture and vapor into the core was reduced by impregnation with a resin. Tests were made which show the permeability aging to be about 8 to10 times slower and less than that measured upon an untreated core. Continuous research is being carried along presently to find materials and techniques that will still further improve the quality."

The second step taken was to approach manufacturers of the cores with the problem of aging. Considerable work was done with Radio Cores Company who have been trying various insulator materials and have been sending cores to us for aging test. The magnitude of this problem has been so great that an answer has not been found, although trends have been established for further research." Page 79, Section 6.0 "Recommendations" States: "The following recommendations are made as a result of the Contractors experience in developing this equipment: 6.1 In a development project of this kind where a group of engineers design and build a piece of equipment, there is one problem always to be faced. That is, to decide at which point in design, work can be stopped and it can be definitely said that this is it. Of course the design objectives and specifications should be the answer to the problem, but no good engineer who is striving for the optimum in his design likes to stop work when he can see further improvement possible even though minimum design objectives have been met. However, in this equipment where production schedules demand completion of the design, it is felt that further investigation and design would be worth while especially in...The VFO has certain drift problems which might be reduced by new and better iron cores."

Well, there you have it, right out of the book. Part of the reasons that the PTO drift may not be that the capacitors have changed but rather that the permeability has changed over time more than the capacitor characteristics have changed. This throws all of the parameters out of kilter. The temperature compensating capacitors are trying to compensate for a value of permeability and drift characteristics that no longer exists. Yes, capacitors do change but not at the same rate as the ferrite cores. Moisture, temperature and vapor affect the cores more than the capacitors over the long run.

The Collins factory used10 different temperature coefficients at the same value of capacitance (20 pf) for C301 and 2 different coefficients for C305 (100 pf) in the 70K-2 that was used in the S-Line series. This would indicate that they had not yet found the one and only perfect temperature and ageless stable core for the PTO. These cores have been aging from the day of their creation and they were not all the same then. Therefore, there is no ONE SINGLE ANSWER to your drift problem. You must consider all of the factors and take them one at a time. To quote a famous individual "Now you know the rest of the story".

The Annual CCA Awards Banquet will be held at the DaytonHamvention on Friday night, May 19th at 8pm at the Downtown Marriott hotel. Please register early. Complete registration information is available on the CCA web site.

Editor's Operating Desk

by H Michael Crestohl, W1RC/VE2XZ
Editor, The CCA Signal

Now that the Holidays are behind us it's time to play radio again. Here in the Northeast it's still hard winter but the days are slowly getting longer and soon it will start to get warmer and that means Hamfests! Some of you folks who live in warmer climes are more fortunate when it comes to outdoor events but this winter has seen some strange weather patterns indeed.

The manual scanning project is proceeding very well. I see that a large number of service bulletins, information letters, dealer memos, Collins Radio Company SIGNAL magazines from the 1930s and, coming soon, operating manuals as well as Rod Blocksome's interesting Collins surveys. There's lots of good stuff free for the downloading and more to come. New BoD member Larry Saletsky WA9VRH (wa9vrh@ocslink.com) is the coordinator of this effort and so if you have any Collins Radio documentation and would like to loan it to Larry for scanning please feel free to contact him.

Recently I was able to borrow a couple of very scarce U S Army manuals from Peter Grave to scan. These are training manuals that he found at a flea market in Jersey that cover setting up and operating the FRC-93 HF radio station (KWM-2A/30L-1/PM-2/312B-4/5). It's quite interesting to see how the military used to instruct soldiers in handling this sophisticated equipment with no prior knowledge or electronics experience and, in many cases, absolutely no interest whatsoever. I'd like to thank Pete for making these rare manuals available and shortly they will be available to any interested party free of charge in .pdf format on the CCA Web Site. In addition to being a very dedicated vintage radio enthusiast and active CCA member, Pete is also an antique car buff as well, particularly knowledgeable on Packards, Edsels and police cruisers and, most important, a good friend. Pete and his wife are regulars in the flea market where he parks his huge white truck loaded with vintage radios, especially Collins and other high-end equipment.

Also coming up soon is the Dayton Hamvention May 18th - 20th 2001. This year marks their 50th anniversary and so hopefully there will be some special events to commemorate the event. I see that there is a full slate of seminars including a Collins Forum on Saturday morning at 8:30 followed by Drake and Heathkit. Wonder why they scheduled them early in the morning which is prime flea market cruising time? You can got full information at: www.hamvention.org. Hope to see you all there!