

Avionics Troubleshooting: Part I

by John Loughmiller

In one of my company's branch offices there is a large poster which lists all of Murphy's laws and all known variations and there is one variation that stands out when it comes to avionics: "If two or more models of any device exist in the same environment, one such device will always operate sub-standard, be completely broken or be of a different production run with no documentation on the changes thereby eliminating any possibility of repair".

Having owned several airplanes I have noted that one of the coms and one of the navs always works better than its brother. ADF units and transponders are probably the same way, but I have never been flush enough to have dual installations of those. If you own a pair of navcoms, you no doubt occasionally notice a difference in operational range in one of the units and most likely take one of two steps: 1. ignore the problem and hope it gets better (or) 2. take it to the avionics shop and pray for a miracle.

LPM thought you might like a third choice which is: investigate and just maybe fix the problem yourself. Therefore what follows the LPM Accelerated Avionics Technician Course 101. No CEU credit (Continuing Education Units) but potentially much MIP (Money In Pocket).

Tools of the Trade

Avionics shops have invested tens of thousands of dollars in equipment and that is part of the reason for their high hourly rates. We will need a couple of items also, but fortunately they're not very expensive items. First, venture down to Radio Shack and purchase a volt-ohm meter and a couple of spray cans of contact cleaner. (Get the kind that leaves no residue.) Also, see if they have a relay contact burnishing tool. On your way out the door, grab a Jetstream Mini or whatever they call their current least expensive portable aircraft band receiver. Head over to the hardware

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Getting a KX170 out of its mounting tray involves nothing more than giving the release screw a turn, then pulling carefully on the radio's face.

store and buy an allen wrench set, a screwdriver set and a nut driver set. If you already have the tools, you have just realized your first savings in "do it yourself" avionics repair and are now ahead of the game.

The Objective

With the items mentioned above, you can cover a lot of territory. What we want to accomplish is the troubleshooting of avionics problems to the point where it is obviously not something that a novice can deal with. At that point, the professionals take over. We will take no steps that make the situation worse than it is already.

Problem Isolation

Problems come in two types: no talk, and no listen. To complicate life, they are often intermittent. Let's tackle "no talk" first.

The microphone is the place to begin anytime the person at the other end complains about your transmitter. If you switch to number two and it is reported as about the same, you probably don't have to go any further.

When you get on the ground, have an assistant transmit while you listen on your recently acquired Radio Shack radio. Do your transmitting on 122.75 if your radio is capable of using that frequency (or unicom if not). In order for the test to be meaningful, the airplane's engine has to be running and cranked up to 1800-2000 RPM or so.

Instruct your assistant to hold the mike and cord perfectly still as he (or she) talks. Next, have him wiggle the mike cord as the test is repeated. If the audio comes and goes or if a crackling noise is absent when the cord is held still but is present when wiggled, the problem is a broken or semi-broken wire in the mike cord, and a cable transplant is in order.

Next, change to another mike altogether. If that fails to clear the trouble another possibility would be a dirty contact in the mike jack on the airplane. Should you continue to have problems on both transmitters, you can try spraying some of your contact cleaner into the mike jack and then insert/remove the mike plug 5 or 6 times. The final possibility that you can check is the audio panel. Some audio panels switch the mike audio between radios with a relay. With the engine off, key the mike and listen very carefully at the audio panel for a "click" each time you push the mike button. A click means you have a relay.

The audio panel will be held in place by either an allen screw lock or a screwdriver-released lock. Determine which one you have and turn the lock no more than one turn CCW. The panel should now come out the front of the mounting tray with just a slight pull. Remove the cover plates, locate the relay and (if it isn't permanently sealed) remove the relay's dust cover and burnish the contacts. If the relay is permanently sealed, there isn't much you can do other than replace it. Reinstall everything being careful not to overtighten the lock screw. Snug is what you need—not 100 foot-pounds.

The final tip for transmit-type audio problems on both transmitters is to remove any intercom system from the equation. Bypass any intercom system totally and see what develops. If none of this works, it's a job for the

guys who would rather talk about sine-cosine pots and microvolts-per-meter than girls or football.

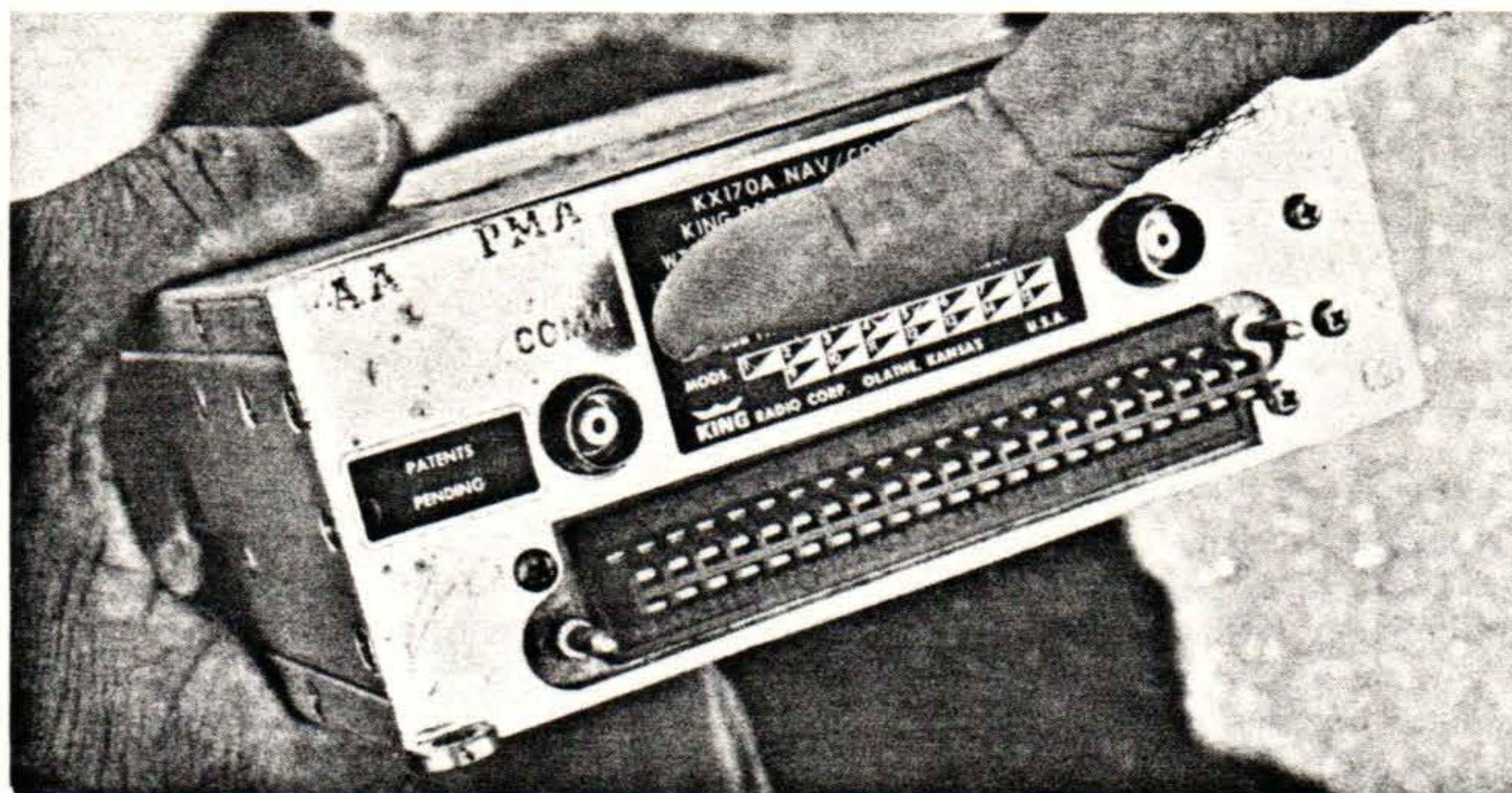
Single Transmitter Problems

If folks report garbled audio on one transmitter only you should perform the audio panel and intercom checks mentioned above. Beyond that, it is probably a case of an off-frequency transmitter or a failure in the transmitter audio circuitry, neither of which you can deal with effectively. There is, however, one exception: This is the cleaning of frequency selector contact, which affects both transmit and receive operation.

If you lose a transmitter totally (no one can hear you and you can't hear your assistant talk when you listen on your portable receiver), proceed as follows: Remove both radios (the good one and the bad one) from their mounting trays utilizing the same technique described above for the audio panel. Reinstall the bad one but this time *install it in the good unit's tray*.

Now apply power and try to transmit. If you do not hear any transmissions with the bad radio in the good tray, the problem is in the radio itself. Remove the radio again and inspect the BNC connectors (these are the silver cylinders with gold center conductors) on the rear of the radio for damage or misalignment. Likewise, look back into the back of the mounting tray to insure that the mating BNC is securely mounted and undamaged. If the radio is old enough to still have a relay in it, remove the dust cover from the relay and burnish the contacts. Finally, look at the large connector mounted on the rear of the radio and closely inspect the connector pins for tarnish or damage. It could be a high resistance problem on the contacts, preventing the keying line function. If any discoloration is evident, clean it off using an ordinary pencil eraser. *Lightly rub off the gold plating.*

If you throw the switch and the transmitter starts working, the problem is either in the audio panel or the antenna. If the audio panel is at fault, it will most likely be the mike switch (usually labelled COM-1/COM-2 on the audio unit front panel) or the relay if it has one. Inspect the mike switch for loose or broken wires and spray some contact cleaner on it as you toggle back and forth between 1 and 2 positions. Burnish the relay if you have one. If you have no luck, remove the radio again and set your ohm-



PHOTOGRAPHY BY THE AUTHOR

Check BNC center elements for signs of damage, and eyeball the condition of the gold plating on the pin connectors.

meter to the R times 1 (RX1) scale. It will require some dexterity but you need to measure the antenna lead for a short or an open condition. Disconnect the antenna cable at the antenna and have the ever-present assistant hold one of your ohmmeter leads on the center conductor of the antenna cable. Touch your lead to the BNC center conductor on the "bad" radio's cover (tray). You should see a short on the meter (no resistance). Try both BNCs if the radio has two; one is for the nav antenna but it's hard to tell which is which. If you see much resistance (more than a few ohms), the cable has opened, which is bad.

Next, with the assistant's lead still connected to the center conductor, move your probe to any exposed metal on the airplane which is known to be a good ground. Here you should see a very high resistance. Even with the meter on RX100, you should see an open condition. If you see any low resistance on the RX1 scale, the cable is shorted which is as bad as open. In either case, the cable has to be replaced.

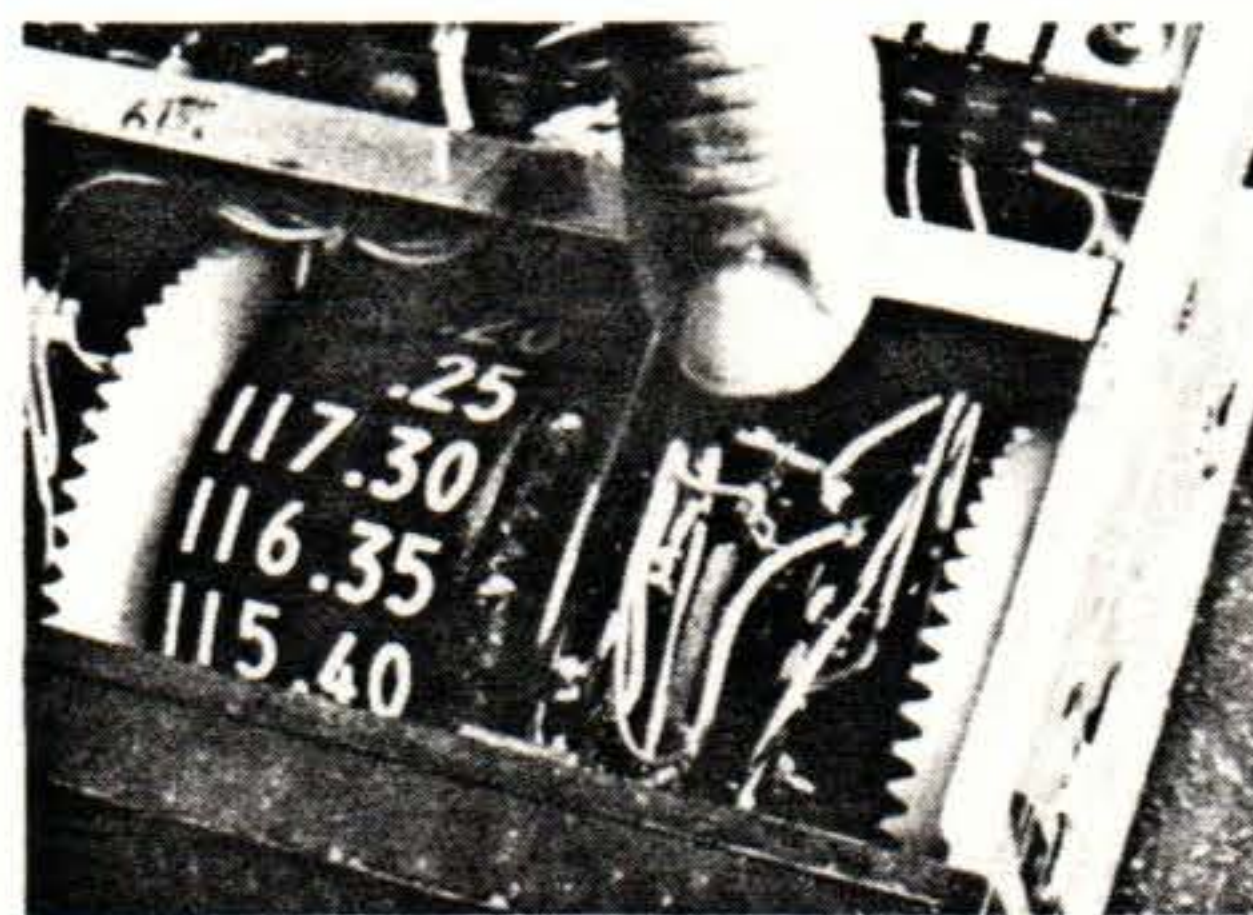
The cheapest way out is to remove the cable from the airplane, have the radio guys make you a replacement, and reinstall it in the plane yourself. The next cheapest is to have your mechanic remove it (his rates are less than the radio shop) and have the radio shop do their thing as before. Bad antenna cables, by the way, are not as unlikely as you might think. If the installation crew didn't do a thorough job of abrasion resistance, a cable can be shorted or opened by sharp metal parts. The receiver may work halfway well in those cases with the transmitter protection circuits

shutting the transmitter down when they see the short or open.

Total Transceiver Failure

If your entire comm goes belly up, the first place to check is of course the circuit breaker feeding the unit. If that's in place, transmit on the apparently dead unit while listening on the portable unit. It may be that the receiver is out but the transmitter's still working. If you find that the transmitter is working after all, listen to the headphone output of the suspect unit. If you have receive function there but not through the speaker, the problem may be in the audio panel. Go through the routine on the audio panel detailed above. The same things that caused transmit problems can under some conditions cause receive problems. If the unit is just plain dead and it isn't a problem caused by lack of voltage, I'm afraid the pros get this one.

Next month: comm receivers, nav receivers, and how to adjust an out-of-tolerance VOR/LOC on some of the more popular units.



Channel-selector wafer switches often benefit from a well-placed blast of aerosol contact cleaner.