Avionics Troubleshooting: Part II

by John Loughmiller

Last month we worried transmitter problems to death. Now it's the receiver's turn. There are a bunch of receivers in the typical IFR-capable aircraft. These include the receive side of the comm radios, the nav receivers, the glide slope receiver, the marker beacon receiver, the ADF receiver, the receive side of the transponder and the receive side of the DME. Add to that a possible C receiver.

Glideslope Receivers

Glideslope receivers (with the exception of the Narco 122) are tuned—or as the pros say "channeled"—from an external VOR/LOC receiver. What this means to you is, should your glideslope go bye-bye you may be able to get it going again by swapping the nav receivers in their respective dust covers. If you have combined units (like the King KX170, for instance), you swap the comms at the same time, but that should present no problem as long as both comms are working properly. This doesn't solve the problem for you but can get you out of a bind and save some money on the radio shop bill since you will have isolated the problem for them. Of course, you could leave it swapped like that until the second nav fails, if you want, and save money that way. It wouldn't hurt a thing.

The only other likely prospect would be the coax cable running from the glideslope receiver to its antenna. It's checked in the same manner as the comm antenna cable covered last month.

As an "Oh by the way," I once had a Narco 122 glideslope head nearly kill me sometime back. It seems that the coil on the glideslope meter movement opened up in flight. There was of course no warning from the flags, and since the intercept was conducted just outside the marker, the centered meter looked right. It worked out okay (I'm here to talk about it) and the episode taught me to use all the test functions supplied on a radio. (Pulling the volume control knob on a 122 will force the GS meter to move upward, thereby proving it's working.)

Marker Beacons

Marker beacon receivers are fixed tuned devices operating at 75 MHz. They are usually paralleled with another receiver's antenna through a device called a splitter. Splitters seldom go bad but their connectors can and do get corroded. If you notice a simultaneous drop in sensitivity in both a nav receiver and the MB receiver, trace the antenna cable from the MB receiver until you come to a small box that is obviously a junction box where several coax cables come together. Remove each cable in turn and spray their connectors with contact cleaner. Plug/unplug the connectors several times.

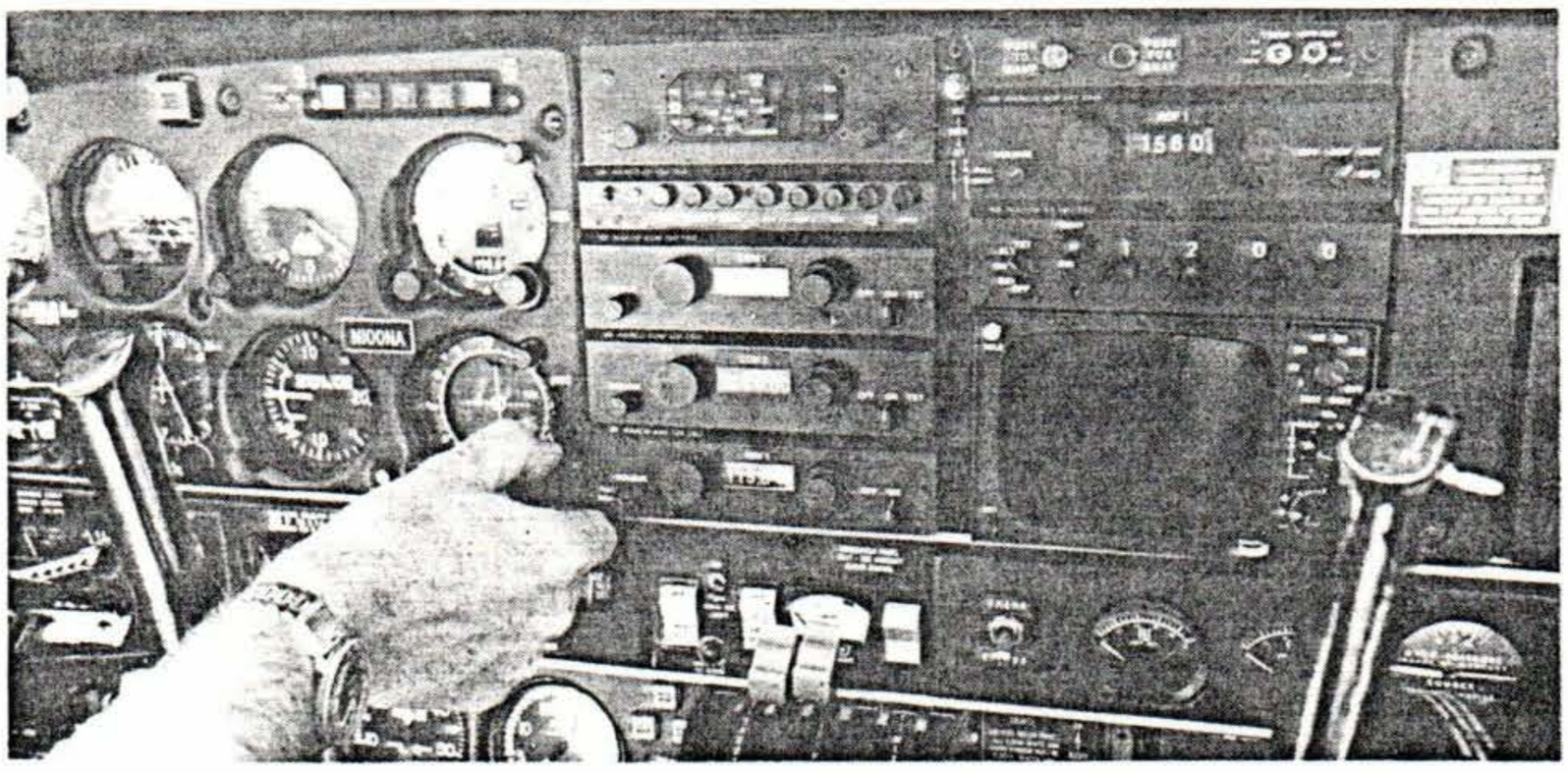
ADF and Transponder Problems

Most ADF radios and transponders have frequency selectors that can get quite dirty, rendering the unit marginal or useless on some or even all frequencies. On the ADF you should spray the frequency selector switches, the band selector and the BFO/ADF/ANT switches with contact cleaner. Exercise the switches as you spray and be extremely careful not to get the contact cleaner on the mechanical wheels that indicate frequency. These wheels have the numbers painted on and the contact cleaner can dissolve the paint! On the transponder, spray the four squawk number selector switches (as well as the mode/A—mode/C switch if center reports an intermittent altitude squawk). Again, don't get the spray on anything except the switches.

The ADF can, of course, be checked for general operation using any AM broadcast station. About the only thing you can do with the transponder is to place a portable TV set nearby, tuned to the higher UHF channels, and push the ident button. A crazy pattern on the screen will verify output from the transponder. If you have no such indication, the transponder may be off frequency or the Truarc clip on the dust cover that holds the antenna connector in place may have come off, allowing the connector to fail to mate with the transponder BNC connector. Check the connector and Truarc it back in place if it is loose or gone altogether. If you come up dry, at least you have done all you can do.

Comm and Nav Receivers

Although you used the Radio Shack receiver as a monitor when checking out the transmitters last month, the *real* reason you bought it is to use it as a signal generator for checking the comm receivers. Every good receiver generates as well as receives radio frequencies. They mix an internally generated frequency with the incoming desired frequency and produce a third frequency called an I.F. or intermediate frequency. This I.F. frequency is always the same regardless of the received frequency. This simplifies the amplification process within the receiver. Since the I.F. frequency stays the same the internal or local oscillator (L.O.) frequency has to vary and it is that L.O. frequency that we will use to help troubleshoot comm radios. In the case of the Radio Shack receiver, the L.O. is 10.7 MHz below the received frequency. Therefore if we want to check out a comm frequency at say 124.4 MHz, we can



After tuning VOT, set OBS to 0 or 180; needle should center within four degrees. (A 10-degree change in OBS should bring about a full-scale needle swing.)

set the portable radio at 113.3 MHz and we will hear a carrier with no modulation on our comm radio. This is the Radio Shack receiver's L.O.

A properly functioning comm receiver should pick up the L.O. with no problem. The test to use is to leave the antenna on the portable receiver all the way down and open up the squelch (or test switch) on the comm. You should be able to sit inside the airplane and very slowly adjust the portable receiver until the noise disappears from your comm receiver. Close the squelch and the carrier should still be there. (Make sure the portable has good batteries before the test.)

This procedure is the one we will use to isolate receiver problems. Any time you have problems with weak reception or you are told your transmitter is weak or unreadable, perform the following tests before you head for the radio shop:

When problems arise, write down the comm unit (1 or 2) and frequency. When you get back home, tune both comm units to the suspect frequency and listen on the "good" receiver with the squelch open as you tune the portable radio. Tune the portable about 11 MHz below the comm frequency and slowly adjust the tuning control until you hear the carrier on the good radio. Next, switch over to the "bad" unit and see if you hear the carrier. If you do, don't worry any more about the problem unless it shows up again (more about that in a moment). If the reception obviously leaves something to be desired, remove the unit from its dust cover, remove its top and bottom covers, and spray the contact spray on all of the switch wafers as you rotate the frequency slector knobs. Again, be careful about the frequency wheels that have the painted on numbers. You will dissolve the paint if the cleaner gets to them.

Reinstall things and see how you fared. Acquire the signal on the good radio first and then check the bad one. The reason for this is that the portable radio's L.O. will drift, and you want to be certain that you have a good signal before you decide whether you fixed the problem or not. Do the antenna cable check and connector cleaning (see last month's article) if you still have problems.

If both receivers were equally strong when the initial test was conducted, the problem may be antenna placement. When one of the comm antennas is on top of the aircraft and the other on the bottom, you will often be told that one transmitter is stronger than the other. It is a function of altitude, ATC receive site location relative to your airplane, and whether you are using the top or bottom antenna. The bottom line is that if both receivers perform well on your test, and do so over a period of several such tests, don't worry about the signal report. Just switch as required to keep everyone happy. (A similar thing happens with your transponder when you are flying at low altitude directly towards a radar antenna in a fixed-gear airplane. The nose gear will shield the transponder antenna from the radar antenna until you get close. If the ATC guy reports no beacon, request a turn of 45 degrees. If he can now see the beacon, you know the problem is caused by the nosegear. You can't do anything about it, but you don't worry about it any more either, and you don't pay the radio shop to look for a non-existent problem.)

Nav receivers use the same type of frequency selection as the comm side and the same technique is used to troubleshoot them. Remove the unit and spray the switch contacts as explained above for the comm unit. The same precautions apply. So does the suggestion to check out the antenna cable and connectors on the rear of the unit. To that add a visual check of the nav antenna. Make certain that both side of the dipole are there. A broken antenna will certainly cause big problems.

The final check-out requires a VOR station. You may be able to set the nav frequency to the highest available and get the Radio Shack portable tuned low enough to raise the flag on the nav receiver, but you need the VOR or VOT station for the radial check.

Zeroing the OBS

It used to drive me crazy to pay a radio shop to restore accuracy to my OBS selector. You know the drill: you check the VOR receiver for accuracy as required every 30 days, you find it isn't right, and you ask your technician to fix it for you. Next thing you know, you're $50 poorer. The only thing he did was carry a portable signal generator out to your airplane, and tweak a hidden control to zero things. If you knew where that tweak was and you had a VOT or VOR check point nearby, you could do the very same thing for nothing. The Narco 122 and King KI-208 and KI-209 VOR heads are popular units. The magic tweak is hidden behind the top left hand mounting screw on the KI-208/209 indicator. (Don't adjust the one behind the top right hand mounting screw. That's the localizer centering control.) On the earlier King units it's right behind the OBS knob. Just remove the knob to gain access. On the Narco 121/122 series, the tweak is behind the volume control. Remove the volume control knob and insert the long skinny screwdriver to reach that control. (On Collins Microline radios, it's in the radio itself and you are out of luck.)

To adjust the OBS, fly/taxi to the nearest VOT or VOR ground-based checkpoint. Set the OBS to the appropriate radial of the VOR—or to 0 or 180 for the VOT—and adjust the zeroing control to make things right. It won't take much more than two turns even in the worst case, and will usually take about a half turn. Make sure the radios are warmed up and do the calibration with the engine(s) running at 1,500 to 1,800 RPM.

For the true adventurer, you can center the localizer display. The KI208/209 control is behind the right hand mounting screw as stated earlier. The Narco 122 localizer zero set is behind the KHz frequency selector knob. Earlier King units had it in an inaccessable place within the VOR head, and Collins is in the radio again and unavailable.

The procedure now is to position the aircraft on the numbers and on the centerline of the localizer runway with the engine(s) turning 1,500-1,800 RPM as before. Dial in the localizer frequency and set the display to dead center with the zero set control. Fly the approach VFR to make certain that things are Kosher before trying it at 200 and a half.

If you didn't see your VOR head mentioned, it's because I don't know anything about any other units. All is not lost for you, however. Insist on looking over the shoulder of the technician the next time you have things calibrated and ask questions. As soon as you discover the location of the proper control, you can do the calibration yourself from that day forward. (Not legally, of course. It's up to you to get a repairman's signoff.)

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