

Audio Systems

Audio and Noise

The perception of how well radios work is affected by the amount of unwanted noise and interference you have to listen to while using the radios. This chapter explains some of the sources of unwanted noise and some of the ways good avionics technicians prevent noise and interference using good installation techniques. The pilot plays an integral part in solving these problems by providing detailed documentation about the failure, such as when, where, and how it occurred.

The random noise of Rice Krispies as it meets cold milk is expected by pilots young and old everywhere, but not in their avionics audio. With the advent of modern radios, noise levels actually increased because radios were now more sensitive. With further engineering improvements, avionics radios became quieter, but the problem is still there and much of it will remain until the aircraft's environment changes. The older the plane, the greater the potential for noise haunting the corridors within the wiring and equipment. Old-timers came to expect the inherent noise that was found in early radios, but today, that has changed. Most pilots want the audio in their plane to be as clean as their car stereo.



KMA 26 audio panel.

Evolution in nature is something that experts on both sides will argue back and forth, but in avionics there isn't much to argue about. Things change, and that usually isn't painless. However, newer and more sensitive avionics have led to an increase in noise because the radios are able to hone in on the previously undetected noise as well as the weak radio signal. This is amplified and is heard as noise in the headsets and speakers. Sure, there has been some jokes about the squawk being a short between the headsets, but it bears repeating that all squawks should be closely investigated to duplicate the problem. Make sure the pilot has adequately documented what happened prior to the squawk developing. This is accomplished when the technician (or avionics manager) and customer first go over the pilot squawks.

The aircraft is a self-contained, dynamic, plastic and metal vehicle, hurtling across the tarmac and through space, carrying environmental, instruments, electrical power systems, entertainment equipment, lighting, pneumatics, hydraulics, control surfaces, engines, and avionics. There is something else; something almost alive that we don't like to talk about; something that is so illusive and cunning that it evades its hunters at every turn. You know what it is—noise—you've tracked it, the harbinger of failure.

Knowing about some of the potential noise sources is a giant step in preventing unwanted signals from entering the audio or navigational circuitry. Solutions are usually hindered by a lack of adequate information. The troubleshooter must be fully familiar with the normal operation of the affected system. Communication with the pilot about the failure or noise onset is a good start but must be tempered

with insight about the pilot's perception and personal flying habits. What pilots hear may not be what they get.

For example, the pilot may be a weekend warrior, flying for fun and not business. This subtle difference could very well be the distinction in how he/she perceives a given failure. Flying is expensive, and denial is just one way a given noise might be ignored. "Might be just a glitch, will probably go away," exclaims the pilot under his or her breath, as the pilot switches to another radio. On the other hand, the customer could be an aviation professional who is very explicit and concerned about flight problems and will expect all squawks to be equally honored and fixed.

This is the world of audio, the necessary and focused interface between the user and the radio, a very indispensable and complex jungle of dedicated electronic signals that maintain a connection between the pilot and the tower. Audio is the lifeline between the pilot and ground. It is also a distraction from loneliness and boredom. Without audio, there would be total chaos. Planes would collide into each other while confusion on the ground would drastically delay flights.

So what are some of the expected and time-honored problems that creep out of the proverbial woodwork? The onset of more evolved electronics has led to greater sensitivity, and resultantly, noise. Everything can be a culprit. It could be inverters, strobes, alternators, motors, actuators, precipitation static buildup, poor bonding, defective shielding and much more. Finding the source of the noise is the challenge for the hopefully skilled and experienced technician. Specifically, noise is that component of a varying signal with frequencies at levels that are audible, invasive, not direct current, and can usually be traced to such sources as 400 cycles from inverters or 60 cycles from lighting systems. Other potential generators are the spiking signals transmitted over a wide range of frequencies from strobes and bad brushes on generators and alternators.

Noise in its practical form is an annoying squeal, pop, snap, or whine coming from the speakers or headsets. Aside from indicating filter failure or power supply problems, it can affect the pilot's ability

to function efficiently after a while. The noise, over a long haul, could easily be enough to impair judgment. The source might be an alternator, inverter, static buildup, defective antennas, poor RF or electrical bonding, defective power supplies, poor shielding, or even equipment failure.

The audio system can be as simple as an internal amplifier in the NAV/COMM unit wired to a common point and switchable from, say, COMM 1 to COMM 2 with mini-switches. Or in the case of a one-radio airplane, the amplifier can be wired directly to the speaker and headphones.

More common, and more complicated, especially in IFR-equipped aircraft, is the panel-mounted amplifier with built-in switching (commonly called an audio panel) or a panel-mounted set of switches connected to a remotely installed amplifier. The job of these amplifiers is to receive low audio (which is basically a weak signal transmitted over many miles), isolate it, send it to the switch-selected output (headphones or speaker), and amplify it so that you can hear what somebody is trying to say to you.

Audio panels tie together multiple inputs to let you use them all efficiently. Instead of having to turn the ADF volume up every time you want to listen to a station, you simply flip the ADF's audio panel switch to either speaker or headphone and listen. This saves wear and tear on volume controls and gives you a central black box from which you can control all your radios' audio. It also can be the creator of the noise and one of the first places to check.



Narco CP136M audio panel.

The easiest unit to install and maintain is the panel-mounted audio panel. Examples of these are King's KMA134 and KMA24, Narco's CP-136, and the former Collins AMR-350. (*Note: Collins sold its line of Micro Line avionics to S-TEC.*)

Audio System Problems

Any kind of switch is always a potential source of trouble, and audio panels have lots of switches. When squawking audio problems, be sure you have the switches set correctly before taking the time and trouble to have someone work on your system. It's all too common for flight instructors to fail to teach students the details of how audio panels are set up. If you rent airplanes, especially those with different avionics setups, take a few minutes to learn the various audio panels so you eliminate lack of knowledge as a source of problems.

In my experience, early audio panels with toggle switches are more reliable than those with push-button switches. Toggle switches are a straightforward design that has proven themselves for many years. Other sources of trouble in audio systems are the switching circuits used to gain the most efficient use of the audio. Without this switching, you'd have to turn down the volume on other pieces of avionics any time you wanted to transmit to prevent the other audio from interfering with your transmission. The other radios are still producing audio, but the audio is prevented from reaching the speaker or headphones by muting circuitry. If the wiring or relays that form the heart of the switching and muting circuits are less than perfect, failures might result, such as audio bleed-through from one system to another.

Following are some common audio problems. Reasons for the failure might involve more than just the audio system, you might see these same problems discussed in other chapters.

1. **Noisy reception.** Check for an antenna problem. Also, it could simply be a weak or noisy received signal.

2. **Distorted or garbled reception.** Check speaker first, then radio, audio amplifier, and associated wiring. If the audio panel uses push-button switches, they could be the problem. Toggle-switch failures are rare. Check for contamination, loose pins, or broken wires on the audio panel mating connector.
3. **Intermittent reception.** This problem can be caused by problems with the radio's power wire, grounds, defective pins on the radio's mating connector, problems with the radio itself, or damaged wiring from recent upholstery work. Check to see if the COMM radio has an intermittent or defective microphone being keyed. This would kill all audio if the microphone key button is depressed or has failed causing a closed microphone key condition. Many technicians test for intermittent audio by turning on the ADF audio and listening to it while proceeding with other tests. If the intermittent audio reception problem occurs, the tech will immediately hear the failure when the ADF audio quits. From there, the tech should be able to isolate the problem further, but at least they will have heard the problem and won't ask you to come back later when it gets worse.
4. **Total audio failure.** Check for the same items as with intermittent reception. But also check to see if you're trying to listen on the speaker with the audio panel set to headphones. Also, make sure the "auto" switch hasn't been moved from where you normally set it. This happens more often than most pilots would like to admit.
5. **Weak reception.** If noise isn't a problem but reception is still weak, check the radio or audio amplifier.
6. **Weak transmission.** This could be from a bad microphone, radio, or antenna.
7. **Modulation, no voice.** Mic jack contacts or the microphone wiring might be defective. Try replacing with a new microphone. Usually, wire breakage occurs directly where it exits the plug or microphone body.