The Fragile Voice Com Link

The essential link between pilots and ATC hasn't changed much since the 1940s.

By Wally Roberts

THERE ARE THREE ASPECTS OF IFR flying that are drilled into every instrument pilot: "aviate, navigate, and communicate." The first two are essential to our very survival during flight in instrument meteorological conditions (IMC). The third is essential to our acceptance, understanding, and compliance with ATC clearances and instructions. In busy radar-controlled airspace, the communications link with ATC often spills over into those other two aspects: "avigation" and navigation.

In this article, I'll delve into the more critical aspects of voice communications for IFR flight. I'll also provide some of my insights gained over many years of using the system in U.S. domestic airspace.

ABCs of radio

Pilots don't need to understand radio concepts nearly to the extent that an amateur radio operator does. However, I believe pilots should know the three different methods of two-way radio voice communications. What we commonly use today is known as simplex, which means the controller and the aircraft transmit and receive on the same frequency.

Simplex transmissions can never occur simultaneously between the parties; when they do, we get a squeal instead of communications. Because aviation radios are amplitude modulation (AM), we get a squeal that is more pronounced than we would with FM when someone steps on someone else's transmission—this can be used as a wary pilot's tool.

Transmitting and receiving on different frequencies, but not at the same time, is known as half-duplex and is hardly used these days in aviation. Finally, transmitting and receiving at the same time on separate frequencies is known as full-duplex, which makes voice radio act like a telephone. Full-duplex is great for cellular phones and such, but it pretty much limits the conversation to a strictly two-way link. Simplex gives us the great advantage of hearing whoever else is talking with ATC, assuming that ATC isn't using more than one frequency at once.

Brief history

When the pioneering U.S. airlines became serious about en route IFR operations in the 1930s, high frequency (HF) radio was the choice for domestic en route and terminal voice communications. HF has the advantage of long-range communications not limited to line-of-sight. The primary disadvantage of HF communications is its susceptibility to static interference from bad weather conditions, especially lightning discharges. Those early IFR communications links were almost always on separate frequencies for air/ground and ground/air communications (half-duplex).

When I started flying IFR in 1958, the FAA's predecessor (the CAA) had long since taken over responsibility for maintaining and operating the nation's IFR airspace and facilities. Centers and approach controls were similar to those of today, except there were many areas of non-radar coverage. Whether or not an approach control had radar, IFR communications were similar to today, in that the pilot spoke directly with the controller.

Center communications were a different matter. There were many areas with gaps in both communications and radar coverage. So, the pilot—especially in low-altitude operations—often communicated indirectly with the Center through the Air Traffic Communications Stations (similar to today's FSS). This relay-type communications is still the norm today for most oceanic flying and in some of the remote land areas of the world.

Distinction significant

Where communications are of the relay-type, ATC is pretty much limited to providing altitude changes and route clearances. Plus, ATC can relay

Even though the technology has improved, our present-day pilot/controller communications are a fragile, two-way human link.

weather and other advisories that might be significant to the pilot. Temporary, short-term loss of communications isn't generally critical in these circumstances.

With direct pilot-to-controller communications, and where there's lots of traffic, it's often perilous to have any gaps in communications. Both pilots and controllers must have an entirely different mindset when communicating in busy airspace, as opposed to en route communications in light-traffic airspace. Flying en route at 0300 in Salt Lake Center airspace over Wyoming is quite different than Chicago Center at 1600 in northern Illinois. A gap in communications en route is far less critical when flying on a Victor airway than when on a Center's direct or radar routing.

Even the busiest Center traffic situation is typically lighter than the busy approach control. Approach control airspace is simply more compressed than Center airspace. There are exceptions, however, such as low-altitude Center arrival sectors that hand-off to major approach controls.

Phraseology and procedures

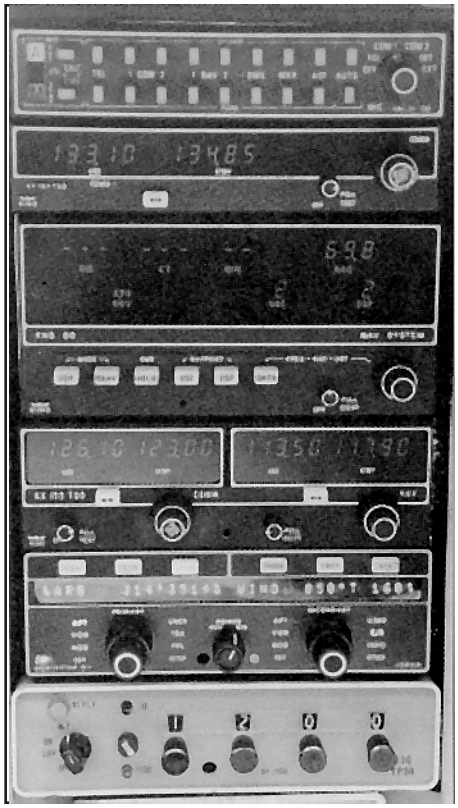
I don't agree with everything the FAA says in the AIM. Some of it's good and some of it's fair to poorly conceived. However, when it comes to AIM Chapter 4, Section 2, "Radio Communications Phraseology and Techniques," I view it as one of those cornerstone "bible-type" documents for both pilots and controllers. To put it another way: this is essential reading for all pilots and controllers and should be re-read in its entirety by everyone on a periodic basis. It may be boring, but it's significant.

When everyone uses the exact same phraseology, the risk of misunderstanding decreases. Standard phraseology is most critical when the frequency is at, or near saturation. Both overloaded pilots and overloaded controllers tend to hear what they're conditioned to hear.

For example, "point" is reserved for use in describing a radio frequency ("decimal" for international flying) and shouldn't be used to describe intermediate altitudes, e.g., "Leaving nine point four," when the correct statement is, "Leaving niner thousand four hundred." Those two are quite different sounding transmissions. Granted, the correct way might be a bit longer, but brevity in communications is only a virtue if done within the context of the ground rules.

Breaking the squelch

When the frequency is busy, we're constantly reassured we're in the communications loop by hearing both the controller and other pilots talking to each other. When it's quiet, however, it seems to be *too* quiet. Breaking the squelch (to hear the frying bacon) gives us assurance we have the volume set at an audible level and we don't have a stuck mic. A squelch check, however, doesn't ensure our receiver is still receiving. If in doubt, sometimes a "com check" with ATC is in order. Like everything else, good judgment is the rule of the day.



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If the squelch check doesn't work, the first thing to do is to verify the switch settings on the audio panel, followed by a check for a stuck mic. Sometimes the only valid check for a stuck mic is to remove the mic plug from its jack, then repeat the squelch check. A mic can stick without its press-to-transmit button appearing to be depressed.

Context and heterodyning

Experience gives us insight into the context of the ATC "game" in play in busy airspace. Of course, this is the same insight that can give both pilots and controllers expectations that sometimes cause us to hear what we want to hear, rather than what we really hear. It takes a concerted effort to separate the wheat from the chaff.

When someone steps on someone else's transmission, the squeal we hear is the result of heterodyning of the two transmitted signals, which are always slightly off the perfect frequency. If the block is complete, context often provides you with a good guess of whether the call was for you. Sometimes, it's appropriate to ask the controller if he/she was calling you; sometimes it's best to simply say, "You were blocked." There was recently a case where the NTSB reversed an FAA enforcement proceeding because of a blocked transmission. Nonetheless, someone took the intended pilot's clearance, which caused a bad situation for everyone involved.

Incomplete clearance/instruction

ATC can sometimes get so overloaded, the controller starts rapid-firing clearances and instructions to different aircraft without letting up on the mic. In this situation, you'll hear a transmission to aircraft "A," followed by the controller saying "break!" and then continue into a clearance for aircraft

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"B." Or, some controllers will preface a multiple clearance situation with, "Standby on your readbacks until I tell you to."

This can place you in a dilemma. If it's an altitude change, I advise against ever changing altitude until you've read back the altitude. However, if it's a heading change, and you feel it's safe to take the heading change without a readback, then do it. The altitude change is a clearance; the heading change is an instruction. You have no obligation to act on a clearance for which you have been unable to acknowledge. In fact, more often than not, you would be remiss in acting on an unacknowledged clearance. An instruction, however, typically has more immediacy than a clearance.

When you receive a clearance or critical instruction, and you're uncertain of the clearance or instruction, don't request clarification by including the questionable item in your question.

What if the controller says "descend immediately!" yet doesn't give you a chance to respond? I would consider that a near-emergency situation which should receive your best judgment as to your immediate course of action. Hopefully, you'll fly a lifetime without one of those!

Don't reinforce the uncertain

When you receive a clearance or critical instruction, and you're uncertain of the clearance or instruction, don't request clarification by including the questionable item in your question. For example, if you think you were just cleared to descend to 5,000, but aren't certain, don't say, "Is Piper Four Five Charlie cleared to five thousand?" Instead, query the controller as follows, "Say again, Piper Four Five Charlie's altitude assignment." Do the same with an uncertain heading assignment or any other critical piece of information. To read back the questionable item is to set it up for confirmation by the other fallible human in the link, even though it wasn't what was stated to you the first time.

Vectors toward higher terrain

You know, and very well should know, when you're being vectored toward higher terrain. Always have limits in mind, based on crossing airways or DME distances, beyond which you won't go without getting fresh assurance from the controller that all is well with the vector. If you routinely fly in areas such as inland LAX, SFO/OAK/SJC, SLC, TUS, PHX, SLC, etc., you owe it to yourself to have terrain-proximity limits.

This is probably the most unsatisfactory area of IFR operations: not only don't you have a means of independently verifying the safety of the vector altitude, you must rely on voice communications to replace a chart, airway, and nav facility with a continuous ident and fail flag. As a result, have your limits set properly and you won't end up smoking on a 5,000-foot ridge at 4,000 feet.

ATIS

ATIS is a valuable tool in that it avoids the repetitious transmission by approach controllers of non-control information. This is especially valuable at the busier terminal areas. On the other hand, pilots flying single-pilot IFR can sometimes get overwhelmed when juggling the voice com-link from ATC to ATIS. If you believe it would compromise the safety of your operation, advise the controller you're "unable ATIS." It's the controller's responsibility to provide you the required information in this situation. (You would never be justified in being "unable" with departure ATIS, however.)

IFR arrivals and CTAF

In "Uncontrolled Tragedy" (January *IFRR*), we reviewed the tragic ground collision between a commuter airliner and Beechcraft King Air at Quincy, IL. The FAA and NTSB seemed to find little wrong with CTAF procedures and instead found the King Air pilot at fault. Well, you can reduce the cost of being wrong or even dead right by assuming the worst at uncontrolled airports. It's one thing to approach and land at an uncontrolled, one-runway airport on a bright, clear day at high noon. It's altogether different during marginal weather conditions and, especially, with intersecting runways.

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Even though the instrument approach goes straight in, most of the time it's best to overfly the airport and enter standard traffic, weather permitting. If the cloud base is less than 1,000 feet, you really have no choice but to land straight in. Always announce, announce and announce your position and intentions. Most of the time the weather will be good enough to fly the straight in at an altitude 500 feet above pattern altitude to mid-field, followed by an orderly standard entry into the full local traffic pattern.

You make the difference

In IFR-arrival CTAF operations and communications (as with all aspects of IFR operations), your diligence, conservative operations and skillful, disciplined communications can make the difference between having a safe operation and ruining your whole day.

Wally Roberts is a retired airline captain, former chairman of the ALPA TERPs Committee and an active CFII in San Clemente, CA. Visit Wally's web-site at www.terps.com