My Own Mouth Shall Condemn Me [1]

Proper radio procedure is a primary deterrent to breakdown of pilot-controller communication.

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by

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The subject of pilot-controller communication is about as exciting as kissing your grandmother. After all, communicating is something pilots and controllers regularly do as part of their respective jobs. Ask the average aviator to list the most important skills of his profession and you would likely find communication listed low on the list. At the top of the list would be systems knowledge, aircraft-maneuvering skills, judgment and the ability to stay cool in a crisis.

Communicating effectively in the air traffic control system is often considered a peripheral task, in the same category as revising approach charts or completing flight logs — it has to be done, but it is not something to spend a lot of time thinking about. And communicating is easy. It must be. No one says we are not proficient if we do not get communication refresher training every six months. It is something every pilot knew how to do before he took his first flight lesson. Aviation communication is merely adapting skills learned in early childhood to a specific task: learn the appropriate words and phrases, and how to operate a transceiver.

However, Capt. William P. Monan (Battelle Columbus Laboratories) working for NASA's Aviation Safety Reporting System (ASRS), disagrees with this simplistic approach to communication. After studying 417 incident reports involving communication breakdowns between pilots and controllers, he writes, "Perhaps no other essential activity in aircraft operations is as vulnerable to failure through human error and performance limitations as spoken communication." [2]

Monan found that something happened to the simple task of exchanging information between pilots and controllers. No matter how simple, automatic and natural this process seems, there is rarely a single flight leg flown in which a communication between the human transmitter and the human receiver does not break down.

Pilots and controllers do not give much thought to the routine, and usually innocuous breakdowns that occur between them. Human nature tends to convince us that it is minor, but we will not let it happen again. When a heading is mistaken for an altitude or the wrong aircraft responds to a clearance, we tend to believe that once we correct the error, we need not worry about it any further. In spite of thousands of incidents and an occasional catastrophe, a healthy respect of the danger of communication breakdowns between controllers and pilots apparently has not generated sufficient alertness to prevent the problem.

On January 25, 1990, we had another tragic example of what can happen when there is a communication breakdown between pilots and controllers.[3] On a winter afternoon, as the holding time grew longer in deteriorating weather, the crew of Avianca Flight 052 told controllers at least three times that the aircraft was low on fuel. Yet, the Colombian airliner was routinely sequenced with other traffic landing at New York's John F. Kennedy International Airport before it crashed due to fuel exhaustion, and 73 of 158 occupants were killed (see April 1990 *Accident Prevention*).

Verbally exchanging uncomplicated and objective information to another person is usually an easy task for a normal adult, but as political commentator George Will once said, "There are times in which it is valuable to repeat that which is already known."

When you consider that more than 70 percent of the ASRS incident reports include a problem with the exchange of information between humans,[4] it becomes uncomfortably clear that the ability to communicate effectively is as important to aviation safety as any other pilot or controller skill.

What Goes Wrong

The data obtained from pilots and controllers through ASRS reveals a gamut of incidents resulting, at least in part, from communication breakdowns. Flight crews have encountered traffic conflicts, near-misses, runway incursions, heading and course deviations, altitude excursions, takeoffs and landings without clearance, missed crossing restrictions and even near-impacts with terrain.

Most of the elements leading to communication breakdowns can be organized into five categories:

- Similar Call Signs

- Alpha-Numeric Errors

- Procedure
    Overly-complex communications
    Inadequate responses and poor radio procedures
    Headsets vs. speakers
    Hearback problems

- Mindset
    Expectation
    Fixation

- Workload

The order of these categories has no significance because there is not enough data to draw meaningful conclusions about what happens most often. Most pilots and controllers will recall communication breakdowns they have experienced in these categories.

Similar Call Signs

One reported incident pointed out that airlines with hub operations have created a perfect environment for error in assigning many of their flights, which depart or arrive one after another, with consecutive or similar flight numbers. Flights 724, 725 and 726 may operate along similar routes, or within the same airspace at the same time, causing obvious problems. This, according to the reporter, is "…good for marketing, no good for us."[5]

In addition, since there are about 245,000 commercial/noncommercial airplanes registered in the United States, and another 96,000 registered in the remainder of the world, there will occasionally be two or more aircraft operating on the same frequency at the same time with similar call signs. Pilots and controllers need to maintain an awareness of this possibility.

Alpha-Numeric Errors

Similar sounding numbers and letters, or ones where the digits can easily be reversed, cause many of the reported incidents. The most common among the incidents resulting from this problem are altitude excursions and incorrect headings.

When a pilot is busy or otherwise distracted, or when transmission quality is not adequate, it may be difficult to pick up subtle differences in the sounds of words or phrases. This explains why numbers with two-out-of-three identical digits are so often mixed. Changing flight level 220 to 200 and vice versa, and doing the same with 10,000 vs 11,000 feet are examples of recurring number errors.

Altitudes can be mistaken with headings or speeds. One pilot reported that he had received an instruction from the center to turn to a heading of 310, fly an assigned indicated airspeed of 300, and expect a later clearance to climb to flight level 330. He had to read back the clearance three times to get the three similar numbers in the right places.

This kind of problem appears to be significant. In one study, misconstrued alpha-numerics accounted for 53 percent of the message errors. [2]

Procedure

Procedure is a method of accomplishing a task; a way of proceeding. But procedure as we use it, means more than that. For us, it is a consistently-used or habitual method of accomplishing a task.

Unfortunately, the way in which pilots and controllers habitually exchange information can also cause communication break-downs. Some examples are:

- Overly-Complex Communications

  When a pilot receives an IFR clearance prior to flight, he can write the clearance on paper, as opposed to committing the information to memory. In flight, if a controller wants to change a route, he may not alert the pilot by asking if he is "ready to copy".

  Unfortunately, controllers frequently issue a complicated clearance in rapid-fire order, often too quickly for the pilot to write down: "N1234, descend now to FL 190, then pilot's discretion to one zero thousand. Descend so as to cross two zero miles southwest of LOSST intersection at or below one one thousand. Area altimeter 30.03."

  Controllers and pilots will recognize that this clearance is not unusual. In it, there are six separate pieces of information that a pilot must read back. Yet, when such a clearance is issued with no warning, it requires the pilot to commit the information to memory, and the clearance often has to be repeated. The potential for error is obvious.

- Inadequate Responses and Poor Discipline

  The practices of deliberately abbreviating call signs and acknowledging instructions with only a "roger," "so long" or a double-click of the microphone are so prevalent in the industry that many impressionable airmen consider it a sign of inexperience to use proper responses. The idea that it is more professional to be unprofessional is a human problem that has a negative effect on safety, and communication practices are especially vulnerable to it.

  The purpose of a procedure is to limit and control the opportunity for error. It is more difficult to misunderstand or confuse a full registration number or call sign than an abbreviated one. Acknowledgement of an instruction with a complete call sign, and not merely a "roger," reduces the possibility that the incorrect aircraft will comply with instructions intended for another aircraft.

ASRS examines this problem in a report, "Addressee Errors in ATC Communication."[6] The report found that nonchalant responses lead both pilots and controllers into errors. Traffic conflicts, altitude excursions and switching to incorrect radio frequencies are often the result of this problem.

Improper phraseology, poor enunciation, lack of verification, poor microphone technique, and so forth, are among practices that contribute consistently to the ASRS incidents.

Aviation radio procedure has developed through the years to minimize the opportunity for errors. Proper procedure is well documented in the Airman's Information Manual.

- Headsets vs. Speakers

  A barrier to effective communication between the controller and the pilot is often caused by an open cockpit speaker for audio reception. The joint FAA/industry report "A Call to Action," published in 1988, noted that 43,000 reports were filed that cited communication problems between 1982 and mid-1988, of which "a large number" specified the exclusive use of speakers as a factor in their incidents. Ambient aircraft noise due to high airspeed or precipitation, crew conversation, interruption from flight attendants and others, and speaker failure played a part in these incidents, and suggests that use of headsets may reduce the problem.

- Hearback Problems

  The act of a controller actively listening to the readback of an ATC clearance has been termed "hearback."[7] This important step in the communication process provides final confirmation that instructions have been received and understood. Prior to 1985 in the United States, there was no written requirement for controllers to actually listen when a pilot read back a clearance. Now, however, the *Air Traffic Control Handbook* clearly states that a controller must "ensure the readback is correct."[8]

  It is unrealistic to assume that a controller's lack of response to a readback is tacit verification of its correctness. Although many controllers understand the importance of hearback, they may over-

look it in a busy period. Pilots should not assume controller silence a verification and they should ask the controller for a verbal confirmation.

Mindset

Mindset interferes with effective communication in two ways.

- Expectation

  Expectation, or assumption, is hearing what one expects to hear. When operations are repetitive or standard, it is very human to be misled by established habit patterns. Crews have reported that they made errors that led to incidents because they did what they had done many times before, only to learn later they had been asked to do something different.

  One report included a crew member, on a scheduled operation out of a low-traffic airport, who was accustomed to being cleared from the ramp through the takeoff on the same radio frequency. This particular time, however, the ground controller instructed the crew to taxi into position, and contact tower. They taxied onto the runway, finished their checklist, and took off. Fortunately, it only caused embarrassment.

- Fixation

  The second way in which mindset interferes with communication is fixation. This problem seems to occur at opposite ends of the workload spectrum. When conditions are completely routine and workload is low, it is common for the mind to wander to other concerns. Because pilots and controllers are human beings, with lives and interests outside of aviation, it is easy to direct attention to family, financial dealings, relationships, hobbies and so forth, instead of the tasks at hand. This may be part of the reason that when the communications-failure incidents are organized by phase of flight, the greatest percentage (22 percent) occurs during cruise. [9]

  On the other hand, high workload can also cause fixation. In this case, it is fixation on one aspect of the job at the expense of others. When the weather is poor, the sector is saturated or there are mechanical failures, it is easy to let attention focus on the problem that appears to be the toughest to handle. The Eastern Airlines Lockheed L-1011 accident in 1972 proved this can be a serious mistake.

During approach to Miami International Airport in Florida, U.S., the aircrafts' crew became fixated with a nose gear malfunction. The autopilot was accidently disengaged and the aircraft descended and collided with the ground in the Everglades National Park. It is during distracting times like this that pilots and controllers tend to put the idea of clear communication on a back burner in favor of one task that commands their attention.

Expectation and fixation cause interruptions in the communication process. Information is transmitted and received, but the mind is not prepared to process it correctly. Sometimes, the result is the same as if a communication had never been attempted — sometimes it is worse.

Workload

Communication, like all other aspects of a pilot's or controller's job, receives a smaller segment of a busy airman's attention compared to that of a less busy one. The job of communicating effectively is always present. Adverse weather, busy airspace, controller inter-coordination problems, failed systems and so forth, are factors that come and go. As a person's capacity to deal with these complexities becomes saturated, he or she has no choice but to allocate an ever-smaller portion of the available processing time to each consideration. At times like these a pilot or controller must become a manager, and resources must be allocated carefully.

Communication is one of the most difficult tasks facing pilots and controllers. The potential for problems is enormous.

The key to errorless communication is in using good procedure. ♦

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About the Author

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Formerly Wilson was chief pilot, charter operations, for the Napa, California, U.S., division of International Air Service Company (IASCO). Along with charter-related and check pilot duties, he was involved in simulator and flight training on Falcon 20 aircraft. He previously was a line captain for corporate and charter flying with Royal Industries in Burbank, California, U.S.

Wilson writes aviation safety articles for Flight Safety Foundation bulletins and contributes aviation features to other aviation publications.

The Communications Procedures That Save Lives

Whether written into company operating manuals or practiced as personal habit, the procedures listed here limit the opportunity for communication breakdowns between pilots and controllers. The strength behind the effectiveness of these procedures is acceptance of the importance of maintaining clear communication.

1. **Use correct radio procedure.** Analyze your radio procedures and adjust them to comply with the *Airman's Information Manual*.

2. **Read back clearances.** Read back completely any clearance containing altitude, heading or speed assignments. Always read back any hold-short or position-and-hold instructions.

3. **When in doubt, verify.** Always seek verification of any clearance you do not understand or is understood differently by any two crew members. Never come to an agreement by cockpit consensus.

4. **Use full call signs.** Brevity can lead to more frequency congestion because of the need to clarify misunderstandings. A communication should be acknowledged with a call sign, not a double click of the mike button or a "roger."

5. **Be alert for similar call signs.** Ensure that the controller and other aircraft involved are aware of similar call signs in use.

6. **Use thoughtful radio technique.** Listening for a full two seconds before keying a microphone will reduce simultaneous transmissions on the same frequency. It is also important to ensure that the microphone is fully keyed before starting to speak. The failure to do this often occurs when pilots and controllers feel rushed to complete their communications. If a communication is not understood the first time, repeat it.

7. **Hearback.**

   Pilots: Never assume ATC is listening to your readback, or that errors will be corrected.

   Controllers: Consider hearback to be an important element in the communication process. Verify the response.

8. **Develop a "pilot-off-frequency" procedure.** In multi-pilot environments, when one pilot is off frequency, the pilot handling ATC should:

- Test radio volume and ensure good personal reception.

- Be sure that communication is understood, and ask for clarification if information is not clear.

- Always read back.

- Brief the other pilot when he returns to the frequency as to what information was received, especially any changes in clearances.

9. **Keep communications simple.** Clearances, instructions or requests should never contain more than two or three critical items unless preceded by a "ready to copy?"

10. **Apply cockpit resource management to communication.** When a particularly distracting problem arises or the workload becomes unusually heavy in multi-pilot environments, one of the pilots should be designated to be responsible for communication. This helps to prevent a whole crew from succumbing to mindset. In single-pilot operations, the pilot must prioritize tasks in a busy environment. The pilot must advise ATC if flying the aircraft demands his full attention for any period of time to avoid unsafe distraction from his prime responsibility — controlling the aircraft and ensuring a safe ending to the flight.

11. **Use a headset.** Make it a habit to wear a headset to ensure clear reception of controller communications and to reduce unnecessary distractions from ambient sounds.

Perhaps the best procedure is for pilots and controllers to develop a general sensitivity to the potential for errors. If each person in the system realizes what could go wrong each time he speaks into a microphone or listens to the radio, he might take action to prevent a problem and thereby make an important contribution to aviation safety. ♦

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