



EFFECTIVE COMMUNICATION IN THE AVIATION ENVIRONMENT: WORK IN PROGRESS

By Anne Isaac, Ph.D.

Anne's early experience in ATM and airline operation was followed by six years with the Human Factors team at EUROCONTROL, where she was associated with the development of tools and techniques to help identify human error and risky performance in the ATM environment, as well as developing the Team Resource Management (TRM) concept for European ATM. Anne now heads a team in Human Factors integration within the Division of Safety in NATS, UK.

Effective communication is a basic human requirement and in the aviation environment an essential pre-requisite to safety. So why do we continue to get it so wrong? - and we do get it wrong about 30% of the time. In a recent radio telephony survey it was found that 80% of RTF transmissions by pilots were incorrect in some way. However pilots are not the only ones in the communication process, and there are some startling statistics from the air traffic controllers as well:

- 30% of all incident events have communication errors, rising to 50% in airport environments.
- 23% of all level-bust events involve communication errors.
- 40% of all runway incursions also involve communication problems.

None of these statistics are surprising when we realise the demand we place on the verbal communication process, and most of us know some of the obvious traps: call sign confusion, the problems with native language, the use of standard phraseology and the increasing traffic and complexity leading to frequency congestion and overload, as well as a high percentage of technical failure of the communication system itself. However, what might not be so obvious is the complexity of effective communication and the aviation cul-

ture which reinforces operational staffs' trust in other colleagues.

The following graph indicates the most numerous problems, however this only illustrates half the story.

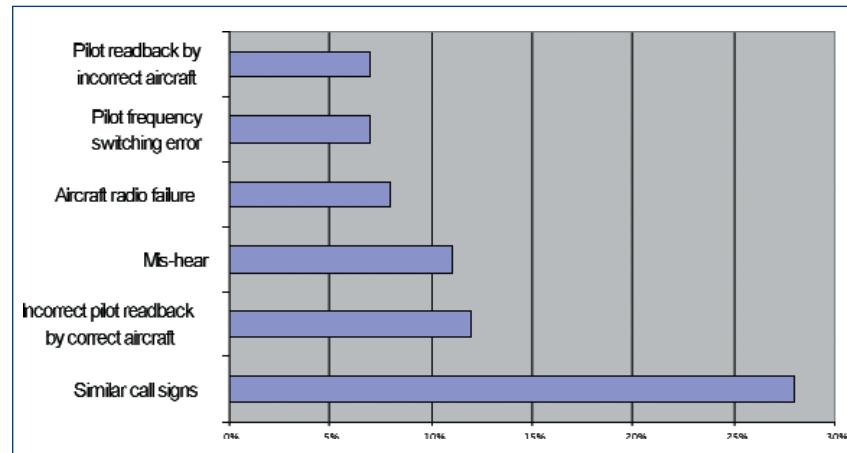
Perhaps more importantly we should ascertain the most serious issues caused by these activities and the context in which they are likely to increase the risk to the system.

The leading events, which encompass some of the above issues are: mis-hearing information over the RTF, often caused by incorrect pilot read-back of information (but by the correct pilot) and transmission and/or recording of incorrect information by either the pilot or controller. In all cases the problems are embedded in the complexity



of the communication process itself. In order to transfer information, both the person sending and receiving the information must be able to formulate, listen, hear and interpret the message correctly as well as verify the information for completeness, and at any of these stages things could go wrong.

The most risky situation is when one of the parties does not identify or recognise an error, since then they are unable to recover from the situation themselves. Some of these risks are embedded in the way we ascertain



information from equally qualified colleagues.

We tend to ask confirmatory questions to solve a problem when we are unsure in these situations. The example below is taken from the Danair 1008 air accident at Tenerife:

Co-pilot : gosh, this is a strange hold, isn't it?

Captain : yes, it doesn't it doesn't parallel the runway or anything.

Co to Engineer : it's that way isn't it?

Engineer : that is a 3 isn't it?

Co : yes, well, the hold is going to be there, isn't it?

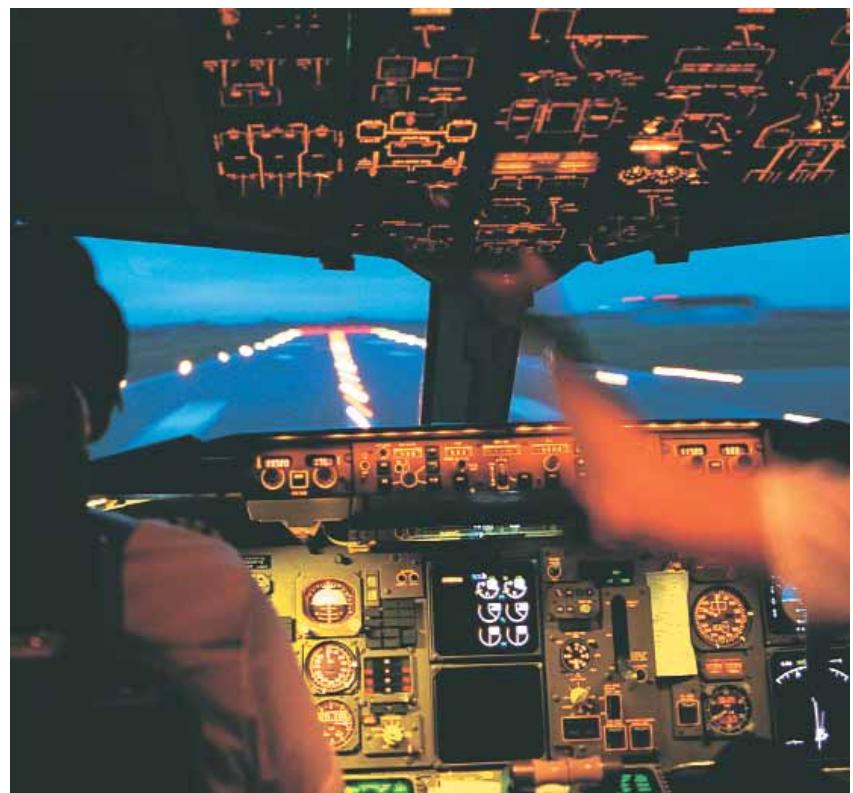
Captain to Co : did he say it was 150 inbound?

Co : inbound, yeah

Captain : well, that's..... I don't like that

Co : they want us to keep going all around, don't they?

Another very risky situation, in terms of the above issues, are conditional clearances. Conditional clearances are used on the understanding that both parties are assured of the message they hear. Since most of the information which is found in the conditional clearance information is standard and known by both parties, it is very rare for one of the parties to question part of this communication. Usually you will hear the person receiving the message say, "Oh he must have said that, or she must mean this". This situation is made more risky when the actual communication is correct but incomplete. Almost all runway incursion incidents which involve conditional clearances are also the result of incomplete com-



munication strings. This is particularly risky for both parties since an incomplete transmission is not so easy to pick up as an incorrect transmission.

Another example regarding communication and feedback to colleagues within the aviation industry is the issue of seniority and expertise. Air traffic control assistants as well as cabin crew believe that it is not their place to question or challenge a colleague who is more qualified or in a position of seniority. The following example illustrates this and had fatal consequences.

On March 9th 1989, an Air Ontario Fokker F-27 was getting ready to take-off from a small airport in Northern Ontario. Take-off was delayed as the tower waited for a small private aircraft to land. It had been lost in a spring snow storm. Whilst

the aircraft waited for take-off clearance, several passengers took note of the accumulation of snow on the wings. One of them brought it to the attention of the flight attendant, who assured him that there was nothing to worry about. Many of the aircraft's occupants were concerned about the snow, but no one, including the flight attendants, thought it appropriate to say anything to the flight crew. When asked about this during the course of the investigation, the one surviving crew member, a flight attendant, stated that she did not feel it was her job to inform the pilots of potential problems. She had never been trained to question an area that in her mind was clearly a pilot responsibility.

Moshansky, 1992.

Since then both the development of Crew and Team Resource Management

activities have enabled clarification and challenge to be an acceptable part of this working environment.

One of the most prevalent errors in all aviation communication is information which is mis-heard or not heard at all. The reasons for this are again many and varied, which is why ICAO and National Air Navigation Service Providers train their operational staff to use standard radio telephony. So why don't we stick to these rules? Research would indicate that there are several human traits which make following rules more problematic. Firstly people, even controllers, assistants, pilots and aerodrome drivers never believe they could be involved in a serious incident or accident. The fact that these events, compared to the number of aircraft movements, are relatively rare, helps to perpetuate this belief. This trait is not exclusive to aviation professionals, we all believe the best when we step outside into the hazardous world, not appreciating we could be the victim of many and varied serious incidents.

Secondly, having developed standard phraseologies, individuals as well as Centres, Units and even National Providers and Airlines believe, because they are different, they need to apply for an exemption or change to the rule. These changes are rarely associated with a study to establish the reason for the changes and the best consequent solutions. Again it is rare that procedure specialists would ask the advice of the human performance specialists about how humans process both written and spoken information. This often leads to the use of incorrect phraseologies being delivered in the wrong order. Some of these risky words and

phrases have been identified as follows:

- In turn - intended sequence is unclear;
- Next exit - who's next are you referring to;
- Pull forward - clearance is not clear;
- One hundred and eleven hundred - as in flight level;
- Three digit numbers ending in zero - heading often confused with flight level;
- Similar sounding letters and numbers - B,G,C, D and 3;
- Made a ... interpreted as Mayday;
- Holding position interpreted as hold in position;
- Climb to, two thousand - action, followed by qualifier.

Many other errors are made because of the problems of expectancy. Because we use standard phraseology, we often expect to hear a particular request or reply in a familiar situation. If the message we receive is distorted in some way, such as due to other noise or cut off, it is easy to assume we heard what we expected to hear instead of confirming the message. Hearing what we want to hear, guessing at an insignificant part of the spoken message, and filling in after the fact, are commonplace. We also reconstruct parts of messages unintentionally - and we do so with the utmost confidence that we hear what we actually reconstructed, not what was said.

Another reason for the prevalence of information which is mis-heard or not heard is associated with interruption and distraction. Usually a verbal message or phone call will interrupt almost any activity, and by the time we realise that this interrupting message is of lit-

tle importance, it is too late to retrieve the activity we were engaged in when the message or phone call started. This results in the two tasks, whether they were verbal (receipt of a message) or another action (scanning, writing) being incomplete. When two activities compete for our limited working capacity we usually end up losing all the communication channels, and have to start again.

This problem is particularly obvious when working under a high task load. Task load is dependent on work load (the sheer volume and complexity of traffic) and contextual conditions such as:

- Weather;
- Experience;
- Fitness;
- Time on position;
- Stress.

Task load is a personal experience, different for everybody and depending on many things. The limitations of the human information processing system are first observed in our ability to communicate. Overloading this system inevitably leads to less effective communication due to tunnel vision (and tunnel hearing), reduction of scanning cycles, less investment in time to execute feedback and a rising temptation to fall for the trap of expectation bias. This results in more incorrect information which leads to further incorrect communication, and finally decisions and actions which are error-prone. We all have a tendency to dismiss the need to invest time in effective communication when it is most needed; under high task load.

The main issues which have been iden-

tified during incident investigation and safety trend analysis are the following:

- Pilot reads back incorrectly and the controller does not recognise and correct the error, often since it is from the correct pilot;
- Pilot reads back correctly, however this is followed by an incorrect action on the flight-deck;
- Pilot reads back correctly however the controller records the information incorrectly, resulting in a subsequent error.

Statistics would also suggest that controllers can often pick up errors in communication more quickly than pilots. Cardosi, in her 1997 study, recorded the fact that controllers correct 50% of pilot read-back errors on ground control frequencies and 89% on en-route frequencies. The reason for this is possibly because not only do controllers have more and varied R/T communica-

tion to deal with, but also because they are constantly tested for their proficiency in these skills.

Well, having explored some of the traps that cause humans to make errors, what are the solutions? These, like the traps themselves, are not easy to manage and implement since the communication process itself is highly complex. However, here are some tips for both pilots and controllers which may help:

- Use clear and unambiguous phraseology at all times; challenge poor RTF;
- Try to avoid issuing more than two instructions in one transmission;
- Be aware that you tend to be less vigilant when speaking in your native language;
- Always insist on complete and accurate read-backs from pilots;
- Set the clearance given, not the

clearance expected;

- Both pilots should monitor the frequency whenever possible;
- On frequency change, wait and listen before transmitting;
- ATC instructions should be recorded where possible;
- Use standard phraseology in face-to-face telephone coordination;
- Monitor all read-backs, try to avoid distractions - especially the telephone;
- When monitoring messages - write as you listen and read as you speak;
- If you are unsure, always check!

The European Action Plan for Air-Ground Communication Safety contains more information and advice on effective communication. Copies may be obtained by completing the form on the EUROCONTROL web-site at http://www.eurocontrol.int/safety/public/standard_page/documentation_distrib.html

