MISUNDERSTANDING OF COMMUNICATIONS BETWEEN PILOTS AND CONTROLLERS

Introduction

One of the frequent information transfer problems cited in ASRS reports is that of misunderstanding of radio communications between pilots and ATC personnel or others on the ground. In a study of factors associated with altitude deviations (see previous section) such misunderstandings were found in 22 percent of the occurrences studied. The potential threat associated with such misunderstandings is high. For these reasons, a study of misunderstood communications was undertaken.

Definitions

Communication is, by definition, the exchange of information. This report is concerned specifically with verbal communications: the exchange of ATC clearances, instructions, traffic information, advisories, pilot reports, and the like. Safety in the aviation system demands that such communications be accomplished with a high degree of accuracy and mutual understanding.

Approach

A search of the ASRS database was performed for reports in which "message confirmation procedures" were cited as an enabling or associated factor. The search revealed 143 such reports. A further search revealed that 40 of these reports were also cited as involving a "potential conflict."[3]

[3]See NASA TM X-3494, p. 11. Potential conflict is defined as any perceived problem relating to risk of airborne collision, from "less than standard separation" to "near midair collision, too close for evasive action."

The 40 reports coded as involving both a potential conflict and a message confirmation procedure were examined further. A check of cross-references indicated that the reports described 38 unique events. Message confirmation procedures were cited as an enabling factor in 31 and as an associated factor in 7. Other enabling and associated factors cited in the 38 occurrences are summarized in table 18.

TABLE 18.– POTENTIAL CONFLICTS INVOLVING MISUNDERSTANDINGS: ENABLING AND ASSOCIATED FACTORS

Factor category	Enabling factor	Associated factor
Message confirmation procedure	31	7
Man		
Perception (cognition)	14	1
Decision-making	6	8
Monitoring behavior	6	2
Subsystem operation	3	
Communications: coordination	2	
phraseology	1	3
System and software		
System configuration	10	11
System functions		7
System procedures		9
Similar numbers and identifiers	2	1
Hardware		
Aircraft radios intermittent	1	
Radar and computers		3
Facility design		1
Environment		
Proximity of two airports	1	
Weather in terminal area		1
Obstructions to vision		2
Frequency congestion		1

Examination of the system and software factors associated with these occurrences indicated that the 21 system configuration factors included those shown in table 19.

System functions involved seven entries; three were related to training in progress, three to shift changes and one to briefing of relief personnel. Procedures (nine entries) included five references to radar traffic information service.

TABLE 19.– SYSTEM CONFIGURATION FACTORS

Factor	Number of entries
Multiple runway operations	6
Split control (local) for parallel runways	1
Aircraft under separate ATC jurisdiction	1
Aircraft on separate ATC frequencies	7
Airspace configuration	3
Combined sector operations	3

Discussion

The study of altitude deviations (previous section) examined factors associated with a particular class of event – an outcome. In this study, we have examined an enabling factor found in several cases to be associated with that outcome. Here, we attempt to search for other classes of events associated with the factor of misunderstood verbal communications, as well as looking for other system factors that may be involved.

In order to illustrate what have been termed "system configuration factors" some of the reports examined in this study are reproduced. Multiple, parallel or intersecting runway operations present a potential for conflicts between aircraft, especially if a clearance or instruction is misunderstood:

> Aircraft A called Tower and reported ready for takeoff runway 18. I instructed A to taxi into position and hold on runway 18. He was not cleared for takeoff because of aircraft C on short final for runway 23. While this was going on I was told to watch for emergency equipment bringing oxygen to gate 6 for a passenger . . . as aircraft C rolled through midfield aircraft B (same make as A) called the Tower . . . I replied . . . He answered "We're ready to go runway 36." I then noticed that aircraft C was past midfield, leaving the way clear for aircraft A, in position on 18. My next transmission was "Aircraft A, runway 18, caution wake turbulence arriving jet, you're cleared for takeoff." I received a double reply with aircraft A coming through saying he was rolling. As I cleared A for takeoff I noticed the emergency equipment coming out with the oxygen and having to cross the runway A was using. My attention was momentarily diverted to what the Ground Controller was doing with the emergency equipment because he had cleared the equipment across runway 18 to gate 6. As I instructed the Ground Controller to hold the emergency equipment because A was rolling on runway 18, Aircraft B called the tower and said "We're rolling runway 36." With my attention diverted I thought I heard "We're ready runway 36" and I took no action. Aircraft B took aircraft A's clearance for takeoff and took off on runway 36 as aircraft A was taking off on runway 18. At midfield I saw aircraft A take evasive action to miss aircraft B.

> Aircraft A, IFR to Houston, was cleared into position and hold. We had aircraft B and aircraft C on final. Aircraft A taxied into position and held for awhile. He then started to

roll on runway 12R with aircraft B on short final for 16R. The Tower controller told aircraft A to hold his position and to abort his takeoff but A continued. Aircraft B was then told to go around. He passed over aircraft A at the intersection . . . It seemed that aircraft A was never aware that there were other aircraft in the area . . .

Aircraft in the same airspace under separate ATC jurisdictions or aircraft communicating on separate ATC frequencies are reported fairly frequently. A number of examples appeared in this sample:

At ––– I accepted a handoff west of Pacific intersection on aircraft B at 15,000 inbound to San Diego. Departure was working aircraft A handed off to Center climbing to 14,000. When I talked to B, I observed the altitude on A to be 14,900, 1 mile from B, opposite direction. I told B "Traffic 1 mile, head-on, northbound." He said "Yeah, he just went by us." The next sweep aircraft B was at 15,000, aircraft A was at 15,200. The tape at Center showed A requested higher. He was told of traffic 12 o'clock 5 miles at 15,000, expect higher when clear. Aircraft A pilot apparently continued his climb . . .

Controller cleared aircraft A for taxi but to hold short of active runway. Aircraft A crossed active runway after aircraft B had been cleared for takeoff. B advised Tower of A on the runway as he flew over A . . .

We were in the process of decombining the arrival and departure positions. The aircraft involved was an A inbound to Dayton Airport on the 24R localizer and a B inbound to Piqua on a converging course, northwestbound. A was cleared to descend from 4000 to 3000 by the arrival controller; pilot acknowledged by saying "All right." I, working departure position, was controlling B at 6000, requesting lower. I coordinated with arrival for the converging traffic and was told I could descend to 4000. I then cleared B down to 4000. A few minutes later A reported seeing the traffic in front of him. I did not realize A was even on my frequency and advised him that the traffic was at 4000 and to contact approach control on the proper frequency. He said he was also level at 4000 and changed to approach frequency. Both aircraft had already crossed courses.

The pilot of the A aircraft should have read back the clearance to 3000 and stated his call sign. The arrival controller should have made certain the pilot received the clearance by getting the proper acknowledgment.

It should be noted that the A arrival was still on departure frequency when positions decombined. When the arrival controller turned off the departure frequencies and just used arrival frequencies, he was unable to contact A on two attempts to verify his altitude. Therefore, I think when positions are combined all aircraft should be on one frequency, to the extent possible with regard to transmitter capabilities.

Similar aircraft or flight numbers and similar numerical data are a continuous problem in a system that relies heavily on voice communications for transfer of information. The following synopses and extracts illustrate the problem in this context.

One aircraft climbing and one aircraft in level flight passed each other with less than standard separation due to misunderstanding of one pilot who turned to 090° instead of 190° as instructed . . .

We were cleared for a Decatur 3 arrival to Lambert Field with a crossing restriction of 8000 ft 25 miles out. There was a flight in trail behind us. The Center controller started mixing up the numbers and in the confusion both aircraft answered the wrong calls. The numbers of the flights were similar. We were a little high and the controller asked us if we could make the crossing restriction. Aircraft B answered for us. I said we could probably make it . . . I asked for a turn to help us get down and got no answer. We then put out speed brakes and made the crossing restriction. In the garble of the communications we had picked up the approach frequency so we switched over on our own and reported level 8000 ft. This controller evidently expected us . . . This situation is caused by overworked controllers and similar flight numbers . . .

I was working the High Sector without a tracker. Aircraft A reported in at FL 310 with a rerouting request which I gave him, to maintain FL 310. Aircraft B (similar number) reported in climbing to FL 290, requesting 410. He was restricted to 290 because of A. The sector then began to get busy due to putting A's route change into the computer and another aircraft entering the sector which I had no information on. At about —Z aircraft B asked me what was the altitude of the aircraft that just passed him. I informed him that A was level at 310. When I looked closer I observed A was at 290. When I questioned A he said he had been cleared to FL 290. I called my supervisor . . . after listening to the tapes it appears that during a busy period aircraft A requested permission to deviate east of course. I understood aircraft B and read back "aircraft B, deviation approved, maintain 290." Aircraft A copied that clearance and descended . . .

In these reports, errors in perception on the part of pilots and controllers were the most common of the human factors. Errors in decision-making, based on faulty information (or on faulty perception of correct information) were nearly as common. The practice of omitting parts of clearances was cited in some reports, as in the following comment. (See also ASRS QR-2, p. 52, report 23.)

It appears that "haste makes waste" again. Radio communications, from all parties involved, are deteriorating, and thus the number of "wrong trip" identifications is on the rise. Specifically, the prefixes, company names, are regularly being omitted, and only trip numbers are used. The safety compromise is too great a price to pay (for the time saved) . . . Some crews are refusing to reply to improper calls, thus causing more radio traffic. Some controllers will not use the proper prefix until pressed in this manner. Both ground and flight crews need to work together to adhere to proper usage . . .

Several reports cited in some detail the factors that made it difficult to obtain clarification, among them frequency congestion and high traffic volume. In the majority of these reports, however, no attempt was made to question the clearance given, perhaps because what was heard was often in accord with the expectations of the flight crew.

> Airline aircraft A reported the field in sight and while being vectored to the pattern by Approach Control was advised to expect a visual approach to runway 10L and would follow airline aircraft B approaching from the southwest. While the controller was checking his progress strips aircraft A turned toward the airport. Controller noticed the excursion from the vector heading on radar scope and advised A to make a 360° turn to the left. The pilot of aircraft A thought he had been cleared for a visual approach rather than understanding he was to expect a visual approach . . .

The interface between flight and ground personnel in the national aviation system is just as complex as the interfaces between each of them and the machines they control. It is subject to degradation because of problems either in the air or on the ground. Distractions, high workload, or equipment malfunctions in either place can affect not only the local environment, but also the situation of the others involved in the interface.

It is worthy of note that several of the problems cited in these two studies arose because of procedural shortcuts or non-standard phraseology, either on the ground on in the air. It would appear that strict adherence to standard operating procedures would have avoided at least some of these occurrences, but it is also evident from other ASRS reports that frequency congestion in certain high-density areas is such that literal use of standard procedures and phraseology is impossible. Federal Air Regulations do not at present require that clearances be read back, only that they be acknowledged.

Summary

The ASRS database contains 143 reports involving misunderstanding of radio communications. Forty of these reports described potential conflicts between aircraft in flight. Faulty perception was a major human factor in these occurrences, with faulty decisions often resulting from the misperceptions. Certain system configurations were also commonly associated with this class of occurrences.