ATC Radar - When It's Not Watching You

Level Busts, unauthorised deviations from ATC cleared level, are facts of aviation life. As the numbers of flights have grown so have the number of level busts although the occurrence rate has remained reasonably steady. Concern over the increasing number of incidents is growing and the CAA's Safety Regulation Group is conducting an awareness campaign to highlight this issue.

Preliminary analysis indicates that some aircrew may harbour misconceptions about ATC capabilities which could contribute to a lessening of vigilance on the flight deck. Issues discussed here relate to the use of radar and are especially relevant to the holding situation.

On November 12th 1996, at around 1638, an MD81 en-route from Aarhus in Denmark entered the Lambourne (LAM) holding pattern prior to making an approach to land at London's Heathrow Airport. Two minutes later a Boeing 737-400 from Amsterdam, also bound for Heathrow, called on the same frequency and was also instructed to hold at LAM. The MD81 was instructed to descend to FL140 and subsequently reported at that level. The Boeing 737 was then instructed to descend to FL150, and this instruction was correctly read back by the crew. 1,000ft vertical separation is the minimum permitted in this airspace.

Nevertheless, by 1644 vertical separation had reduced to 100ft and the two aircraft had closed to around 750 metres horizontally. The Boeing 737 had descended at a rate of about 1,000ft per minute, and at its lowest, had descended to 14,052 ft (1013mb). The controllers concerned, having taken appropriate action to ensure that the aircraft were vertically separated, were no longer specifically required to constantly monitor the two aircraft and were devoting their attention to other flights. Their attention was drawn to the incident when an automatic system, the 'Short Term Conflict Alert' (STCA), activated to indicate that there was a possible imminent loss of separation requiring immediate attention.

No one is entirely sure why the correctly read back cleared level was not set on the Boeing's flight deck. However, when the Boeing 737 pilot read back the correct descent

clearance to the Air Traffic Controller, the other pilot was not in the communication loop. Instead, he had been briefing the passengers over the aircraft's passenger address system. Thus an essential safeguard, a second pilot to check that the vertical clearance was correctly understood and implemented, was missing from the system. One conclusion that can be drawn is that the timing of passenger announcements and other non-essential tasks which remove a crew member from the R/T communications loop can be critical to flight safety.

Following their investigation, the AAIB recommended that the airline concerned review its Standard Operating Procedures in the light of this incident. 'Human factors' such as this have been implicated in many aviation incidents. It is likely that, as technology becomes more reliable in itself, such factors will become more visible in the future, not so much because they are on the increase, but because incidents due to other factors will be fewer.

This incident, though, raises questions about the relationship between Air Traffic Control and the Flight Deck Crew, and what Flight Deck Crews might reasonably expect from the Air Traffic Controllers responsible for their aircraft's separation from others; after all, these flights were in controlled airspace and ATC should have been watching all the time, shouldn't they?

Actually, Air Traffic Controllers cannot monitor all flights at all times, and they do not attempt to do so. Rather, they mentally sort flights into groups - groups of aircraft which require frequent attention and groups which do not. In the case of the MD81 and Boeing 737 at LAM, these aircraft were in the 'do not require frequent attention' group. That is because, as far as the controllers were concerned, the immediate problem of separating these two aircraft had been sorted out 'procedurally' - by the aircraft being assigned vertically separated levels, and the pilots correctly reading back the appropriate instructions. For the controllers this communication and confirmation process is a matter of ingrained normal operation and has greater significance in the holding situation since controllers are trained not to rely on SSR information when aircraft are in close proximity laterally, as is the case when aircraft are stacked in a holding pattern.

This is not to say that controllers will never use SSR to check on holding aircraft, they will and do. Instead it is a recognition that the radar systems in use are unable to reliably present controllers with consistently accurate data when aircraft are close together horizontally. In fact, on occasions, the data blocks containing aircraft identity and altitude information can transfer from aircraft symbol to aircraft symbol on the radar screen, even when the aircraft concerned are correctly vertically separated (or indeed are many thousands of feet apart vertically). So, what looks to the controller to be one aircraft's data are actually those of another, or are completely corrupted. This corruption of information may even lead to spurious activation of the STCA facility. (STCA is not a TCAS for controllers in that it does not give 'advisories' to resolve a situation: the controller must take a few seconds to assimilate the situation, perhaps by querying the pilots' actions via R/T, before being in a position to act - by which time it may be too late to prevent an erosion of separation. It is worth noting that neither aircraft in this incident was equipped with TCAS.)

So where does this lead us? In holding patterns, perhaps more than anywhere else, the ATC separation system relies on the accurate communication of vertical clearances between all those involved in safely managing a flight. The process of safely changing the level flown by an aircraft is a complex one where the pilots flying the aircraft and the controllers managing the flight can be considered to be part of the same team exchanging information with opportunities for error every time information is passed on. Sometimes, as in the incident discussed earlier, that error is a human one which exposes a weakness in procedures designed to provide "fail-safes" on the flight deck, or between the flight deck and the ATC unit, or within an ATC unit alone. These mistakes can happen at any stage in a flight, but in a holding situation the safety net of ATC radar is much less effective, resulting in a less secure environment should a vertical clearance be misunderstood.