CONFLICT DETECTION ERROR - SEEN BUT NOT PERCEIVED!

By Markus Wassmer

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Constant situational awareness is crucial to air traffic controllers in order to handle traffic without any conflicts. An error occurring in the traffic situation can easily have a dangerous outcome. Radar is undoubtedly the key technical tool to providing a complete picture of the traffic situation. The primary task of the radar or executive controller is to continuously monitor traffic and thus maintain complete situational awareness using radar. It is no surprise then that the origin of infringements of separation minima can often be found here. This article provides an insight into conflict detection errors.

There are various reasons for overlooked or delayed conflict detection in air traffic control. Often controllers fail to detect potential conflicts during periods of low traffic volumes as they may be easily distracted in such a situation. Problems are known to occur when controllers have to handle a small workload - particularly after a traffic peak. But the other side of the coin is that stressful situations can, of course, trigger tunnel vision in controllers who then overlook traffic relevant to their sector. In the following example, an aircraft is cleared to descend through the altitude of an oncoming aircraft, even though the latter aircraft could be clearly identified on the radar screen. So, what went wrong?

In the ACC sector, two aircraft on the same routing were flying close together, but vertically separated, at altitudes FL240 (flight A) and FL220 (flight B). The standard procedure is to hand these flights over to the adjacent sector at FL150 and FL160. The overall traffic situation at that point was very demanding. The controller later described the traffic volume as high and complex. At the time of the conflict, nine aircraft were on the frequency, some of which were moving vertically in the sector. The sector capacity value in this hour was almost reached but not exceeded. A further control problem had to be solved in another area of the sector. The weather conditions were good and did not impair the flow of traffic. Generally speaking, high demands were placed on the controller's attention, but the workload was not too high.

A crossing aircraft (flight C) at FL170 was relevant to the descent of flights A and B. Furthermore, a departing aircraft from the nearby airport (flight D) climbing to FL210 also represented oncoming traffic for flights A and B. Flight D had originally been cleared to FL230 by the controller, i.e. the requested flight level for this flight according to the flight progress strip. However, the crew changed its request to FL210 while still climbing - a short time before the conflict occurred. Flight D reached and maintained this flight level at approximately 15 NM opposite flights A and B.

The controller was under pressure to have both flight A and flight B descend to the coordinated lower flight levels on time before handing them over to the next sector. This explains why flight B was instructed to descend from its current flight level FL220 to FL180. The controller took the crossing flight C at FL170 into consideration, but not the oncoming flight D at FL210, which at this stage was approximately 10 NM opposite.

The controller reported having a mental picture of the flight at FL230, i.e. the flight level that had been originally planned. This was probably because the pilot had originally been instructed to climb to FL230 and had confirmed this instruction. The controller had lost awareness of the change to FL210. It was no longer perceived by the controller, despite being clearly visible on the radar screen.

It is true that the daily work of controllers involves picturing a two-dimensional radar screen - with flight levels and speeds depicted as numbers on all radar labels - in three dimensions, but this nevertheless poses a special challenge for our spatial visualisation. Thus, this skill is an important criterion in the aptitude tests for air traffic controllers. However, controllers often overlook information on the radar screen, such as altitudes, speeds or even the complete label of a radar target.

Analysis of incidents like this is important to aid understanding of error, error trends, development of error avoidance techniques, and assessment of techniques, and assessment of these results. The Human Error in ATM (HERA) method* developed by EUROCONTROL is a standard method of categorising human error based on interviews with controllers. Use of the HERA taxonomy ensures that similar incidents are always categorised in the same way.

The case in question is in fact a typical example of many other cases. After interviewing controllers according to the HERA method, it is common to find that there was an error detail "perception and vigilance", an error mechanism "no detection of visual information" or an information processing "tunnelling of information". In our example, however, the changed flight level of flight D also played a part. According to HERA, this may be an error detail "working memory", an error mechanism "forget previous action" and an information processing "preoccupation".

Categorisation is important, but we cannot ignore the fact that human error is a normal characteristic that will surface time and time again. It would be foolish to believe that people could ever shake off this characteristic. So this is where the really difficult part of the investigation begins. According to Sydney Dekker, Professor of Human Factors and Flight Safety and Director of Research at the School of Aviation at Lund University in Sweden, this concession is the root of investigations into what went wrong: the starting point and not the end.

The Causal Factor Analyses Group (CAFA), a common working group of the EUROCONTROL Safety Improvement Sub-Group (SISG) and the HERA Users Group, addressed the issue of conflict detection error. Yet no common denominators were discovered during the investigation into the conditions surrounding comparable cases. It appears safe to say that conflict detection error cannot be correlated to the experience or age of the controller. Nor is it related to the length of time spent by the controller at the working position, the length of absence from duty or the type of shift.

In our experience, conflict detection error occurs more frequently in ACC and UAC sectors than in APP or TWR. But, of course, conflict detection in TWR and at radar working positions cannot be directly compared. Based on past experience, it can be said that this human error is more likely to occur in situations where the controller is under- or over-challenged. The number of such errors could be reduced if the controller handles 30%-70% of the maximum workload and works a restricted amount of time in front of the screen, depending on how stressful the traffic situation is. Preventing noise and other disturbances certainly also has a positive effect.

Enhancing our awareness of our own human weakness may also help us to identify potential for errors. Research in this field and the quest for solutions has only just begun. Although human factors findings are taken into account in technical systems, for example in terms of design and the human-machine interface, future air traffic control systems with their state-of-the-art functions should support us humans in detecting conflicts and preventing errors.

*For more information concerning the HERA method see the EUROCONTROL Human Factors web-site:
http://www.eurocontrol.int/humanfactors/public/standard_page/humanfactors.html