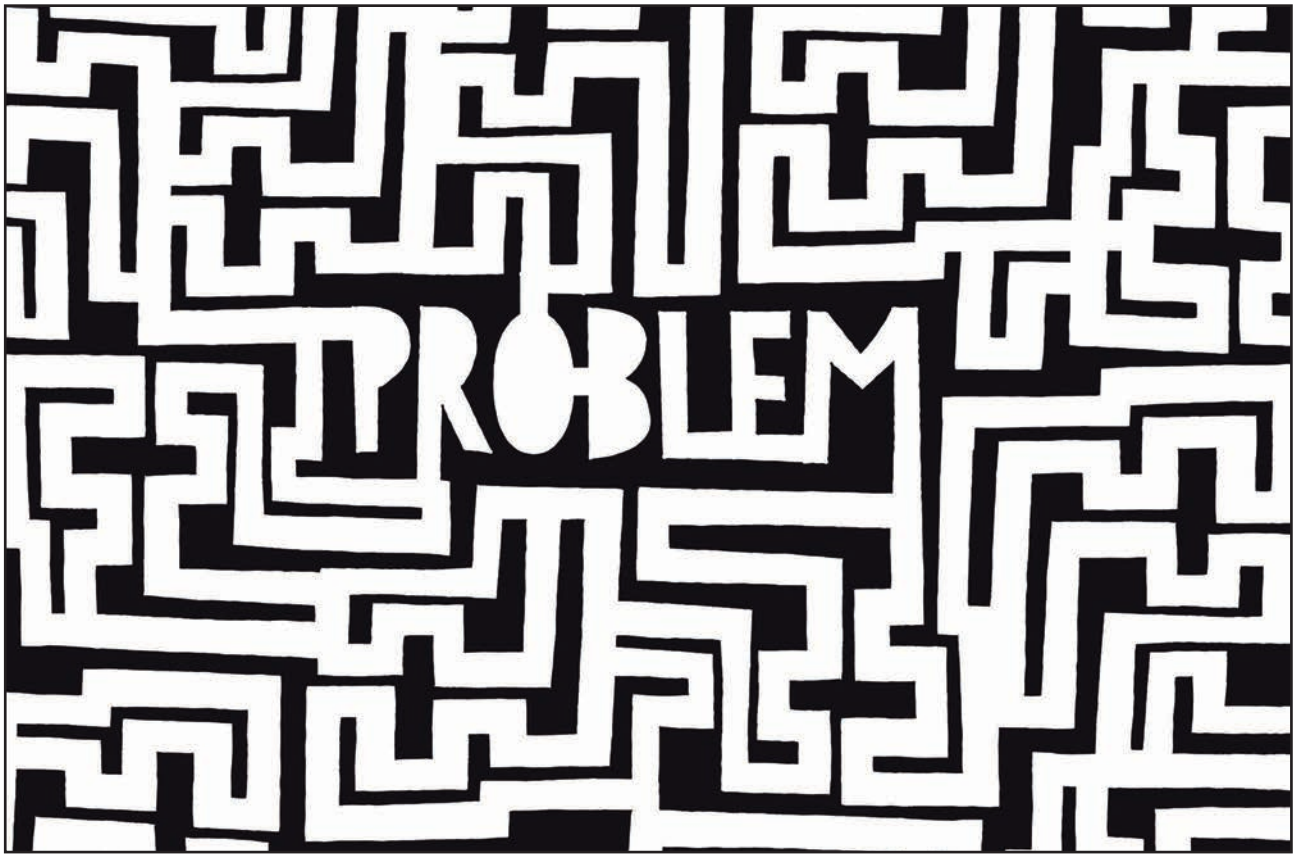
ALAN'S BAD DAY AT OFFICE

by Mike Edwards

Alan Norman Oldgit was not having a good day. It was about to get a lot worse. He was rostered to be on duty at 1400 for his fourth day in the work cycle. He had already completed two morning shifts, followed by his first afternoon shift. Yesterday he left work at 2200 and took one hour to drive the 15 miles to home. There was the usual accident where a major tourist road joined the motorway. Alan always kept well out of the way. He remembered having to attend lecture called "Defensive Controlling". He thought it was just stating the obvious, but funnily enough every time he got into his car to drive home, he said to himself "Defensive Driving Alan".



Suffice it to say that this morning he was tired and not in a good mood. His wife had told him, as she was getting into her car to go to the gym, that the backyard needed tidying and the wood store was nearly empty – both of which he already knew but it had rained every day for a week and the forecast was for more rain today. And yes, he got soaked. He drove to the ACC hoping for just a quiet afternoon.

There were extra security checks on the Gate, which were fair enough but were annoying and time consuming. In consequence he was a little late getting to the Ops Room where, after exchanging the obligatory pleasantries in his usual gloomy manner, he plugged into the EMMA Sector.

The out-going controller was Yung Gun, one of those fresh-faced twenty-somethings who know everything. He liked to be called "Top" by his colleagues; partly because of the name (Top Gun) and partly because it acknowledged his controller status. Nothing bothered Yung. He didn't realise that people gave him traffic in "interesting" positions just to see what he would do. Even in the last minute before the handover, the POLLI Sector

had asked him to take Chancer 181 direct to TRAPY, which was at least 40 nm south of the Flight Plan route. "Yep" said Yung in his usual laconic manner of co-ordination.

When Alan plugged in, Yung told him he was late (as if he didn't know) and then proceeded to give him a Handover something like. "As you see it, TAROT 66B at 15 under the 16, Chancer at 18, a Tyro trainer going around the houses at 8. 3 at 24 coming soon from POLLI and you can see the outbounds". Alan nodded as he tried to take it all in and Yung immediately unplugged and walked away. There is no recording of this conversation.

Alan settled himself in, adjusting the chair and radar display settings to his liking – he needed things to be a bit brighter these days. The three arrivals from the POLLI sector called one after the other, all at FL240 as per the Standing Agreement and quite tightly grouped. He would need to split them out a bit to facilitate their descent. Two more aircraft called in the climb to FL100. He checked that they were clean against the slow training aircraft at FL80 and told them to continue climb to FL140 and FL130 respectively (under the TAROT 66B at FL150). Alan was unsettled by the increase in workload so soon after taking over the sector.

Right, next job, he thought, I need to get the TAROT 66B up to FL230 to meet the Standing Agreement out to the POLLI sector. Alan quickly scanned the strips and the radar – nothing - "TAROT 66 Bravo climb FL230". Now to sort out the three at FL240. "TCAS RA TAROT 66 Bravo". Alan got as far as thinking "What the.." when he heard "TCAS RA Chancer 181". He looked at the screen in panic. He could not see Chancer 181 but the STCA was flashing over TAROT 66B and the TYRO 06 at FL80. He said the standard "Roger" and waited.

He searched the strips again. Chancer 181 should be up by NORDA, 40 miles away. He looked again at the radar, trying to make sense of a mass of "eights" and "zeros".

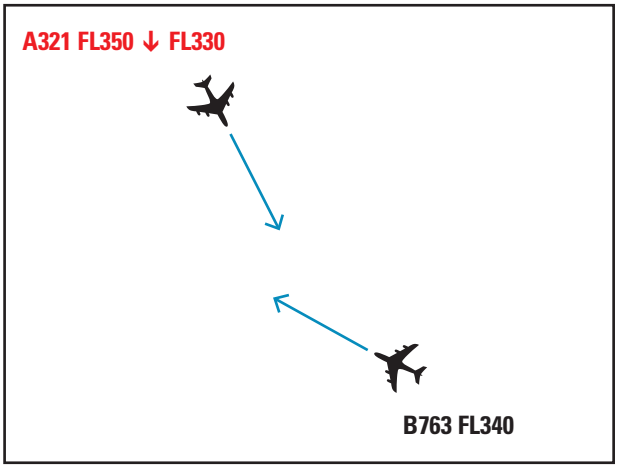
"Clear of Conflict TAROT 66 Bravo, confirm cleared FL230?" "Affirm 66 Bravo" replied Alan, who could feel people standing close behind him. Now he could see the Track Data Block for Chancer 181 at FL185 moving ahead of the slow traffic at FL80. "Okay Alan, I've got it" said a kindly voice behind him. "I didn't know that it was there, he didn't tell me that it was there" was all Alan could mutter as he walked away and towards the Supervisor's Desk.

This story about poor Alan illustrates one of the EUROCONTROL Operational Safety Studies that has recently been completed. This phenomenon is known as Controller Blind Spot. In essence it is when a controller clears an aircraft to climb or descend, often in order to resolve a future problem or requirement, and not taking into account a conflicting aircraft in its immediate vicinity.

So, how do these Blind Spot events come about?

Well, we identified four basic scenarios.

1. Loss of Separation involving a rushed vertical clearance immediately after a pilot request.
This scenario trigger occurs when a pilot makes a request for climb/descent. This grabs the attention of the controller whose focus was elsewhere. There is a perceived need to deal with the request as quickly as possible so that the limited attention resource can be returned to other tasks. The controller does not carry out any structured scan for potential conflicts and agrees to the request. The clearance leads to a conflict.



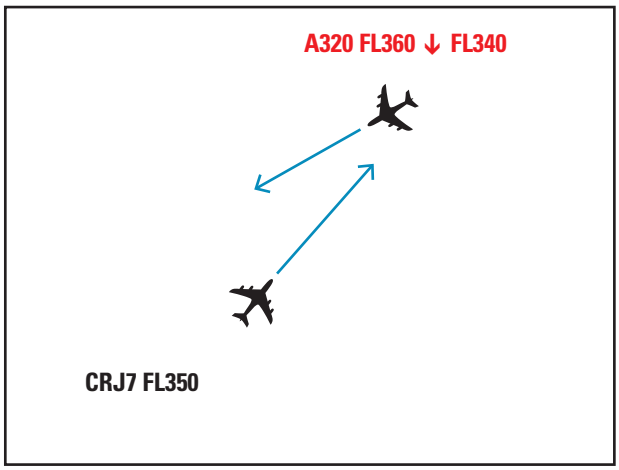
In this real event there is turbulence between FL350 and FL370 and the controllers had to deal with a lot of Flight Level change requests which increased their workload.

An A321 was southbound at FL350. Its pilot reports moderate turbulence and requests information about the turbulence on its route. One minute later the A321 requests descent to FL330. ATC clears the A321 for FL330. The B763 is westbound at FL340 crossing left to right, not yet on frequency.

A minute later a B763 makes its first contact with the sector. The A321 is descending through FL347 in its one o'clock position 10nm ahead. ATC gives the B763 it's routing but does not detect the conflict. Almost immediately STCA triggers. ATC turns the A321 30° to the right and the B763 20° to the right as avoiding action. The controller reported that he was concentrating on another area of the sector at the time and approved the descend request too quickly.

2. Loss of Separation involving an instruction to meet future constraints.
Airspace design for En-Route and TMA sectors has become complex. To accommodate the various constraints, such as the transfer of control, the task is increasingly governed by silent handovers either by standing agreements or individual electronic acceptance. The controller's attention turns to a requirement to climb/descent an aircraft to meet these constraints and does not take into account the potential conflict ahead.

In this real example, an A320 was routing westbound at FL360, on its own navigation in the centre of the airway, with a required exit level of FL280. A CRJ7 was eastbound at FL350 and had been following the centre of an airway



immediately to the south at FL350. The track label of CRJ7 was hooked by the controller. This highlighted the aircraft but equally obscured all other aircraft within the track label area. The controller then gave the CRJ7 a direct routeing which effectively turned it left towards the A320.

The A320 was cleared to descend to FL340 as a start to its required descent. This was against a third aircraft 10 miles behind the CRJ7 at FL330. The CRJ7 was 8 miles ahead in its 11 o'clock and closing. STCA activated and the controller moved both labels. He gave 10° turns to both aircraft, including the words "Avoiding Action" but neither aircraft replied. He then instructed the A320 to stop descent. Both aircraft then reported TCAS RAs.

The controller had issued a direct routing to CRJ7 but subsequently reported that it was "possible" that he forgot that he had done so.

The controller reported that he had formulated his plan for the A320 before he gave the CRJ7 its direct routing. He then did not adjusted his plan before giving the descent clearance.

3. Loss of Separation involving an aircraft that is not following the Flight Plan Route.

Flight Data Processing (FDP) systems are designed to highlight the planned routing of aircraft. This may be via paper or electronic strips, or by information overlaid onto the radar display.

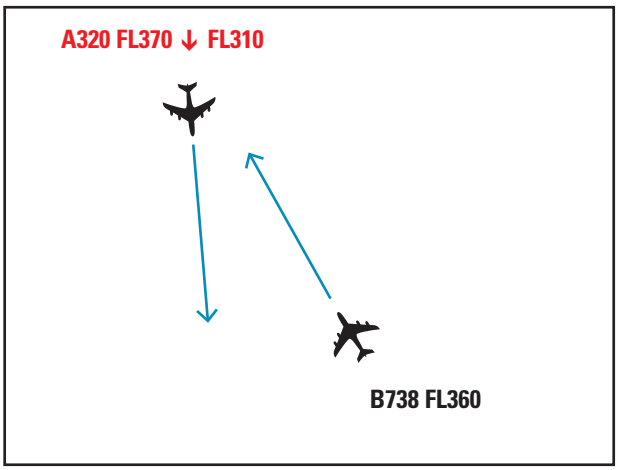
When flights do not tactically follow the pre-planned flight profile, the information gleaned from the FDP system may no longer highlight the potential conflict.

This scenario trigger involves instruction or clearance from the controller that result in horizontal deviation from Flight Planned Route. This includes the first clearance and any subsequent clearance before the aircraft re-joins the Flight Planned horizontal route, including the instruction to resume own navigation after vectoring.

In this real example an A320 was southbound, maintaining FL370 and would need descent soon to begin its approach. A B738 was northbound, maintaining FL360. It had been given a direct routing to a waypoint 25 west of its Flight Plan Route. The controller was aware of this routing but had not marked or moved any of the Flight Data to indicate the change. When contact was made with the sector the A320 was approximately 50nm in front of the B738.

The controller instructed the A320 to descend to FL310. The B738 was now 10nm directly ahead of the A320. STCA alerted the controller to the event. The B738 was instructed to turn right 60° and the A320 was instructed to climb back to FL370. Both aircraft reported visual with each other and both had TCAS TAs. The aircraft passed 2nm apart with the A320 at FL364 and the B738 at FL360.

The controller considers that she may have missed the more immediate conflict with the B738 for two reasons:



a) The B738 had made contact 6 minutes earlier and there had been no requirement to give it any instructions, such that its presence had been forgotten.

b) The strip display would normally have shown the two aircraft under the same designator. However, because the B738 was on a direct routing, the strips had become separated.

4. Loss of Separation involving conflict resolution against another aircraft further away.

A significant proportion of a controller's attention is "living in the future". Immediate issues are dealt with and filtered out as "complete".

The controller's attention can become focussed on resolving one issue and bases the next action on that resolution, while not identifying the resultant new conflict that was created by the action. This scenario trigger involves only conflict situations that were directly created by the actions to resolve another conflict. It does not involve situations where the distraction by solving a separate conflict contributed to the inappropriate attention for other conflicts. In this later case the trigger will be one of the other scenario triggers and distraction will be a contributing factor.

In this real example a B764 was eastbound at FL370. An A320 was southbound at FL360. The aircraft were under the control of a combined frequency configuration of 3 Sectors. The controller reported that he was aware from the times on his strips of a potential conflict between the subject B764 and a separate B737 which were both at FL370 on crossing tracks. As the cross was still more than 50 miles off, he decided no action was necessary at the time but cocked

the strips for the two aircraft out as a reminder to descend the B764 in good time.

When the A320 called on his frequency, the controller reported that he identified the B764 as a confliction and therefore climbed the A320 only to FL360. He considered that he had resolved the potential confliction and moved on to other tasks.

The controller was then unable to establish two-way communications with an aircraft elsewhere in the sector despite repeated attempts. He stated that as he was doing this, he became more and more distracted and considered that the extra attention he gave to this issue increased his overall workload.

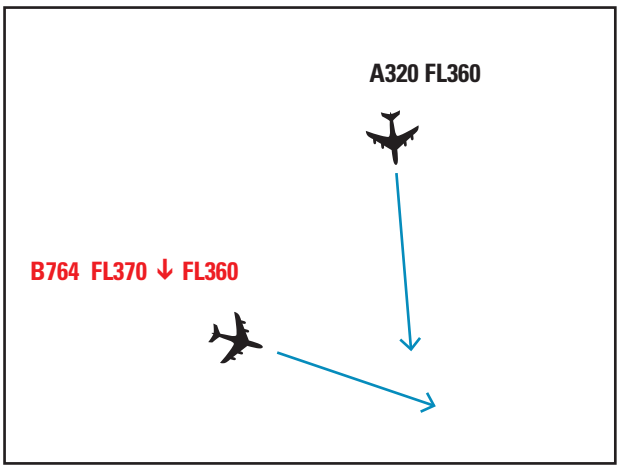
The Supervisor decided to split the sector and, in preparation for this, the controller began to transfer aircraft to the correct frequencies within the sector group. When the controller reached the B737 in his handover, he informed the incoming controller that he had cocked out the strips on B764 and the B737 as a potential conflict existed and that he would descend the B764 now to FL360 to resolve this. He stated that his decision to descend the B764 prior to transferring the aircraft to the incoming controller was influenced by the number of strips that were being put in front of his colleague and he was keen to help. He instructed the B764 to descend FL360 without referring to his own situation display or the paper flight progress strips, as he was still turned towards his new colleague. He stated that neither the A320 nor the B764 were visible on his colleague's situation display and he had forgotten about the presence of the A320. Although he wrote the descent clearance on the B764 paper flight progress strip, it was not adjacent to that of the A320. The Planning controllers did not detect the conflict as they were busy with their own sector split at the time.

The controller instructed the B764 to descend to FL360. The A320 was in its eleven o'clock position, 10 nm away, crossing left to right. STCA activated unheeded for almost a minute before the controller reported that his attention was drawn back to his own situation display by the call from the A320 "er Centre, (callsign)", which he described as being in a "questioning tone". He saw the STCA at that point and realised his mistake. He instructed the A320 to descend immediately FL350. The A320 however reported that he was responding to a TCAS RA. The B764 confirmed that it too had responded to an RA.

The following learning points were identified with the help of the controllers involved:

The controller considered that the sector split prompted him to descend the B764 much earlier than he would have done otherwise. He tried to be helpful in response to the upcoming traffic load on the adjacent sector by sorting out the potential conflict for the incoming controller. In so doing, although working to a plan he had already constructed to resolve the conflict, he would appear to have made a hasty decision which he also executed in haste.

The controller was distracted by his inability to communicate with an aircraft prior to the handover. This, coupled with the distracting effect of the sector split, reduced the controller's focus on the entire sector.



So, what are the most common Causal Factors?

The three most common factors present in the 20 real events analysed are:

a) Flight Data Display not updated to reflect change of routing away from FPL routing.
In our story Chancer 181 has been given a direct route to a new Waypoint which took it 40nm south of its FPL route, but the flight progress strip display did not show this and thus the potential conflict was not evident on the controller's data display. This was a contributing factor in more than half of the actual events studied.

b) Sector Hand Over/Take Over and immediate post Take Over period.
In our story, the Handover had no structure and was hurried. Whilst the Chancer at FL180 was mentioned, it was not passed on that it was "off-route" and to be alert to the fact. This was a contributing factor in a significant minority of the actual events studied.

c) Track labels obscured
In our story the Track Data Block of Chancer 181 at FL180 was overlying the Track data Block of TYRO 06 at FL080. It is easy to see how the display of 181. 180, 06 and 080 could have challenged the detection and interpretation of the information.

Track labels being obscured, either by function or by manual selection, was a contributing factor in a significant minority of actual events studied. This involves labels overlaps but also situations when the label was in other, unconcerned colour that makes it less visible. These include situations when the aircraft was in the volume of controlled airspace but was not under control. Some ANSPs has successfully adopted a new functionality that displays part of the track label (the Aircraft Identity) still in concerned colour in case the aircraft is not anymore under control but is still in the physical volume of controlled airspace, extended with some additional airspace buffers.

**I know... We were in your blind spot...
What's not shown on TCAS doesn't exist...?**

So, what are the best ways to prevent these events happening?

The study analysis found that there is no single tool or method that can efficiently and universally prevent all the scenarios involving 'blind spot'. A combination of 4 tools/methods seems to deliver the best reliable protection to prevent losses of separation because of blind spot events. Any combination of 2 or more of these tools/methods would be advantageous.

These tools/methods are:

a) Predictive Separation Alert Tool with ATC intentions inputs like Cleared Flight Level (CFL). This has the potential to prevent all losses of separation caused by Blind Spot. This barrier is less efficient in proactively identifying potential conflicts due to unplanned horizontal manoeuvres towards a proximate aircraft. The barrier may be affected by the consistency of inputting the Cleared Flight Level (CFL) information in the system.

b) Short Term Conflict Probe: This has the potential to prevent most losses of separation caused by Blind Spot but scenarios of clearance not following the horizontal flight planned route as the existing probes are what-if tools for vertical manoeuvres. The advantage of the probe is that it is purely preventive barrier to be used before any instruction or clearance is given. The hypothetical nature and additional time requirement can be considered by some controllers as a drawback and affect their willingness to use it.

c) Structured Scan: This has the potential to prevent most losses of separation caused by Blind Spot. There is a caveat that the information may be suppressed or diffuse. Track labels may be obscured and flight data displays may not be arranged in such a way to highlight a confliction. Time pressure and workload may erode the attention that the controller is able to give to each piece of information and working knowledge may then become layered and the filtered. When a controller becomes under pressure, a "return to basics" such as using a structured scan before making an executive decision would reduce the likelihood of controller error.

d) Predictive Separation Alert Tool with flight crew intentions inputs: This has the potential to prevent all losses of separation caused by Blind Spot blinds spot. The barrier efficiency will depend on the proximity of the conflicting aircraft and will be triggered later compared with the STCA with CFL inputs. On the other hand this barrier will not depend on the controller consistency in inputting the CFL into the system. The cases of flight crew manually manoeuvring the aircraft before entering the clearance change will be less frequent.

Finally, whilst there is no empirical evidence to confirm this, it was suggested by some ANSPs that the use of velocity leader lines from the track labels by the Controller may reduce Blind Spot occurrences.

If we assume a layered situational awareness of the controller, one layer will be fixed in "now" time and one layer – in a "future time" horizon of some minutes ahead (depending on the size and complexity of the sector). What would be left, is some "gap" in the controller's focus of attention that can be expressed in time. This "gap" in time could be viewed as the "blind spot" around the aircraft. The use of a velocity leader lines set for one, two or three minutes could help bridging this gap.

What happened to Alan and Yung Gun?

Well Alan learnt never to let any anybody unplug until he had really got the picture, not matter how pushy they were; and Yung was never called 'Top' again.

MIKE **EDWARDS**

was until recently Head of Safety Investigation at NATS (the UK Air Navigation Service Provider). He held this role for 7 years and prior to that he was Head of Investigation at London ACC. He had been an ATCO at Edinburgh and Heathrow before becoming the manager of all student controllers and then a Supervisor at London Terminal Control. He holds a PPL with Group B rating.