THE CHANGING CONTEXT OF SITUATIONAL AWARENESS

by Captain Ed Pooley

My time in aviation has included a great deal of direct self interest in the subject of Situational Awareness because – like all pilots – I was "there at the time". The number of passengers and fellow crew members accompanying me made no difference whatsoever to my interest in the subject because this situational awareness was always a personal as well as a professional priority – and for once there was complete harmony between these two spheres of life. So what I am about to offer on the context of this matter is couched essentially in those terms.

That doesn't necessarily mean controllers of air traffic and controllers of UAVs should stop reading now but you should be prepared to evaluate my remarks against your own degree of such harmony. And one caveat - what follows considers the issues from a singular perspective. As airline pilots, we are fortunate to operate most aircraft whilst working in teams of at least two equivalently-trained individuals, although I don't believe that invalidates a transfer of most of my observations to other front-line working environments.

My first observation is that the context in which situational awareness is achieved is continuously evolving. At least theoretically, the direction of evolution is for the better. We have increasing aids to enhance our situational awareness - in my case the traffic displays provided by TCAS II and the terrain mapping provided by an EGPWS database used with the accuracy of a GNSS position are the two outstanding examples which come to mind. Viewed from the perspective of situational awareness, however, these two cases are rather different. Before TCAS II arrived, unless I could see other traffic, I had only the mental map limited to aircraft working the same radio frequency which was both comparatively vague and often incomplete. Before EGPWS and GNSS position accuracy, I made sure (a) I was absolutely clear what the disposition of terrain along a route was both pre flight and in flight and (b) because knowledge of one's position unless in VMC was to varying degrees less accurate, I allowed for significant margins between me and trouble! Afterwards, the preparation and monitoring became less rigorous and the acceptable margins less generous. In both these cases, the possibility of complacency was not, for me at least, a risk since it would not be allowed to diminish the overwhelming priority of maintaining active self awareness of position relative to terrain and traffic. And in both cases, to keep me in one piece, it was often necessary to continuously maintain a far greater level of alertness because reliance on what was then a much lower level of automatic provision of information, alerts and warnings was not an option.

So my next observation is that as we continue to rapidly and inevitably accelerate into the age of automation, we should not forget that the primary driver for this is often efficiency rather than safety itself and that the latter has only been dramatically enhanced through making the aircraft 'pilot-proof' as far as possible through automation which is almost all-encompassing and extremely reliable. However, despite the fact that this scheme seems to work most of the time for most people, some of the accidents and serious incidents out there have been primarily founded on an obvious absence of situational awareness.

Let me acquaint you with a few out of many examples which show cases where the situational awareness barrier against the risk of (or actual occurrence of) loss of control, mid air collision and CFIT respectively failed to function:

- On 27 February 2012, the crew of an Airbus A330 en route at night and crossing the East African coast northbound at FL360 encountered sudden violent turbulence as they flew into a convective cell they had not seen on their weather radar[1]. They briefly lost control of their aircraft in both pitch and roll as it climbed 2000 feet, but flight envelope protection was activated and they eventually regained control and continued the flight. The Investigation concluded that they had not seen the rapidly developing cell because they had not been using their weather radar properly.

1- see more at: http://www.skybrary.aero/index.php/A332,_en-route,_near_Dar_es_Salaam_Tanzania,_2012

IN CASE OF EMERGENCY

BREAK THE GLASS

- On 2 September 2013, a Boeing 737 crew delayed their go around at Delhi despite it becoming obvious that they were not going to get a landing clearance because an A320 was taking off from the same runway. Despite VMC prevailing and both aircraft being on the same frequency, the 737 was then flown straight ahead on go around so that it began to catch up with the unsighted A320 also climbing, but at a faster, rate below. The 737 crew then received a TCAS RA to DESCEND which they were very slow to respond to. As the A320 crew responded to their coordinated TCAS CLIMB RA, the 737 RA strengthened to INCREASE DESCENT. At the very last minute, the 737 crew spotted the A320 about to climb through their level and made a rapid 30° bank as they passed within 90 metres of each other at 1600 feet agl[2]. You might well ask what the role of ATC was in all this but that makes no difference to the fact that situational awareness would have enabled the 737 crew to foresee and fully mitigate the risk of collision in a situation where the aircraft were only just sufficiently clear of the terrain for TCAS II to generate RAs.

- On 15 March 2012, a Norwegian Air Force Hercules was on a positioning transport flight over northern Sweden when it descended into uncontrolled airspace below MSA and entered IMC. Shortly after levelling at FL070, it flew into the side of a 6608 foot high mountain which destroyed the aircraft and killed everybody on board[3]. The Investigation attributed the accident primarily to the crew and noted that they had selected an EGPWS mode of operation which had no terrain database at the latitude they were flying.

All three of the aircraft in the examples quoted above were relatively new designs which in many ways enhance overall crew awareness, but do so passively. So my final observation is that I am not sure whether we have fully understood the challenge which the 'age of information' we now live in has created for the maintenance of proactive situational awareness as well as informed reactive situational awareness. Or whether we are getting so good at detecting problems automatically that we will soon be able to outsource 'proactive' situational awareness to computers. A good example is the increasing prevalence of the Visual Situation Display (VSD). Pilots no longer have to actively deduce whether they are descending towards their destination, the VSD shows them the situation and saves them the trouble. But what does this do for the maintenance of an active mind during a typical flight in which relative boredom often increasingly characterises most of it apart from the take off and the non-automatic landing? And does it matter? Unless the 'machine' can also deal with the problem detected, I suggest that it probably does matter. A reduction in 'before-the-event' situational awareness due to reliance on passive acquisition of information rather than active is likely to increase the time it takes to revert to an active reality on the rare occasions when something abnormal or otherwise unexpected does occur. There is a good chance that we are watching the decline of active situational awareness and if we then rely solely on 'reactive' situational awareness then we have arguably removed a significant barrier to an unwanted outcome. And that is before the case where, on a particular day, the automated aeroplane is not quite 100% – the MEL has allowed despatch without that VSD which you are now so accustomed to relying on for situational awareness – that you need to revert to the application of mental agility. But will this be easy, or even possible, unless more training time is allocated to both the 'old-fashioned' and now 'back up' ways of actively maintaining routine situational awareness as well as the new ways?

So we need to ask how best do we persuade the pilots of today and those who are concerned with their professional competence that proactive self-generated rather than simply received routine situational awareness is still important - and train them accordingly.

We also need to persuade system designers that one of their primary objectives in an automated flight deck is not only to deliver an environment which is 'pilot-proof' but one which, to the extent possible, also effectively supports proactive as well as reactive situational awareness.

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2- see more at: http://www.skybrary.aero/index.php/A320/B738,_vicinity_Delhi_India,_2013
3- see more at: http://www.skybrary.aero/index.php/C30J,_en-route,_northern_Sweden_2012