# SITUATIONAL AWARENESS **CHANGES OVER A PILOT CAREER FROM DC9 TO A340**

**by Captain Johan Glantz**

When preparing to write this article and Googling for a good definition of Situational Awareness, I came across not only the general definition found on SKYbrary - '*it is the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future*'-, I also found a definition used by the US Coast Guard - *'Situational Awareness is the ability to identify, process, and comprehend the critical elements of information about what is happening to the team with regards to the mission. More simply, it's* ***knowing what is going on around you.***

The final sentence, **knowing what's going on around you,** made me realise that over my now 27 year career as a commercial pilot the demands and focus of everyday normal operations situational awareness have changed. This everyday situational awareness can be defined as that which is needed not only for specific events or situations, where there are numerous articles available, but rather the everyday operational situational awareness needed in normal flight operations, that has changed depending on the equipment that's installed in the aircraft.

The drivers for this change over my career have been developments in aircraft design and new technologies resulting from a desire to increase safety and to accommodate an increase in air traffic volume and environmental demands among other thing.

The first nine years of flying was spent in the DC9. A generation 2 aircraft using a definition where present day aircraft such as B777 and A340 comes into the category generation 4 and B737 and MD80 generation 3. During my career I have managed to fly all the generations apart from generation 1 (DC3 etc.) which still is on my bucket list.

Already when training on the DC9 there were discussions on Situational Awareness, but the meaning was quite different from later on when flying A340 and A330. In a DC9 knowing "what's going on around you" often meant 'Where are we?'

The DC9 was a fantastic aircraft to fly and after some time you became more or less at one with the aircraft. Strapping yourself into the seat and almost making it an extension of yourself on a good day. There was no auto throttle, no Navigational Display (ND) that graphically tells you where you are. We were at that time trained in Mental Flight path during company training. A subject that gave us some useful techniques for building a mental "map" based on DME, VOR and ADF electro mechanical instruments, mentally calculating descent and climb restrictions and how to stay on track across the North Sea without a VOR in range either behind or in front during a cross wind.

What the aircraft was doing was more obvious to the DC9 pilot as there were very little automation and, compared to today, a simpler and in a sense more straightforward design. For example, the DC9 warning panel was immense compared to later generations as there was one specific individual lighted small panel for each possible warning or caution, When applicable one light for the Right and one for the Left system. However just like today's generation 3 and 4 aircraft, the DC9 wouldn't do anything that the pilot didn't tell it to do. The big difference is that there were limited ways to interact with the aircraft, stick & rudder, manual throttle and an auto pilot that only could be coupled to an ILS down to minima apart from the two basic modes IAS hold and V/S.

With today's high density and efficient use of airspace and airports, as well as environmental demands on navigational performance and overall noise restrictions, a generation 2 aircraft would most likely not be a viable aircraft anymore. At least not in most regions of Europe.

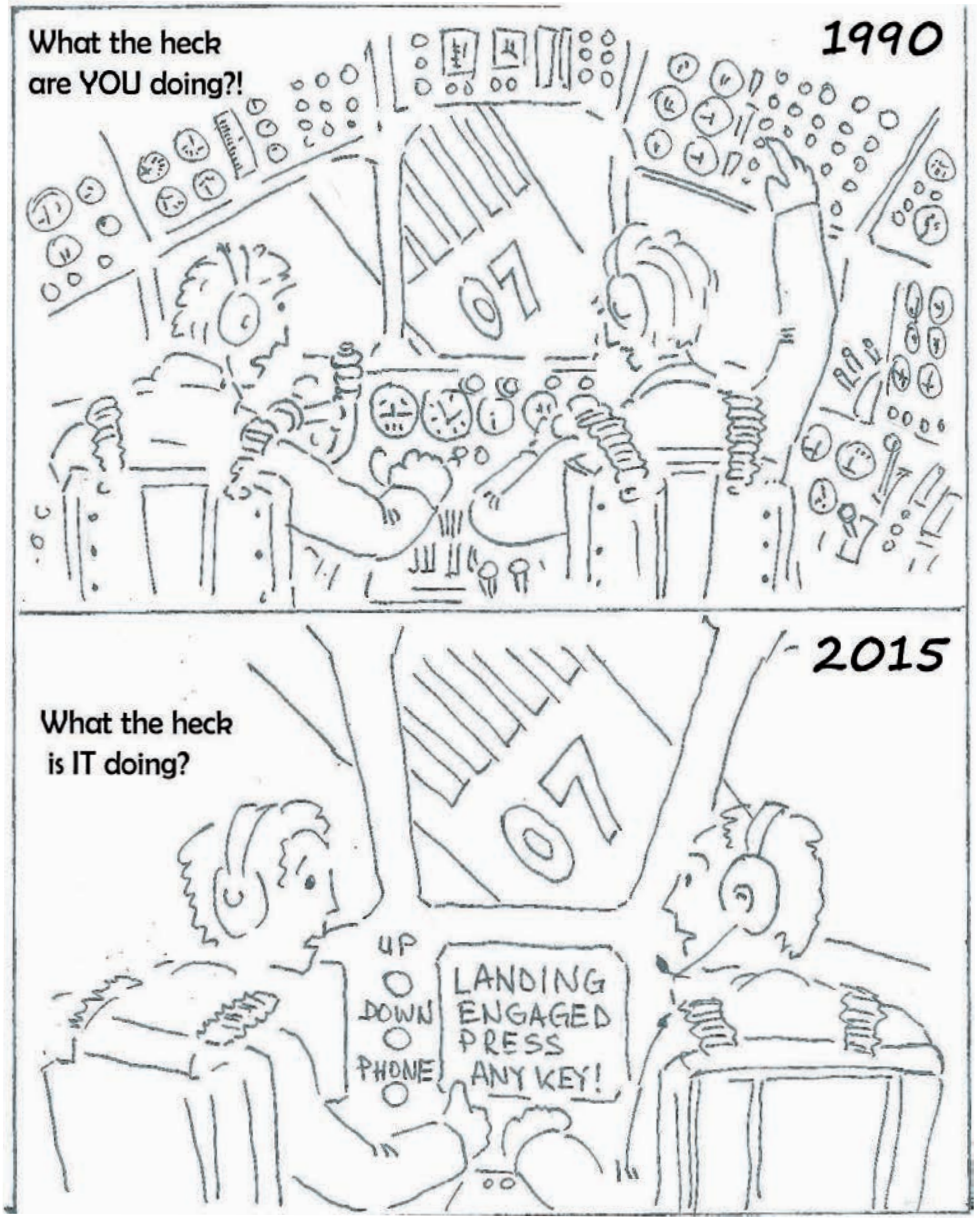
This and other commercial factors meant that when the DC9 was to be phased out I had the opportunity to be among the first to train on the new B737 NG. A very different bird with a glass cockpit. A Primary Flight Display (PFD) instead of the classic T arrangement of electro mechanical instruments. A Navigational Display (ND) with a map showing waypoints, track, terrain and weather. Automatic navigation based on GPS and IRS input as well as radio navigation with an accuracy that was well beyond the capability of the DC9 Fluxgate compass.

With this new technology also came new challenges on crew situational awareness. What is our position became less of an issue and the old DC9 joke 'what's the most common phrase in a MD80 cockpit? - what's it doing now?!', which we sometimes told about our colleagues flying the more automated MD80/90, became a reality for us too.

The issue of having knowledge of the maximum engine Exhaust Gas Temperature (EGT) can serve as an example of how new technology can affect a person's ability to create situational awareness. During training, some of our older Captains who started as FOs on the Caravelle, were frustrated by the lack of information they felt was important. Not by the technology itself but rather by the way they needed to adapt to what information was available to build their situational awareness in operating the B737NG. One such issue was the max EGT for engine start and normal operations.

They had flown their whole career and done numerous technical courses on various aircraft types and one of the more important numbers to be memorised had always been the max EGT for engine start and normal operations (usually two different temperatures, one for starting and one when the engine runs). At the time of our training, these values were not found in any of our manuals covering the B737NG. The reason for this was that there was really no need to know the numbers as the new technology with digitally created EGT displays allowed the EGT instrument to be adapted. During an engine start, the EGT instrument displays a red line indicating where the max temp is, without any number. When the engine is started and runs at idle the line will move to max operating temperature. Should an exceedance of temperature occur, the instrument will start to flash red thereby visually indicating the exceedance. A good way to increase the situational awareness of the crew during engine start. But some of my colleagues were, as mentioned, extremely uncomfortable with this. Based on their background, they felt a strong personal need to know the numbers, in order to have situational awareness during the engine start. These temperatures were eventually included in the manuals.

Perhaps the main reason for needing




looking at how different aircraft generations have made different demands on normal operations situational awareness, it can be said that the nature of situational awareness is ever changing and there is no simple solution that covers everything. What is needed depends initially on the type of equipment that is available and then specific situational awareness based on a particular situation or event.

There are a number of articles in this edition of HindSight on different scenarios with appropriate solutions to increase situational awareness for given events or situations. However, the success of those improvements, in this context is, apart from the operator/pilot previous experience and the technological level, also dependant on how well the improvement interacts with the available technology as well as procedures and warning systems already in place.

to adopt a new personal technique to gain normal situational awareness was the Flight Management System (FMS). On the FMS the flight path, both vertically and horizontally can be controlled by programming. The FMS controls the aircraft as instructed from the setting optimum take off thrust, calculating climb and descent restrictions, flying approach down to an auto land and so on. As with all computers that are programmable it does what has been programmed. Compared to the non-FMS DC9, flying an FMS-equipped aircraft therefore became, in my view, more a matter of managing the flight than directly interacting with the flight controls. Consequently, everyday normal situational awareness during a flight became, in very general terms 'is the aircraft performing as expected? If not, why not ?'

After a few years on the B737NG there was an opportunity to move to the then new (to SAS) A340/330 fleet. The latest and then most modern generation of aircraft with fly–by-wire and an electronic checklist demanding another variation on normal operations situational awareness. In my view, the difference in the context of normal operational situational awareness between generation 3 and 4 is less than that between generation 2 and 3. If anything, flying a generation 4 aircraft in normal operations is even more a matter of managing the aircraft systems than for generation 3, requiring another everyday situational awareness.

Coming back to the US Coastguard's simplified definition **knowing what is going on around** you and

CAPTAIN JOHAN **GLANTZ**

FRAeS, is presently one of the two elected Executive Board Members Technical Affairs at the European Cockpit Association (ECA) with primary responsibility for ECA involvement in Air Traffic Management, Aerodrome, Single European Sky and Helicopter issues. He is also an active Training and Check Captain flying for Scandinavian Airlines (SAS). He has a degree in Human Factors / CRM from University West, Sweden and is presently perusing a MSc in Air Safety Management with City University, London.