DOES MORE INFORMATION EQUAL BETTER SITUATIONAL AWARENESS?

by Captain Wolfgang Starke

Compared with the flight decks of older generation aircraft, the flight deck of today's modern aircraft offer a tremendous amount of information to pilots. Basic information like attitude, speed or altitude is complemented by trend vectors, flight directors, all kinds of situation displays and much more. On top of all this information we find numerous advisory messages, cautions and warnings that are designed to direct the operator's attention. Is all the information needed? Does more information lead to an increase in situational awareness?

Imagine a small child visiting the pilots in a flight deck of a modern airliner. Maybe the pilots turn on the light test switch that illuminates all the different lights and displays in the flight deck, giving it a very special atmosphere. One of the top 10 questions all these little children are likely to ask is "how do you remember all these lights and switches?".

Some typical answers to this question might be "oh, we have all the switches two times so you just need to know half of them" or "you need to work hard, get good marks in school and then you are able to learn all this". There is a little bit of truth in both these answers. Of course the two screens in front of the First Officer have the same content as the two screens in front of the Captain and we also go through a lengthy and intensive type-rating course to learn all the systems, switches and indications. At the end of this course we know them all.

Still, the questions of our young visitors and our answers to them in this case invite more serious consideration. The real question is not how can you remember all these switches and indications, but how can you observe all these indications, how can you build up your situational awareness with so many indications at the same time? Do we have the mental capacity to acquire all the information, process it and build up complete situational awareness?

To answer this bigger question, we need to figure out the capacity of human information acquisition and processing. In typical documentation about human performance and limitations it is mentioned that our short-term memory can "store" seven pieces of information for a couple of seconds. As the flight path of an aircraft is rather dynamic, this could mean that sometimes, we need to continuously refresh our awareness of the seven most important indications every couple of seconds if we are to maintain our situational awareness.

A very theoretic and certainly not particularly insightful way of looking at this complex question!

On the other hand there is some truth in it. You need to look over and over again at the most important information to maintain awareness of the flight path. If you look too much at other indications, your awareness of the flight path will be lost. The same is true when driving a car. Setting up the navigation system whilst making a phone call could - and probably will - reduce your attention on driving your car and observing the traffic.

Of course, the more relevant experience you have the more things you can do in parallel. I remember my first session in a Boeing 737-400 full flight simulator. Once my colleague set the thrust for take-off, I nearly lost my situational awareness completely. It was just too much of information for me as brand new Second Officer. Of course, since then my acquisition and processing of information has improved significantly! Still, it does have its limits - perfectly normal as all of us have our limits.

If we now look in a bit more detail at the question of how much information we need, I believe the amount of information should be selectable. We all have different limits so it will be hard to find a "one size fits it all" solution.

In Summer 2014, I flew a route training sector into Berlin Tegel whilst supervising a new Second Officer. As weather was good and traffic density was not too much we decided to fly a non-precision approach into runway 26R. The Second Officer did well flying the procedure and about two miles from runway threshold he decided to continue visually to touchdown and disengaged the autopilot. Now the problems started. While I was happy with all the information I had, he was starting to get increasingly overloaded. In what we call the "getting back to Mama" response, he reverted to the approaches he had first flown and concentrated on the flight director. When flying an ILS-approach, following the flight director will bring you to 50ft above the threshold on centre-line. But if you fly a non-precision approach using may be "vertical speed" and "heading select", you will certainly not arrive at this position.

After calling out the flight path deviations two or three times, I needed to make a decision. My first try was to disengage his flight director. Without his flight director, my colleague was able to process other information. He looked out of the window, saw the runway, corrected his flight path and a successful landing followed.

What I try to show with this example is that additional information sometimes takes our attention away from where it should be. Also the point at which additional information will distracting us from our main task differs from one human being to another. For any individual, that limit also depends on many more factors like time of the day, length of duty, experience, mental and physical state, problems at home and so much more. This basically means that the amount of information presented

WOLFGANG **STARKE**

is a Bombardier Dash8-Q400 check captain and type-rating instructor with the Air Berlin group. He chairs the Air Traffic Management and Aerodromes Working Group of European Cockpit Association (ECA) and serves on committees for the Vereinigung Cockpit (German Air Line Pilots' Association) and for IFALPA (International Federation of Air Line Pilots' Associations). He is an IFALPA representative member of ICAO's Surveillance Panel.

As long as we are flying IFR I will trust my instruments absolutely ...

to the pilot must be adjustable to their prevailing capacity. When considering information like airspeed or attitude that cannot (and should not be able to be!) deselected, this decision about what information is a "must" needs to be taken very carefully.

A good example of a non-switchable indication is the flight path vector on the Embraer E-Jets. Unlike most of the aircraft types I know that are normally flown by reference to pitch and heading, this type is flown by direct reference to a flight path target. In normal operation this is a very good concept as pilots do not need to calculate pitch or heading to adjust their flight path. Using the flight path vector pilots can directly fly by reference to the target they are aiming - their flight path.

However, remembering my type-rating course on the Embraer 190, a complete malfunction of the air data unit will cause you more of a problem than on other aircraft. Pilots become used to flying by reference to the flight path vector rather than thinking about pitch and thrust. So if the air data unit is unserviceable, the flight path vector is no longer useable and the required flight path must be achieved by reference to pitch and thrust. But even knowing this, you will tend to look at the information source you usually use, the now invalid flight path vector. Now you need to "deselect" this information in your brain cognitively. Certainly it is possible to do this but being able to simply deselect this now erroneous information would be a lot easier in a relatively stressful situation.

So, coming back to the title of this article "does more information equal better situational awareness". I think the answer is a clear "no" but certain information still can increase situational awareness.

Two things need to be done. First, the majority of information in a flight deck needs to be selectable at the discretion of the pilot. Depending on his mental capacity and the usefulness of an indication they can then select the information they need for safe operation and deselect any distracting information. The second and even more important requirement is that the information presented to the pilot must be safety-assessed taking into account the 'big picture'. Additional information does not automatically mean better situational awareness and additional information can sometimes be a distraction which diverts attention from where it should be. Major safety issues can result.

The full picture therefore needs to be safety assessed and any piece of information should be evaluated. That evaluation needs to ask whether that information is a permanent "must", can be switchable for the operator or whether the balance between distraction and added value is such that the information should not be presented at all.

Flying, especially in poor weather after a long duty is highly dynamic, can even be challenging, so a flight deck that seems very well designed when seen in relaxed circumstances on the ground can be very impracticable and unsupportive under certain in flight circumstances. The more demanding a situation is, the more focused on the most important information the displays have to be.

More information and more directive indications do not always favour situational awareness. Sometimes less is better.