SITUATIONAL AWARENESS **VERSUS TIME IN POSITION**

by Michaela Schwarz and Fuat Rusitovic

It has been widely accepted that Situation Awareness (SA) is important for effective decision-making and performance in Air Traffic Control (Endsley, 2006). HindSight asked Michaela Schwarz and Fuat Rusitovic to explain how SA is managed and ensured at Austro Control, Vienna.

What does Situation Awareness mean to you?

Fuat: Imagine sitting in front of a screen and suddenly one of your fellow controllers calls out "The Austrian is requesting 360!" What? Which of the 20 airborne Austrian Airlines flights is he/she referring to? Was this message for me? Those are questions that would normally rise, if my situational awareness is compromised as an ATCO. However in the majority of the cases it is not and I instantly know that this message was for me and which aircraft was concerned. How come?

Michaela: In the basic ATCO training we teach that Situation Awareness consists of three elements (Endsley, 1988):

1. the perception of the elements in the environment (aircraft targets) within a volume of time and space,
2. the comprehension of their meaning; and
3. the projection of their status in the near future.

But how does it work in practice?

Fuat: When I start working in position, I receive a handover from the previous controller. He/she will give me a short briefing about the current traffic picture, things to do in the next few minutes, ongoing conflicts, unusual circumstances, adverse weather situations and so on. Basically I receive a part of his/her mental picture in order to build my own mental picture as quickly as possible and I don't have to start from scratch finding my way into the traffic situation When I am about to be released from position, I share my mental picture with the new controller coming in, so she can get started more easily.

Michaela: From a scientific perspective (Dominguez et al., 1994, p.7) an ATCO *'continuously extracts information from the environment (i.e. the radar screen/ aircraft label etc.), integrates that information to create a mental picture of the current situation and uses that picture in directing further perception and anticipating future events.'* (compare Figure 1)

So how long does it take to get the whole mental picture?

Fuat: To be honest, I don't know. It could be 2 minutes; it could be 7, 10 or as long as 15 minutes depending on the quality of the handover, the sector complexity and the time it takes to adjust my personal settings. There are so many bits and pieces in this puzzle that nobody could tell. And that puzzle changes all the time. Traffic load, traffic complexity, adverse weather, who is my sector partner, who works on the adjacent sectors, what other conversations are going on in the room (SUP instructions, private talks etc.).

So when I come back from my break I already take a look around to see

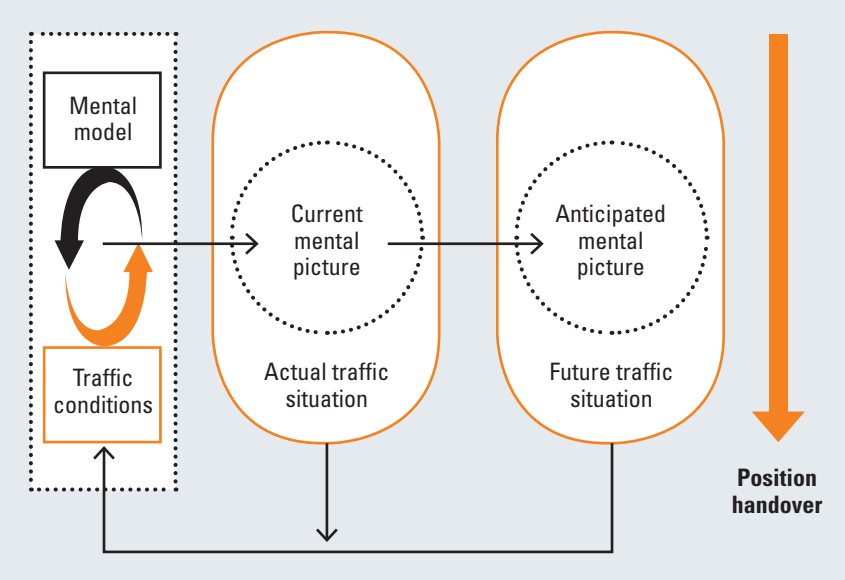

Figure 1 - Individual Situation Awareness Loop (Adapted from Kallus et al., 1998, p.9)

who is working on the other sectors. I receive another handover and setup my screen/ adjust my personal settings. I check the traffic in my sector and in the adjacent sectors. Are there departures from nearby airports? Will they get their requested flight level? Any inbounds to local or nearby airports that I will have to handle in the next 10 minutes?

"Maintaining Situational Awareness is the fun part of ATC!"

Once you have the picture how do you keep it?

Fuat: The process of maintaining situation awareness is one of the parts that make my job so tough and exhausting. But it's also the fun part of it as it is challenging and rewarding. There is no better thing than feeling that you are absolutely aware of the situation and being able to predict actions that will happen in the next couple of minutes. We (ATCOs) consider it absolutely normal, that most of the times when an adjacent sector calls you, you already know what the other sector is going to say. Or you hear that an aircraft in the previous sector is requesting a direct routing and you coordinate that routing just before the previous sector calls. But it's a hard way to get there and requires a lot of training.

"Keeping the situation awareness is like working on an assembly line"

Keeping the situational awareness as an ATCO is like working on an assembly line with information on it that moves at a very high speed. You have to take a quick look at every single piece of information and decide quickly if you need to further process that information or not.

Michaela: This process includes integrating information from various sources (compare Figure 2):

- aircraft label (e.g. speed, level, heading) on the main screen
- radar screen
- support screen (weather, CARD, flight plan/ lists)
- pilots
- CPDLC/ datalink?
- Verbal communication/ coordination within/between sectors
- Supervisor/sector chief
- Charts/ manuals? Any other?

Fuat: Furthermore you even have to decide early if you might need that information in the future. If you mistakenly discard relevant information or use the wrong/ outdated information, your situational awareness is compromised. Sometimes you may not recognize straight away that you missed out on a piece of information which is part of the big picture, such as turbulence reports from traffic at FL360 in the adjacent sector, because there is no traffic at that level in your area of responsibility. You only recognize that you missed it at the moment an aircraft is requesting the very same level. If you detect your mistake early, it might be insignificant, if you end up detecting the mistake late or not at all, your work can get difficult. You never know.

How do you train for Situation Awareness?

Fuat: Trainee controllers tend to focus on their own sector in the beginning, while neglecting what is going on around them in other sectors. With time they are trained to listen to what's going on in their immediate environment and observe actions of other controllers to complete their own traffic picture. "What if scenarios" help trainees to switch their attention between their own sector and other sectors. Moreover they learn to think ahead and project their own actions and actions of pilots and other controllers in the near future to anticipate certain actions.

So what is the hardest part for you?

Fuat: The hardest part is building that mental picture. Building up situational awareness takes time. No handover procedure in this world is capable of ensuring a complete transfer of the mental picture from one controller to

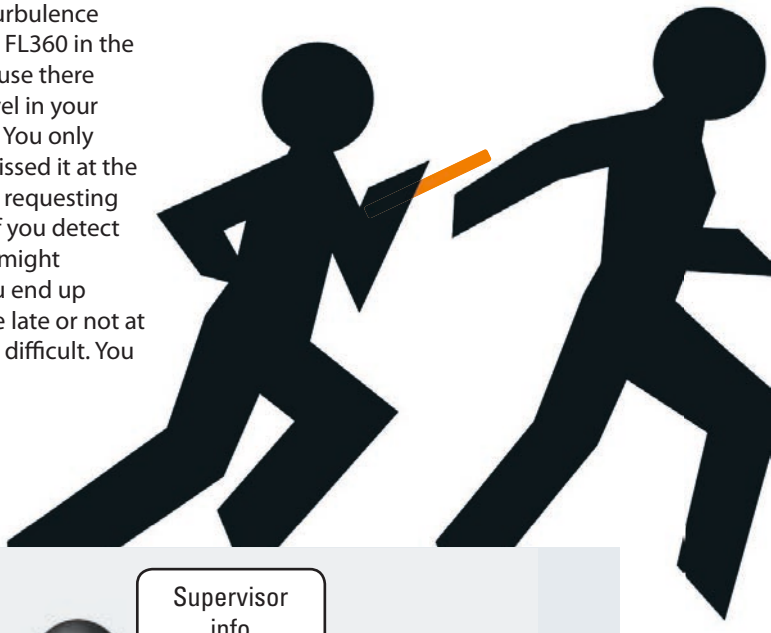

Figure 2 - Integration of information sources

another. You can highlight certain things, but you can't transfer the big picture with all of its details. That's probably the reason why statistically a majority of occurrences happens within 5-10 minutes after a position handover.

Michaela: From a HF perspective the hardest part is preventing human errors related to situation awareness on the assembly line. We follow a proactive approach and address Situation Awareness already at the design stage of new or changed operational equipment and procedures. The tricky part however is the interactive nature of SA subcomponents. When implementing new controller support tools or procedures that were initially designed to enhance SA, they may on a second look reduce SA on another unexpected and unmeasured factor (Wickens, 1995).

So what's the ultimate solution?

Michaela: The impact of changes to equipment, tools and procedures on SA can be measured through subjective and objective means. A complete review can be found in Endsley (1996). And in practice Fuat?

Fuat: Maintaining situational awareness is fun, but there is a good reason why the time in position is limited as an ATCO. Over time your brain gets mentally fatigued and information processing slows down. Even at off-peak times you have to keep the assembly line - let's call it quality management for information - working at a very high level. What are the adjacent sectors talking about, how will their traffic situation affect yours? Is an aircraft reporting adverse weather conditions in an adjacent sector? Just to make sure that the next call out of "Austrian is requesting 360!" does not come in unexpected.

MICHAELA **SCHWARZ**

works as a Safety Management and Human Factors Expert at Austro Control in Vienna. She is a registered Aviation Psychologist with more than ten years of practical experience in the aviation industry including assignments at EUROCONTROL and Qantas Airways.

FUAT **RUSITOVIC**

works as an ATCO and on-job-training instructor at the ACC Vienna. He is involved in the planning and development of pre-on-job simulator training and the coordination of the Team Resource Management program at Austro Control.

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