

# Situation awareness

Techniques to make sure you don't lose sight of the big picture.

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*The two military jets are flying low level to Mt Isa. After more than an hour over the featureless countryside, getting low on fuel, and thinking they ought to be there by now, the wingman radios, "Where are we, Ron?"*

*There's no answer, so he tries again, a petulant edge to his voice, "Where are we, Ron?"*

*A well-modulated, airline-pilot-type, voice comes up, "Go on Ron, tell him."*

*"I don't (expletive) know," says Ron.*

\* \* \* \*

**S**ITUATION AWARENESS IS KNOWING where you are and what's going on. It's "the big picture", and one of the very foundations of pilot competence.

Breakdown of situation awareness is the root cause of so many aircraft incidents that eliminating it would dramatically reduce the accident rate.

Sometimes the outcome of loss of situation awareness can be tragic, such as in the case of ZK-NEY, a de Havilland DHC-8 aircraft, which on June 9, 1995 crashed at Palmerston North, New Zealand while conducting an instrument approach.

As the aircraft approached 12 DME the captain called "gear down". The landing gear

didn't lock. The Captain instructed the first officer to look in the quick reference handbook to locate the "landing gear malfunction, alternate gear extension" checklist.

As the first officer went through the checklist, the captain questioned an item, and became distracted from his primary task of flying the aircraft safely. The Ground Proximity Warning System (GPWS) audio alarm sounded. The aircraft collided with terrain 4.6 seconds later, killing 1 crew member and 3 passengers.

This accident highlights the need for pilots to always monitor the position of their aircraft in relation to the ground and other traffic, regardless of any system problem.

It also suggests that distractions are the main cause of loss of situation awareness. Because problems in the air are not always neatly labelled, and may have begun well before the aircraft took-off, it is easy for pilots to get distracted with minor problems at the cost of maintaining situation awareness.

**Losing it:** Ambiguous problems often cause pilots the most difficulty, mainly because there is no clear-cut course of action. Serious in-flight emergencies, such as an engine failure, tend to be managed more effectively because established procedures take the place of the time and effort needed to solve the problem.

## FLYING OPERATIONS

There are a number of factors that may increase your risk of losing situation awareness. The most obvious is stress, which can result in a pilot being less attentive or making a decision without considering all the information available.

Under stress, a narrowing of attention, or tunnel vision, may make your method of gathering information (scanning) scattered and poorly organised. Too much work (overload) or too little (underload) is also bad for situation awareness.

If there is a great deal of information that needs to be prioritised quickly, your situation awareness will ultimately suffer. Under periods of low workload, such as in long-haul flying, vigilance problems may affect your motivation to actively find out what is going on around you.

Every pilot, from the most experienced to the beginner, can improve their capacity for situation awareness at no cost. But first, you need to know what it is.

When you look at something, you note what it is, its location relative to you, and its importance in the scheme of things.

You do the same thing just after levelling the wings to fly the downwind leg. You check the runway position for distance out and alignment. Noting your heading, airspeed, altitude, undercarriage position, flap setting and fuel state adds to the picture. Conclusions are drawn from the evidence presented; you are situationally aware.

Situation awareness is gained by searching for and collecting information. You might think that you are already maintaining situation awareness every time you fly. But are you doing it as well as it can be done?

Let's look at an example. You know how things get interesting when the demand for information intensifies.

You may have looked for too long at the runway and not paid attention to height and heading control. Now they need correction. And while you're doing that, you've drifted in too close to the runway. Crips! That's far too close in. Turn away. That radio call. What did he say? Aarrgh, the height! Get it back. And then there's that other bloke on downwind, where is he? Oh no! Now we're right on top of the base turn point. Check speed for more flap, while turning and entering descent. Power setting. Trim. Heading. Descent rate. Where's the plane landing on the parallel runway? Strong wind up the tail, got to turn finals already; too high on glideslope. Speed control. More flap. Undercarriage? It was selected down, wasn't it...?

**Scan pattern:** Situation awareness can be seen as maintaining control over a range of information sources. You do that by looking at each source through a "scan" pattern that

you control. Time is the critical variable.

You need time to get a reading from an instrument, time to look at places of interest, time to build the picture. Just like fuel, time is a resource.

Sensible rationing of your time resource can represent the difference between "losing the plot" and staying with it.

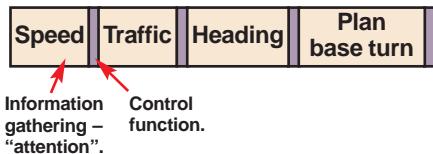
**Precious time:** When you want information, you look at each source for a finite length of time.



But some "readings" take longer than others.



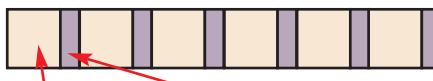
Controlling where you look – the situation management or "control" function – also takes finite allocations of time.



So you can begin to see how you can make your situation awareness scan more efficient. Minimise the amount of time you spend looking at each information source to just that amount needed to get the reading (heading), or complete the task (radio call), no more.

You know from experience that you may need to look at an instrument, say, for longer than you might wish to get a confident reading. A series of glances can be used to "accumulate" readings from multiple sources when you need to keep track of many issues.

#### Rapid switching (readings from many places)

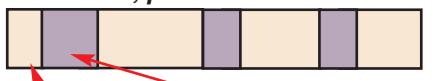


Attention time, i.e. information gathering time, "rationed" through a series of glances.

The time needed to control/manage the situational awareness scan.

You will also have had experience with inefficient use of time in information gathering.

#### Confused; poor effective attention.



Too little time used to take up information.

Too much time used on the control function.

Most pilots will have experienced total breakdown of the situation awareness scan.

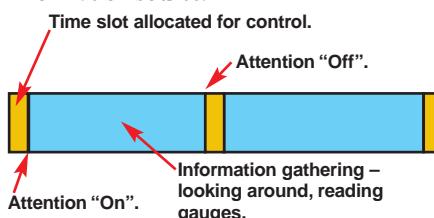
#### Control function disabled.

##### All attention, no time control

As this condition can lead to serious problems, how it comes about, and how to prevent it, are critical areas of interest.

As you have already seen, the attention you pay to each single information source has a finite time-length. That is the basis of your situation awareness scan. It is managed by the time allocation function. There are two "switches":

- An "on switch", causing you to look at an information source.
- An "off switch", to stop you looking at that information source.



Knowing you need to know something – altitude, say – you'll look at the instrument until your craving for what it can tell you is satisfied. The "lock-on" problem occurs when you find the information unwelcome, but you keep gazing at it until the correction has taken effect.

The first trick in your scan pattern is not so much when you start to look at each information source – your "need to know" will take care of that. The trick is about when to stop looking.

For the optimum situation awareness scan, you need to control not only when you look, but when you cease to look at each of your information sources.

**Active management:** Another way of saying the same thing is that you must learn to "actively manage" your situation awareness scan.

In fact, you probably do that a lot, already. Every time you run through a checklist, you are positively controlling where you direct your attention, when you look at something, and when you move on.

What checklists get you to do is to manage time as a resource. The better you have learned your checks, the less time you use in "running" them.

As with any budget, there's never enough cash on hand – or, in the case of your situation awareness scan – not always time available to keep you fully informed in tight situations. However, you can maximise your situation awareness if you minimise unwise withdrawals from the bank. For example:

- Detailed pre-flight planning for every flight minimises the time needed for spur-of-the

## A CHECK LIST

### How do you know if you've lost it?

THE FOLLOWING ARE COMMON EVENTS identified in accidents that have involved a loss of situation awareness. If you answer yes to more than 4 items on the checklist, you could be losing situation awareness.

#### Ambiguous information

Do you have information from two or more sources that do not agree?

#### Confusion

Are you uncertain or uneasy about a situation?

#### Primary duties

Are all crew focused on non-flying duties?

#### See and avoid

Is there too much heads-down time with nobody looking outside for conflicting traffic?

#### Compliance

Is there non-compliance with aircraft performance limitations, minima etc?

#### Standard Operating Procedures (SOPs)

Are established SOPs not being followed by everyone?

#### Fixation

Are you focused on any one task to the exclusion of others?

#### Communication

Have you heard or made any vague or incomplete statements?

#### Contradictions

Have you failed to resolve any discrepancies or contradictory information?

#### Navigation

Have you failed to meet an expected checkpoint on the flight plan?

moment, "What'll I do next?" decision-making.

• Knowing the current duty runway and weather conditions before you go to the plane will mean that you rapidly absorb what the ATIS is telling you.

• Routinely check the ATIS so you are not trying to gather all-new information while busy organising your GAAP entry.

• Always have the next VHF frequency dialled up ready to select – don't wait till you need it.

• Use "line of least resistance" to access information. For example, if you can get the ATIS on the ADF, you will save yourself a radio frequency change.

OK, that's all pretty basic, and may not even apply in the area you operate. However, you can see the principle at work – be a "scrooge" with time, so there's always some there when you need it.

Most pilots don't actively manage their



## Automation takes pilots out of the loop

Recent developments in flight management systems and other technologies on the flight deck have increased the complexity of the pilot's task.

The more complex the task, the greater the mental workload needed to maintain situation awareness. Automated tasks on the flight deck can also impact on situation awareness because flight crew are "out of the loop". As a result, pilots may be slower to detect problems.

Additional effort is also required for re-orientation to resume manual control.

information collecting. They do it passively, only paying attention to something when they have a need for what it has to tell them.

# 9 ways to improve your situation awareness

1. Plan ahead and predetermine crew roles for phases of flight that have high levels of workload. Assign responsibilities for handling problems or unexpected distractions.
2. Be aware of all the services available to you, then use them. For airline pilots this may require getting input from all crew members, including cabin crew. For single pilots, be proactive in sourcing input from ATC, maintenance, dispatch, etc.
3. Avoid fixating on a problem. Direct your attention systematically to the aircraft, the flight path and finally to the people around

Try an active scan management routine and you'll see the benefits.

This is not just for high task and information demand scenarios. You can and should maintain the maximum situation awareness possible at all times – even on long, boring, straight-leg transits. For example, running a "howgozit" check on fuel every 10, rather than 30 minutes, gives you heightened situation awareness. So, too, does keeping a constant awareness of the nearest forced landing field, and so on.

**Exercises:** There are other exercises you can use, while in transit. For example, by looking at a valley to one side of track, you can make an appraisal of your ability to execute a 180 degree turn if, say, you were caught under cloud.

And if there is cloud along track, you can practise assessing whether you will clear it – that is, the cloud top appears to get "lower" as you get closer – or whether, by not taking avoidance action you would penetrate it – that is, the cloud top appears to rise higher above the nose as you get closer.

Long-haul pilots "force" themselves to maintain situation awareness by relentlessly scanning through things to do, checking all systems are tuned ahead, and checking that all relevant knowledge is collected and thought through.

This keeps them alert over hours of unchallenging routine flying. Every pilot can do the same. For example, even before engine start, check the wind and where the tail is pointing so as not to send a blast of prop

you. Repeat this attention pattern over and over again.

4. Monitor and critically evaluate your current performance (flight path, fuel estimation) based upon your pre-flight plan.
5. Anticipate by considering the "what ifs". That is, project ahead and design contingencies to avoid being taken by surprise.
6. While it is important to focus on the details, don't forget to scan the big picture.
7. Tasks that take time or are subject to interruptions from ATC or other crew are less likely to be done right. Therefore, create visual and/or aural reminders of interrupted

wash where it is unwanted.

Again, it all comes down to pre-flight planning. Plan every aspect of the flight, including your information management, it is also about active control over the techniques you will use to acquire and process information – your situation awareness scan.

Managing situation awareness is about avoiding being caught off guard or being unprepared. It involves making the effort to stay ahead of a situation.

Vince Mancusom, coordinator of line oriented flight training (LOFT) at Delta Airlines, suggests that having good situation awareness is like sitting on the jumpseat of your own flight. In other words, it is important to regularly take a giant step back to review your situation.

By mentally stepping back from your situation, you can become more aware of where your attention is, and where it is not. Achieving and maintaining a high level situation of awareness does not come naturally. But being aware of the traps, and using a checklist tailored to your own flying, can help you learn to see and think about where you are and what's going on around you.

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tasks. For example, some pilots use the technique of selecting the audio for the outer marker when they have been instructed to contact the tower at the outer marker early in their approach.

This aural reminder means that they don't have to remember to look during a busy phase of flight.

8. Use the checklist on page 16 to watch for clues of degraded situation awareness.
9. If you observe any obvious signs in words or actions that indicate situation awareness is breaking down, speak up.