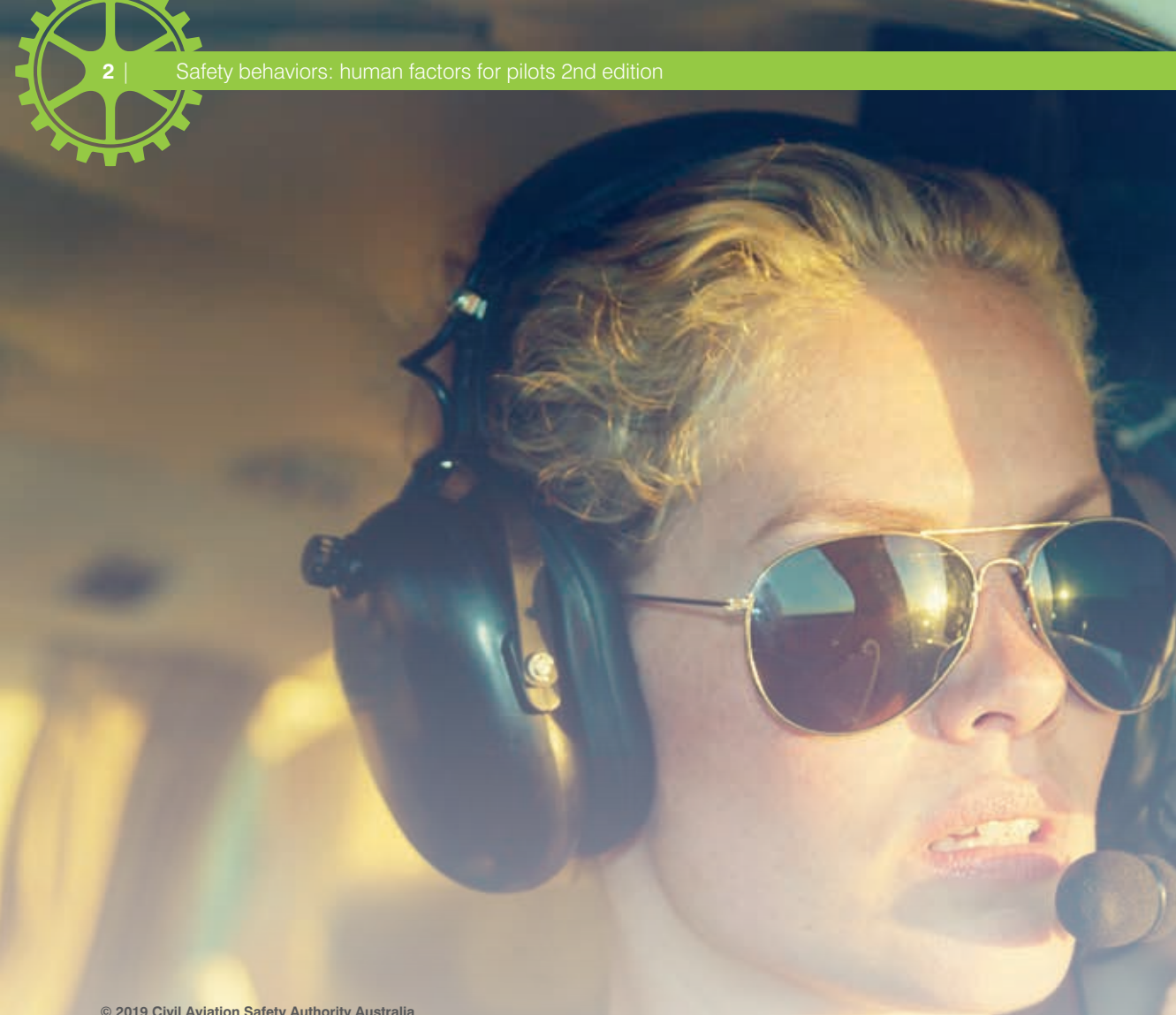
Australian Government
Civil Aviation Safety Authority

Safety behaviours: human factors for pilots 2nd edition

Resource booklet 6 Situational awareness



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How many aircraft accident investigation reports have you read where one of the contributing factors has been identified as the crew lost situational awareness, or the pilot did not maintain situational awareness? In other words, the pilot or crew did not maintain the big picture and think ahead. Loss of situational awareness (SA) continues to be identified frequently in Australian Transport Safety Bureau (ATSB) reports.

Situational awareness is one of the most critical cognitive skills a pilot needs. It sounds like a simple concept, but many things can lead to your situational awareness being compromised. They include ineffective communication, fatigue and stress, high workload and challenging environmental conditions.

Contents

The difference between being a victim and a survivor is often a low level of situational awareness.

American novelist Barry Eisler

Introduction

Hidden in plain sight

Many professional operators pride themselves on being highly observant. This is particularly true of operators in safety-critical industries, such as pilots, long-haul truck drivers, doctors and nurses. However, no matter what job we hold, what qualifications we have, or how experienced we are, as human beings, fallible and sometimes miss the most obvious things.[1]

Consider these real-life examples from the healthcare domain.[2]

- A nurse pulls a vial of heparin from an automated dispensing cabinet. She reads the label, prepares the medication, and administers it intravenously to an infant. The infant receives heparin in a concentration of 10,000 units/mL instead of 10 units/mL and dies.
- A nurse reaches into the refrigerator for a piggyback antibiotic for her patient. She reads the label, spikes the bag with intravenous (IV) tubing, and administers the medication to her patient. The patient receives a neuromuscular blocking agent instead of the intended antibiotic and dies.
- A nurse picks out a prefilled syringe of pain medication for her patient. She reads the label and administers the medication intravenously. The patient receives hydromorphone instead of morphine and experiences a respiratory arrest.

These errors and many more have happened under similar circumstances. Consider this example from an aviation study:

An experienced pilot attempts to land an aircraft on a busy runway. He pays close attention to his display console, carefully watching the airspeed indicator on his windshield to make sure he does not stall … yet he never sees that another aircraft is blocking his runway.

We would all like to think that a professional, attentive pilot would notice the second aircraft. However, the results of a well-known study showed that some experienced pilots in a flight simulator faced with this specific scenario proceeded with their landing even though a clearly visible aircraft was blocking the runway. These pilots said they were totally unaware of the aircraft on the runway until it was too late to avoid a collision.[3]

In both the medical and aviation examples, the people performing the task failed to see what should have been plainly visible and could not explain later why this had happened. Such people have often been labelled careless and negligent, but not seeing what appears to be obvious is common—it can and does happen to the best of us. The reason is usually 'inattentional blindness', a phenomenon we all experience from time to time because our attention is engaged on another task, event or object. It is aptly described as 'looking but not seeing'.[1,2]

Inattentional blindness

Have you ever slowed down at a 'Give Way' sign, looked right and left, thought you were clear and accelerated—only to slam on the brakes as you heard the blaring of a car horn or squealing of brakes from another vehicle? Most of the time in this type of scenario, we're lucky. We get a bit of a scare, apologise profusely to the other driver, swear to pay more attention and drive away thanking our lucky stars that it was a near miss, while anxiously wondering how on earth we didn't see the approaching car.[4,5]

Sometimes the outcome of such scenarios is not as fortunate. Research shows we rarely see what we are looking at unless our attention is directed to it. This phenomenon can have serious life-and-death consequences, as described in the following case study of a collision between a heavy vehicle truck and a passenger train north of Kerang in Victoria.

Collision—truck and passenger train Kerang, Victoria

On 5 June 2007, at about 13:40 AEST, a northbound truck collided with a V/Line locomotive-hauled passenger train. Eleven people, including several children, were killed and many more were injured. The truck driver sustained serious injuries. Calculations revealed the estimated relative (closing) velocity was 150 kph, with the collision resulting in extensive damage to the truck and passenger cars, some of which were sheared open. The investigation concluded that the incident resulted from the driver of the truck not stopping at a level crossing at which active warning devices were operating.[6]

Figure 1 The truck which collided with the V/Line train at Kerang, Victoria

image: AAP Image | Craig Borrow

Figure 2 Extrication of victims from the sheared carriage

image: AAP Image | Julian Smith

As with any accident investigation, there are often multiple contributing factors identified. However, let's focus on the question of why the truck driver did not stop at the crossing—even though at the time the level crossing flashing lights and warning bells were operating.

Given that the truck driver refused to submit to an interview as part of the investigation, the analysis examined three broad scenarios:

- the driver observed the warning devices and decided to continue over the crossing intending either to pass in front of, or behind, the train
- the driver perceived the warning devices, but took too long to interpret and react appropriately
- the driver did not become aware of the activated level crossing warning devices and the approaching train until it was too late to avoid the train.

The investigation report concluded that 'the first scenario would require a significant error of judgment for an experienced truck driver. The second scenario could involve the driver not fully perceiving the potential danger indicated by the passive advance warning signage, then not reacting appropriately to the flashing lights. If the third scenario were true, then the driver was not concentrating appropriately on the driving task.'[6]

In an attempt to understand the truck driver's actions, investigators interviewed a small sample of truck drivers in the Kerang area experienced in long-haul operations. These drivers reported that in their experience on the open road, a driver's focus narrows and they believed that they were not necessarily fully aware of the entire environment around them. They also mentioned that it was rare to hear a train warning horn in country driving.

Their description of their focus narrowing and not being fully aware of the entire environment around them may help us understand why the truck driver failed to see what should have been plainly visible.

Role in investigations

Accident investigators and safety professionals appreciate that it is quite common for anyone, including pilots, to miss something in flight. This could be a visual reference; it could be not noticing that the aircraft is losing altitude; it could be missing a light on a master caution panel.

It is far too easy to sit back in a safe, controlled environment, with the benefit of hindsight and make judgmental statements such as *How on earth didn't they realise they were losing altitude? I just don't understand why they didn't realise how close to terrain they were. Why didn't they see that amber light illuminated—it was right in front of them?* As discussed in booklet 3 *Human performance*, many factors affect our performance as pilots.

During high workload phases, such as take-off or landing, when a pilot's attention is completely focused and absorbed, it is easy, and unfortunately quite common, to miss things that may appear to be in plain sight. They might be overt, or they might be more subtle cues, providing awareness of a developing situation and its implications.[4]

In the case of the truck driver in the Kerang level crossing incident, the driver told police that as he approached the level crossing he first saw the vehicles stopped on the opposite side of the crossing. He then observed the crossing flashing lights and, before seeing the train, wondered momentarily why the vehicles had stopped.[6]

The observation of the vehicles stopped on the opposite side of the crossing would have been a situational cue for the driver to recognise a problem or state existed that (time permitting) required a decision or action.

But it's not enough to *notice* a cue; we also need to appreciate its significance. Situational awareness involves interpreting cues to recognise that a problem or state may require a decision or action.[1,4]

Unfortunately, in the unforgiving environment of aviation, missing some cues or landmarks can be the difference between maintaining or losing situational awareness: between a safe landing and one that rapidly fills social media news feeds.

Why does good situational awareness matter?

Not surprisingly, research has shown that loss of situational awareness has been implicated in up to 80 per cent of workplace accidents across various industries.

Statements from operators[7] who have survived accidents where the main contributing factor was found to be a loss of situational awareness, commonly made statements during post-accident interviews such as:

- 'I didn't realise that …'
- 'We were very surprised when …'
- 'I didn't notice that …'
- 'I was so busy attending to …'
- 'I wasn't aware that …'
- 'We were convinced that …'

In the unforgiving safety critical environment of aviation, a loss of situational awareness at altitude can result in catastrophic accidents. One of the most common types of aviation accident that occurs with a loss of situational awareness is controlled flight into terrain (CFIT). CFIT is 'when an airworthy aircraft under the complete control of the pilot/crew is inadvertently flown into terrain, water or an obstacle, usually with no prior awareness of the pilot/crew'.

Factors leading to CFIT can include loss of terrain awareness, non-adherence to standard operating procedures and VFR operations into IMC—operating in areas with a low cloud base, and/or poor visibility. The case study below shows how a reduction in visual cues led to a serious accident.

Collision with terrain—Aérospatiale Squirrel helicopter

Collision with terrain involving an Aérospatiale Squirrel helicopter, AS350B2, VH-HRQ, 240 km west of Davis station, Antarctica, 1 December 2013.

- On 1 December 2013, an Aérospatiale AS350B2 helicopter, registered VH-HRQ (HRQ), was on a return flight to Davis station, Antarctica, with a pilot and two passengers on board. HRQ was one of two helicopters tasked with taking a scientist and two field training officers to a penguin rookery at Cape Darnley.
- The helicopters refuelled during the return flight at a fuel cache on the Amery ice shelf, before departing to the south east for their next refuelling stop.
- As a result of a rapid reduction in visual cues, the pilot of HRQ maintained altitude about 150 ft above ground level. The pilots of both helicopters discussed the reduced surface definition and loss of visible horizon along their flight path and elected to return to the fuel cache until the weather improved.
- During the turn back to the fuel cache, HRQ descended and hit the ice shelf. The pilot and two passengers were seriously injured, and the helicopter destroyed.[9]

Also see page 14 of Resource booklet 9 Human information processing.

image: Eurocopter AS 350 B2, Christopher Ebdon | Creative Commons 2.0

What is situational awareness?

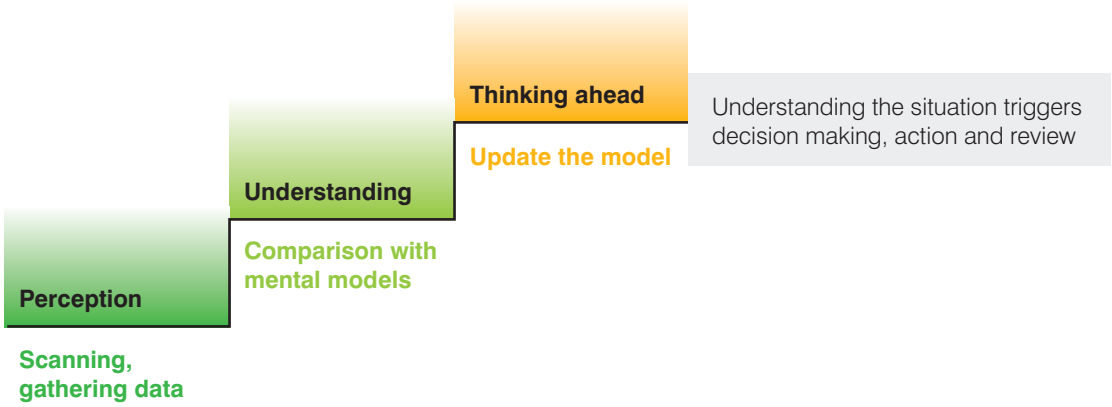
The simplest explanation of situational awareness is that it involves an accurate understanding of what is going on around you, and what is likely to happen next. In aviation, that means having an appreciation of everything you need to know about—flying, controlling or maintaining an aircraft.

One of the leading researchers on situational awareness, Dr Mica Endsley's, formal definition of situational awareness is:

- *the perception of the elements in the environment within a volume of time and space*
- *the comprehension of their meaning*
- *the projection of their status in the near future.*[10]

Simply put, the three key processes of SA, therefore, are:

1. perception (scanning, gathering data) of what is happening (level 1)
2. understanding what has been perceived (comprehension) (level 2)
3. using what has been understood to think ahead (projection) (level 3).



Gaining and maintaining situational awareness—adapted from Endsley's definition

Level 1—Perception: scanning, gathering data	Potential problems
To build a good mental model of your environment, you must have data. This data comes from actively scanning your environment and using your senses of vision, hearing and touch to gather appropriate information about the most important and relevant factors around you. Then you compare what your senses tell you with your experience and knowledge in your memory. • You need to gather information about your aircraft and its systems (airspeed, position, altitude, route, direction of flight, system status and warning lights etc), as well as weather, air traffic control clearances, emergency information and other relevant elements. • This means gathering all the currently available information. *For example: you need to get information from many sources; not only inside the aircraft (instruments, fuel information, engine state, passenger welfare), but also outside the aircraft (other aircraft, weather, navigation).*	• Data not available • Data difficult to detect or perceive • Failure to monitor or observe data • Misperception of data • Memory failure

Level 2—Understanding: creating a mental model	Potential problems
We build our understanding by combining observations from the real world (the data we have gathered above), with our knowledge and experience recalled from memory. If we successfully match our observations with knowledge and experience, then we have built an accurate mental model of the environment.[11] We must update this model by continuing to adjust it in the light of observations of what's happening around us. • Level 2 situational awareness goes beyond simply being aware of the elements present to include an understanding of the significance of those elements; i.e. 'what does that mean for me?' • You form a picture of your environment, an accurate mental model, including an understanding of the significance of information and events. *For example: there is an aircraft over to my left that is travelling in the opposite direction; I have used more fuel than I was expecting at this point.*	• Lack of, or poor, mental model • Use of incorrect mental model • Over-reliance on default values in mental model

Level 3—Projection: thinking ahead and updating the model	Potential problems
Our understanding, our accurate mental model, enables us to think ahead—'to fly ahead of the aircraft', and allows for timely decision making. • This means anticipating what will happen next and using this expectation to make decisions. *For example: I will maintain my heading to avoid another aircraft; I will need to land at the next airfield to refuel so I can make it to my destination.*	• Lack of, or poor, mental model • Over projection of current trends

Factors that can reduce situational awareness

A CFIT accident occurs where a charter pilot is found to have flown into a mountain. That mountain didn't just appear at the pilot's cruising altitude overnight, it's been there since time began. It's on the charts and the area's minimum en-route altitudes consider it. How could the accident pilot not know it was there?

The simple answer is that the pilot probably did know the mountain existed, but lost track of their position. The circumstances of this accident and evidence demonstrate that the pilot's situational awareness was compromised, and for whatever reason (distraction/workload etc.) the pilot also ignored various cues before impact that his situational awareness was compromised.[4]

We can see that managing situational awareness means not being caught off guard or being unprepared. Common factors that can reduce situational awareness include:

- insufficient or poor communication
- fatigue and/or stress
- task overload or underload
- 'press-on-regardless' philosophy—'press-on-itis'
- degraded operating conditions.

Insufficient or poor communication can result in a pilot making a decision based on incomplete or incorrect data. (See booklet 4 *Communication* for strategies on communicating more effectively.)

Fatigue, stress and work overload can cause a pilot to fixate on a single task which can reduce their overall situational awareness of the flight. (See booklet 3 *Human performance* for more information on the impact of stress and fatigue on our operational capability.)

Distraction due to multiple steps or tasks can result in inadequate time being given to monitor the overall conditions. (See booklet 9 *Human information processing* for more information on how we process information, and the importance of taking this into account to manage workload and distraction.)

The inherent pressures of schedules and passenger demands can put pressure on pilots to try their best to maintain departure and arrival times, and despite obtaining the latest weather information, it can change rapidly leading to unanticipated weather conditions.[11]

When you're under the pressure of a high workload, it is easier to overlook important information. In single-pilot operations, particularly, task saturation—having too much to do without enough time, tools or resources to do it—is a major factor. This can lead to an inability to focus on what really matters. Imagine the workload pressure of flying on a dark and stormy night, with low fuel, an intermittent electrical failure and a malfunctioning gear indicator light.

Task saturation can be insidious, and we can become too busy to recognise that we're overloaded.[4] For example, on approach into a very active terminal area, you might miss radio transmissions, or forget instructions. However, during a long navigation leg that is proceeding according to plan, or in cruise, you need to be aware of the opposite danger of low workload/underload. When the pressure is off, and there is inactivity, it can be very easy to become complacent, relax and stop thinking about what is happening and what could happen.[12]

While regular public transport operators have dedicated teams for tasks such as maintenance, catering and passenger check-in, it's often completely different for the non-scheduled or charter industry operators flying passengers and cargo on demand.

On a small charter, there are no cabin crew to look after the passengers or clean up afterwards. Pilot/s do everything, including arranging maintenance of the aircraft, flight planning, checking in passengers, loading luggage, ensuring the cabins are clean, and handing out food and drink.

Charter pilots often have schedules dominated by customer demands. This can mean being on call for urgent work or hanging around waiting for a client who said they would be there two hours earlier. John J. Nance, a well-known airline captain, aviation consultant and author, described life for a charter pilot in his book *Medusa's Child*.[13] To paraphrase:

'The non-scheduled or charter world is a fraternity ... hauling demanding clients and unpredictable loads to unlikely places with minimum notice.'

How do you know when you've lost situational awareness?

A pilot who needs to ask air traffic control to repeat clearances, or misses calls altogether, has degraded situational awareness, as in the following account.

I was on short final; the gear was down and I suddenly realised I couldn't remember if I'd been cleared to land. I mean, I just couldn't be sure. I radioed the tower, and they confirmed I had, but I had absolutely no memory of the readback. The weather was marginal, but within my capabilities. On board were my father-in-law and his partner, and we were flying an approach I'd not conducted before. I wouldn't call it a high stress situation, but there were unfamiliar factors, which distracted me from the usual routine.

Another example is where degraded work cycles lead to fixation or tunnel vision; or the pilot who focuses too long on a checklist item, to the detriment of making appropriate radio calls or maintaining a good lookout.

The following issues warn of an error chain in progress:[8]

- **Ambiguous information:** does information from two or more sources not agree?
- **Confusion:** are you uncertain or uneasy about a situation, asking yourself 'where am I'?
- **Primary duties:** are you/crew members 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 or minimums? (For example, descending below safe altitudes.)
- **Standard operating procedures (SOPs):** is everyone, including you, following them?
- **Fixation:** are you focused on any one task to the exclusion of others? (For example, trying to locate a mobile phone number in your mobile phone contacts.)
- **Communication:** have you heard, or made any vague or incomplete statements?
- **Contradictions:** have you resolved any discrepancies or contradictory information? (For example, failing to resolve a discrepancy—knowing the aircraft is at the wrong altitude, but failing to correct it.)
- **Navigation:** have you failed to meet an expected checkpoint on the flight plan?

Staying ahead of the aircraft means knowing exactly where you are, and where you're going, at all times.

Pilots should always be planning the next step and preparing for arrival before it happens. This keeps pilots aware of their position in the clouds and prevents them from losing track of their position without any visual reference to the ground.[15,16]

Unfortunately, not maintaining good situational awareness by projecting ahead, can result in pilots, who plan a visual flight rules (VFR) sector, suddenly finding themselves in IMC, as in the following case study.

Collision with terrain—GA-8 Airvan, Flinders Island

- In October 2010, the pilot of a Gippsland Aeronautics GA-8 Airvan was flying charter from Lady Barron Aerodrome, Flinders Island, Tasmania, to Bridport, Tasmania, with six passengers on board.
- The forecast weather was marginal for a VFR flight, with broken cloud forecast down to 500 ft above mean sea level in the area. However, the pilot's assessment from the ground was that the cloud base was 1000 ft to 1500 ft.
- During the take-off climb at 1700 AEDT, the weather conditions deteriorated to below those necessary for VFR flight. The pilot, concerned about adhering to an unwritten operator rule to maintain a minimum height of 1000 ft, continued to climb into IMC, instead of remaining visual below the cloud. He lost all visual reference with the ground and horizon.
- The pilot, who was not qualified to fly in IMC, continued to fly in cloud for several minutes in the hope that he would climb above it. When this did not happen, he decided to turn the aircraft back towards Lady Barron Aerodrome, initiating a gentle turn to the right. He succeeded in maintaining controlled flight with reference to the aircraft's flight instruments. However, although intending to turn through 180°, the pilot inadvertently turned less than this and steered towards high ground in the Strzelecki National Park.
- When the pilot finally became visual at 1715 hours, he turned the aircraft into a valley in which he could neither turn around nor climb out of. The pilot elected to make a forced landing into the tree tops, slowing the aircraft to land at the slowest speed possible. Moments later, it hit the tree tops and then the ground.
- The first passenger to exit the aircraft used the aircraft fire extinguisher to put out a small fire that had begun beneath the engine. The other passengers and the pilot then exited the aircraft safely. One passenger was slightly injured during the impact, but the pilot and other five passengers were uninjured.
- After spending several hours in the cold, the aircraft's occupants were winched to safety by helicopter during the night and taken to the hospital in Whitemark, Flinders Island. The pilot and passengers were extremely fortunate, as the circumstances could have easily have led to a fatal accident.

image: GA-8 Airvan | Alec Wilson

LESSONS LEARNT

The GA-8 Airvan accident illustrates that adverse weather is one of the major contributing factors to a loss of situational awareness.

For a non-instrument-rated pilot, even one with basic instrument flying proficiency, maintaining control of an aircraft in IMC by reference to the primary flight instruments alone, entails a very high workload that can result in narrowing of attention and loss of situational awareness (with the accompanying difficulty of 'staying ahead of the aircraft').

Here are some tips to avoid loss of situational awareness due to weather.[18]

- If you encounter deteriorating weather, turn back or divert before you are caught in cloud.
- The fact that you are outside VFR criteria may be a clue that you are losing or have lost situational awareness.
- Pilots often choose to take off and assess the weather as they go. If you are confident that you can depart in visual conditions and return safely should conditions deteriorate ahead, then departing is a safe option.
- If you are inadvertently caught out by the weather, remember that the regulations regarding minimum heights to fly do not apply if 'through stress of weather or any unavoidable cause it is essential that a lower height be maintained'.

Managing situational awareness

Situational awareness is a key skill. You need to build it, maintain it and monitor cues which indicate that your situational awareness might be compromised.

By properly managing situational awareness you should be able stay ahead of a situation and avoid being caught off guard or unprepared.[11,19]

image: © Civil Aviation Safety Authority

Building situational awareness

4. Plan ahead and manage workload.
    a. Predetermine crew roles for phases of flight which have high levels of workload. Assign responsibilities for handling problems or unexpected distractions. If you are flying a single-pilot operation, don't forget that passengers can be a useful resource—so make sure you brief them well.
    b. Tasks that take time or are subject to interruptions from ATC or other crew, are less likely to be done correctly, so create visual and/or aural reminders of interrupted tasks. For example, some pilots select the audio for the outer marker when, early in their approach, they are instructed to contact the tower at the outer marker. This aural reminder means that they don't have to remember to look during a busy phase of flight.
5. Make risk assessments. Anticipate by considering 'what ifs'.
    a. Project ahead and design contingencies to avoid being taken by surprise.
    b. Consider the potential of visual illusions, missing information, etc.

Maintaining situational awareness

1. Communicate.
    a. Keep everyone in the loop.
    b. Be aware of all the services available to you and use them. For multi-crew operations, this may require input from all crew members. Single pilots should seek information from sources such as air traffic control and their maintenance base.
    c. If you observe any obvious signs in words or actions that indicate situational awareness is breaking down, speak up.
2. Manage attention.
    a. Avoid fixating on a problem.
    b. Direct your attention systematically to the aircraft, the flight path and finally to the people around you. Repeat this attention pattern over and over.
3. Check your understanding.
    a. Monitor and critically evaluate your current performance (flight path, fuel estimation) based upon your pre-flight plan.
    b. While it is important to focus on the details, don't forget to scan the big picture.
    c. Validate your data—cross-check.

image: © Civil Aviation Safety Authority

The following case study shows the value of asking for assistance as soon as any loss of situational awareness is indicated.

VFR into IMC, Cessna Caravan, 83 km north-east of Broome Airport, Western Australia

On 20 June 2007, a Cessna C208 Caravan float plane left Broome Airport, Western Australia (WA) at 0615 WST on a VFR charter flight to Talbot Bay, WA. On board were the pilot and 10 passengers. About 40 minutes into the flight, the weather deteriorated, and the pilot elected to return to Broome. During the return, the aircraft entered an area of reduced in-flight visibility that resulted in the loss of the visual horizon. While manoeuvring the aircraft to regain VMC, the pilot became disoriented.

The pilot made a general radio broadcast requesting assistance, which was received by the crew of another aircraft who initially advised the pilot of the Caravan to concentrate on maintaining the aircraft's orientation using its attitude indicator.

After confirming that the Caravan pilot was maintaining the aircraft's attitude with reference to its instruments, the assisting pilot advised him to set cruise power and to maintain level flight with reference to the vertical speed indicator. The crew of the assisting aircraft reported that, about five minutes after the initial radio contact, 'the pilot of the aircraft sounded less stressed and advised us he was in level flight'.

Fortunately, the pilot was able to regain control of the aircraft and, shortly after, resumed the flight to Broome, which required the non-instrument rated pilot to descend through cloud before becoming visual and landing.

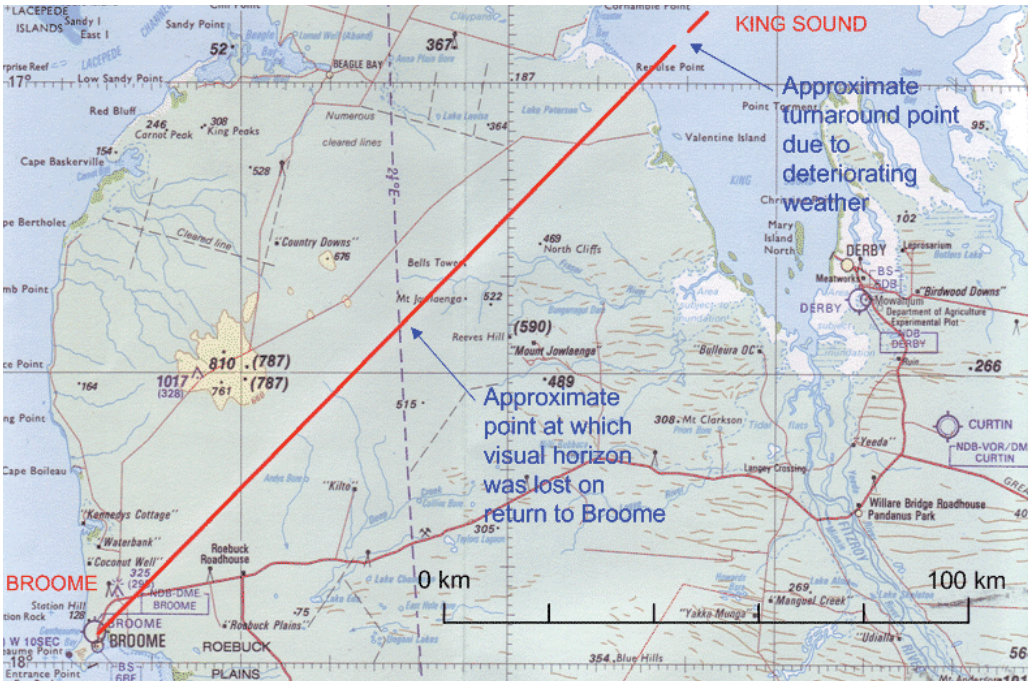


image: © ATSB | Aviation Occurrence Investigation report– AO-2007-014

LESSONS LEARNT

This case study is an excellent example of a pilot recognising they were in an undesired state and deciding to use all available resources to assist in recovery of normal operations.

The potentially severe consequences of this occurrence were probably averted by the pilot's decision to seek assistance and the ability of the flight crew of the other aircraft to provide appropriate input and guidance.

The lesson is, don't be afraid to ask for help. The crew of the other aircraft was able to provide advice and reassurance to the pilot of the Caravan during a period of very high stress. Some tips to recover situational awareness are:[18]

- If you find yourself in marginal weather and becoming disoriented or lost, seek whatever help is available. Air traffic services may be able to help, especially if you are in radar coverage.
- When caught in deteriorating weather, many pilots will descend to remain in VMC. Apart from the terrain hazards, descending may eliminate radar and communication contact.
- It is up to the pilot to keep the aircraft under control and get the aircraft safely on the ground. Being able to make a 180° turn, and if necessary climb to a safe altitude, requires proficiency in basic flying manoeuvres on instruments. Those skills, learned while training for your pilot's licence, disappear if not regularly practised.

Situational awareness and decision making

Situational awareness is strongly related to the decision-making process, which is discussed in more detail in booklet 7 *Decision making*. Situational awareness must precede decision making because pilots must understand their environment before they make a decision and act upon it.

Limitations of the term 'situational awareness'

While 'situational awareness' has been a well-used term in aviation, both in terms of training and investigations, for many years there has been criticism that it has become a 'catch-all' explanation as to why a pilot may have drifted into a situation with an undesirable or adverse result.

The main criticism against using the term situational awareness is that too often it seems to be used as a causal explanation—why an adverse event occurred, as opposed to being used descriptively. While most agree that situational awareness (and the subsequent loss of it) is a phenomenon, critics state that it should be viewed as a condition that can facilitate accidents, rather than cause them.[21,22]

'Loss of situational awareness', which is often cited in accident investigations, has been heavily criticised as a statement that actually explains nothing—because it says nothing about the mechanisms behind the critical behaviour. For example:

- Why did you lose situational awareness?
  - » Because you were complacent.
- How do we know you were complacent?
  - » Because you lost situational awareness.[21,22,23]

Another example of circular reasoning is that a pilot flew into controlled airspace, according to the investigating authority, because of 'loss of situational awareness'.

- How do they know that situational awareness was lost?
  - » Because the pilot acted inappropriately.
- Why did the pilot act inappropriately?
  - » Because situational awareness was lost.

This circular argument does not identify why the pilot responded inappropriately in the circumstances.[21,22,23] Having more specific information, such as that the pilot had pressed the 'go-to' function on the GPS thus leading to the airspace incursion, is more useful in identifying contributing factors (over-reliance on technology) and devising appropriate corrective/mitigating actions.

However, situational awareness is still a useful description used across many safety critical industries (such as aviation, military, law enforcement, space, oil and gas, health care, mining, nuclear power and energy distribution).

Key points for professional pilots

Situational awareness is a critical skill for all pilots. Keeping the 'big picture' in mind in relation to the location, flight conditions, configuration and dynamics of your aircraft as well as any other factors that could affect its safety such as terrain, obstructions, other aircraft and weather etc., is critical. Sadly, history shows us the potential consequences of loss of situational awareness are serious accidents. Know and keep in mind cues that can warn of impending loss of situational awareness.

Key points for charter operators

Charter operators have the added stress of both flying and non-flying duties. The added work load and coordination required of a charter pilot in attending to non-flying duties can easily result in work overload and distraction. These, and customer demands and expectations, and non-scheduled flights to remote or unfamiliar locations, can create links in the error chain which lead to loss of situational awareness.

For single-pilot charter operations, therefore, thorough pre-flight planning is even more critical, so that both flying and non-flying duties are factored into the overall planning to prioritise key tasks and manage workload and time pressures safely.

Resources

FURTHER READING

CASA *Look out*! Situational awareness pack—DVD and booklet https://www.casa.gov.au/promotion/look-out-situational-awareness-pack

KEY TERMS

charter operation Carriage of passengers or cargo on non-scheduled operations by the aircraft operator or their employees for hire or reward, but excluding publicly available scheduled services.

comprehension In situational awareness, comprehension goes beyond simply being aware of the elements that are present to include an understanding of their significance (information and events) in light of the pilot's goals.

controlled flight into terrain (CFIT) Occurs where an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew, or without sufficient or timely awareness by the flight crew to prevent it.

fixation Also known as tunnel vision, fixation causes all cognitive capacity to be focused on one task. If pilots are totally preoccupied with something other than flying the aircraft (such as navigating around terrain, trying to deal with malfunctioning gear indicator lights or erroneous instruments etc.), the potential for an accident rises exponentially.

inattentional blindness Also known as perceptual blindness, this is a psychological lack of attention not associated with any vision defects or deficits. It can be further defined as an occasion on which an individual does not see something which is in plain sight.

instrument flight rules (IFR) Required for flight in 'non-visual meteorological conditions'. IFR rules and regulations govern flight under conditions where flight by outside visual reference is not safe (e.g. the weather being so bad the pilot can't see out the window). IFR flight depends upon flying by reference to instruments in the flight deck and navigation is accomplished by reference to electronic signals.

instrument meteorological conditions (IMC) Describes weather conditions that require pilots to fly primarily by reference to instruments and therefore under instrument flight rules (IFR) rather than by outside visual references under visual flight rules (VFR). Typically, this means flying in cloudy or bad weather.

perception Perception of the elements in the environment is the first step in achieving situational awareness. It involves perceiving the status, attributes and dynamics of relevant elements in the environment. Pilots must accurately perceive information about the aircraft and its systems (airspeed, position, altitude, route, direction of flight, etc), as well as weather, air traffic control clearances, emergency information, and other pertinent elements.

projection The third step of situational awareness, projection of future status is the ability to project the future actions of the elements in the environment. This is achieved through knowledge of the status and dynamics of the elements and a comprehension of the situation.

see-and-avoid Is recognised as a primary method for avoiding mid-air collisions between aircraft. Pilots should actively search for potentially conflicting traffic, especially when operating in non-controlled airspace. Alerted see-and-avoid uses radio calls to help overcome the limitations of see-and-avoid especially with fast-moving aircraft.

situational awareness 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. Alternatively, knowing what has happened, what is happening, and what is likely to happen next.

visual flight rules (VFR) The regulations under which a pilot operates an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going via visual reference to the ground and by visually avoiding obstructions, terrain and other aircraft.

visual meteorological conditions (VMC) An aviation flight category in which VFR flight is permitted as the conditions are such that the pilot has sufficient visibility to fly the aircraft maintaining visual separation from terrain, obstacles and other aircraft.

visual meteorological conditions minima (VMC minima) Defined by visibility, cloud ceilings (for take-offs and landings) and cloud clearances.

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