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Pilot incapacitation occurrences 2010–2014



Australia's national transport safety investigator

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Safety summary

Why the ATSB did this research

Occasionally pilots become incapacitated during flight. Incapacitations can arise from different reasons. They include the development of an acute medical condition, changes in environmental conditions during the flight, or the effects of a pre-existing medical condition. The effect of incapacitation on a pilot can be restricting their flight duties for the remainder of the flight, or for single-pilot operations, a collision with terrain.

This research report documents pilot incapacitation occurrences in high capacity air transport, low capacity air transport, and general aviation to help educate industry about the causes and risks associated with inflight pilot incapacitation.

What the ATSB found

In the past 5 years, there have been 23 pilot incapacitation occurrences reported per year on average.

Nearly 75 per cent of the incapacitation occurrences happened in high capacity air transport operations (about 1 in every 34,000 flights), with the main cause being gastrointestinal illness, followed by laser strikes. In the majority of the occurrences reported, the incapacitation was severe enough for the pilot to be removed from duty for the remainder of the flight. With multi-pilot crews in high capacity operations, these occurrences usually had minimal effect on the flight.

Low capacity air transport and general aviation had fewer occurrences with a wider variation of causes of incapacitation. These ranged from environmental causes, such as hypoxia, to medical conditions, such as heart attack. Furthermore, 70 per cent of pilot incapacitation occurrences in general aviation had an effect on flight operations, namely return to departure aerodrome or collision with terrain.

Safety message

This report highlights that pilot incapacitation can occur in any operation type, albeit rarely. In high capacity air transport operations, the practice of ensuring all pilots on the same flight eat different meals prior to and during the flight has been an effective defence preventing all pilots on the same flight becoming incapacitated at the same time. Providing pilots with training in dealing with incapacitation events has been effective for when these events do occur. Pilots are also encouraged to

report laser strikes to police and the Office of Transport Security. In low capacity air transport operations, providing emergency training to non-flight crew, such as aeromedical nurses, is an important defence in case of pilot incapacitation. Finally, in general aviation, pilots are reminded to assess their fitness prior to flight. Assessment of fitness includes being aware of any illness or external pressures they may be experiencing.

Background

Pilots are required to maintain medical certificates as part of their licencing requirements. However, occasionally pilots still become incapacitated during flight. In-flight incapacitations can result from a variety of reasons. These include the development of an acute medical condition, changes in environmental conditions during the flight, or the effects of a pre-existing medical condition. The effect of incapacitation on a pilot's duties varies. Effects on duty include restricting their flight duties to a pilot monitoring role, or in severe cases, the need to be removed from the flight deck for the remainder of the flight. While air transport operations involve multi-pilot operations, which will act as a safety net if one crew member becomes incapacitated, other aircraft operations may only have one pilot. This makes any potential incapacitation a higher risk for single-pilot operations.

Between 2010 and 2014, there were a total of 113 flight crew incapacitation occurrences reported to the ATSB (23 per year on average). This report documents flight crew incapacitation incidents, serious incidents, and accidents within high capacity air transport operations, low capacity air transport operations, and general aviation that occurred in Australia or on VH-registered aircraft overseas.

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High capacity air transport

In high capacity air transport operations (typically airlines),¹ pilots undergo extensive medical testing on a regular basis to ensure their fitness for duty. However, there are still instances where pilots may experience incapacitation. Over the 5-year period 2010 to 2014, 86 of the 113 flight crew incapacitations were in high capacity air transport operations. This translates to about 29 incapacitation occurrences per million departures (or 1 incident about every 34,000 flights).

Half of the incapacitation occurrences were related to gastrointestinal illnesses, such as food poisoning or gastroenteritis.



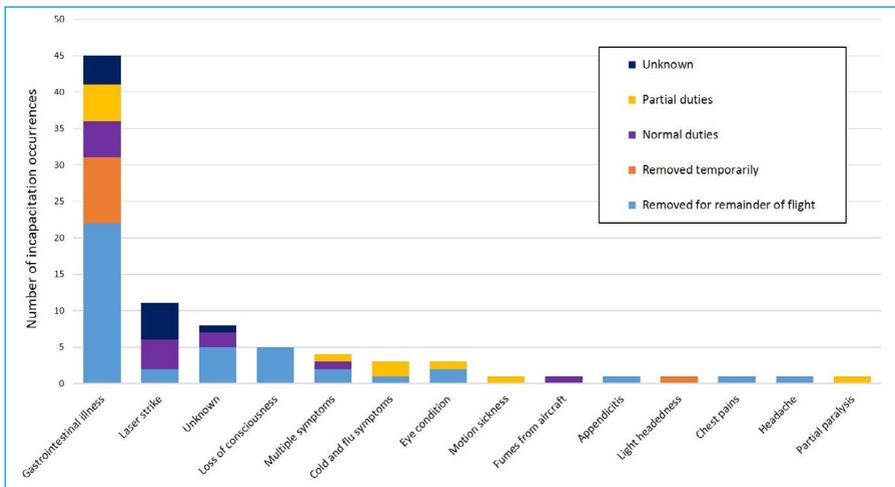
Source: Stock image

¹ Air transport high capacity are operations conducted in an aircraft that is certified as having a maximum capacity exceeding 38 seats, or having a maximum payload capability that exceeds 4,200 kg. Includes regular public transport (RPT) and charter operations.

Half of the incapacitation occurrences were related to gastrointestinal illnesses, such as food poisoning or gastroenteritis (Figure 1). This type of illness tends to be contracted from external sources, such as food consumed or contact with an infected person.

Laser strikes (13 per cent) were the next most common causes of flight crew incapacitation occurrences in high capacity operations. Between 2010 and 2014 there were 1,316 laser strikes in high capacity transport operations reported to the ATSB. However, only 11 during this period resulted in pilot incapacitation. The chances of incapacitation from a laser strike are low, but when they occur, they can be serious enough to lead to total incapacitation of the pilot.

Figure 1: Causes of pilot incapacitation and resultant duty restrictions in high capacity transport operations, 2010 to 2014



In the majority of the occurrences reported, the incapacitation was severe enough for the pilot to be removed from duty for the remainder of the flight. This was most evident when a pilot lost consciousness or experienced gastrointestinal illnesses (Figure 1). Given high capacity transport flights are multi-crew pilot operations, another pilot has been able to assume the role of the incapacitated pilot. In a small number of occurrences, the incapacitated pilot has been able to assist the pilot flying by assuming a pilot monitoring role. Furthermore, having a multi-pilot operation means there is little effect on flight. In less than 10 per cent of flights, a return to the take-off airport or diversion to another airport en route was initiated due to the severity of the incapacitation.

Case studies

Incapacitation from gastroenteritis and dehydration

A Fokker F28 aircraft departed West Angelas mine site in Western Australia on a flight to Perth with two flight crew. During cruise, the first officer reported feeling a stabbing pain in their lower abdomen, which increased in intensity over half an hour. The pain continued after using the toilet so the first officer took paracetamol for pain relief. The first officer also advised the captain and the aircraft operator they were experiencing abdominal pain.

A short time after, the first officer's pain increased significantly. They advised the captain that they were unable to continue with their flight duties. The first officer then reclined their seat, and began to feel faint and advised the captain. They then became unconscious for about 10 seconds.

As the captain was completing the PAN² call, the first officer regained consciousness and reported still feeling pain and feeling 'groggy and nauseous'. The captain then called the senior cabin crew member to the cockpit who assisted by administering oxygen to the first officer, locking their shoulder harness in place, and moving their seat rearwards. The first officer's pain and nausea persisted for the remainder of the flight. Although conscious, the first officer did not resume flight duties.

After landing, the first officer received medical treatment from ambulance personnel and was transported to hospital. The Designated Aviation Medical Examiner (DAME) determined the first officer had most likely suffered from an acute gastric event aggravated by dehydration and the food consumed ([ATSB investigation AO-2011-079](#)).

Food poisoning from crew snack

During pre-flight preparation in Dubai, United Arab Emirates, the second officer of an Airbus A380 ate a crew snack chicken roll and commented that it did not sit well. Approximately 8 hours after departure, the second officer was affected by severe diarrhoea and could no longer continue with their duties on the flight deck. They self-medicated with anti-diarrhoea treatment and after 2 hours, the second officer's condition improved and they advised they felt better. At this time, the second officer was medically assessed by the cabin crew and captain. Their temperature was normal, although their blood pressure and pulse rate were elevated slightly. As a precaution, the second officer did not continue with duties for the rest of the flight as they were still pale and lacked energy.

The first officer had also consumed the chicken roll and had commented a feeling of discomfort, but not to the extent that it affected their flight duties. The captain and other second officer ate a different crew snack and neither experienced any illness (ATSB occurrence 201408031).

² An internationally recognised radio call announcing an urgency condition which concerns the safety of an aircraft or its occupants but where the flight crew does not require immediate assistance.

Gastroenteritis after contact with infected family member

En route to Nadi, Fiji, the captain of a Boeing 737 reported they started to feel nauseous and had sweaty palms. They initially believed the symptoms were a result of poor rest from the night before, so they started controlled rest. After 15 minutes, the captain felt like it was more than tiredness and likely to be gastroenteritis. They had been in contact with their son in the past 36 hours who had the illness. The captain then decided to alert a company check captain who was a passenger on the flight to assume flying responsibilities. The captain then left the flight deck and sat in the front row cabin for the remainder of the flight (ATSB occurrence 201004004).

Motion sickness from turbulent conditions

En route to Hobart, Tasmania, an Airbus A320 encountered severe clear air turbulence at flight level (FL)³ 380 north-west of Mallacoota, Victoria. The wind speed and direction could not be determined as it changed rapidly. The pilots had difficulties maintaining straight and level flight of the aircraft.

The first officer reported feeling fine upon entering the turbulent area, but progressively felt sick as the flight continued through this area. After the flight had left the turbulent area, the first officer still felt sick and vomited. They reported that their concentration and ability to perform their duties had deteriorated. The first officer then consulted with the captain and used the oxygen mask for 20 minutes. After having used the oxygen mask, the first officer reported feeling better. They were able to perform pilot monitoring duties for the remainder of the flight (ATSB occurrence 201410224).

Flu symptoms resulting in a return

During climb through 8,000 ft from Sydney, the first officer on a Bombardier Dash-8 reported feeling discomfort in their ears from a recent flu. They advised that they may be unfit to complete their duty on return from Tamworth, New South Wales. A short time later, the first officer reported increased discomfort in their ears and requested a return to Sydney, citing pronounced ear pain. The operator and air traffic control (ATC) were notified. The first officer was able to assist in their duties during the return (ATSB occurrence 201007113).

Eyesight issues

During take-off from Sydney, the first officer on a Boeing 737 noticed an abnormality in their visual field which reduced their ability to read instruments easily. The first officer notified the captain about the visual abnormality. They did not experience any other symptoms nor was the first officer incapacitated. After an examination by a flight attendant who was previously a nurse, the first officer's vision began to return to normal. The flight attendant recommended the first officer seek further medical examination as a precaution. The captain then decided to

³ At altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 380 equates to 38,000 ft.

return to Sydney for the first officer to undergo further medical examination. During the return, the first officer was able to continue their duties and continually updated the captain on their condition (ATSB occurrence 201312951).

Partial paralysis

En route to Brisbane, the first officer on a Boeing 737 left the flight deck to use the toilet. Several minutes later the cabin service manager advised the captain the first officer had collapsed in the galley and was being attended to by a flight attendant, a qualified nurse. The flight attendant informed the captain the first officer was experiencing a lack of control in their left leg and reduced ability to use their right arm, but was otherwise mentally alert. The first officer was also using an oxygen mask. During the flight, the first officer regained use of their arm but not their leg. The first officer then returned to the flight deck with a full harness. The flight attendant sat in the jump seat to monitor the first officer's condition. The first officer was able to assist with duties during descent and landing. After landing, the first officer was transported to hospital (ATSB occurrence 201001745).



Light headedness from flu and medical testing

En route to Nifty, Western Australia, the first officer of a Fokker F28 reported feeling light headed and decided to apply their flight crew oxygen mask for a few minutes. Shortly afterwards, the first officer's condition deteriorated and a flight attendant was notified. The flight attendant provided oxygen from a passenger portable oxygen bottle. Within minutes, the first officer reported feeling better. Afterwards it was concluded that the first officer's condition was satisfactory for the flight to continue. During landing, the flight attendant sat in the jump seat for additional monitoring.

At Nifty, the crew decided that the first officer's condition was satisfactory enough for them to continue the return sector to Perth. On the return sector, the first officer's condition was good enough to perform duties as a flight crew member.

It was noted by the first officer that four days before the flight, they underwent a medical assessment as part of their Civil Aviation Safety Authority (CASA) Class 1 Medical Certificate. This assessment involved computed tomography (CT) scans of the first officer's head, chest, and abdomen to detect cancer. These tests involve dyes being injected into their body, which can have side effects or reactions. The

first officer reported they had not experienced any side effects previously, but believes the combination of the testing and a mild case of the flu may have caused them to feel unwell.

The first officer also noted that in the future they will take annual leave the week after the tests for monitoring. The DAME's report for the first officer yielded negative results for any medical condition (ATSB occurrence 201103749).

Suspected brain aneurysm upon landing

During landing in Perth, the first officer was the pilot flying on a foreign-registered Boeing 787 Dreamliner. After a normal touchdown, the first officer became unconscious at the flight controls and the aircraft began to veer to the right of the centreline. The captain took control of the aircraft to return to the centreline and completed the landing. The two other flight crew members immediately supported the first officer and administered oxygen. The first officer remained unconscious and was stretchered from the aircraft by paramedics. The first officer died in hospital 2 days later from a suspected brain aneurysm. The flight crew reported there were no warning signs from the first officer that there was something wrong (ATSB occurrence 201408011).

Laser strike

During the climb from Sydney, a green laser was pointed at an Embraer ERJ 170. The first officer, who was pilot flying at the time, saw the laser and reported that they had impaired vision. The captain then assumed flying responsibilities for the remainder of the flight to Canberra. After landing, the first officer went to hospital for an eye examination (ATSB occurrence 201105659).



Source: Stock image

Cockpit fumes

During the climb from Brisbane, the captain of an Airbus A330 noticed the slight smell of burnt oil fumes from the cockpit vents. The smell became progressively stronger on descent into Perth at FL 140 and both the captain and first officer reported accompanying nasal and eye irritation. The captain also reported a slight headache which dissipated within an hour after shutdown. An engineering inspection found a fault in the engine bleed air supply system (ATSB occurrence 201408897).

Lessons learned

Avoiding all pilots having the same illness

Pilot incapacitation in high capacity air transport operations can have a sudden onset from different sources, most likely gastrointestinal illnesses. The practice of ensuring all pilots on the same flight eat different meals prior to and during the flight has been an effective defence preventing all pilots on the same flight becoming incapacitated at the same time.



Emergency training

To ensure the flight is under control, it is important pilots have been trained adequately to manage cases of pilot incapacitation. In the ATSB investigation described previously, it was reported that the operator provides emergency training to flight crew for incapacitation with captains of Fokker F28 aircraft twice in a 3-year period. The captain involved in that incident had completed the training 3 months earlier and was assessed as 'very good'. The captain also reported the training had greatly assisted with their response to the incident.

Commencing 1 September 2014, Part 61 of the Civil Aviation Safety Regulations 1998 (CASR) Manual of Standards has included assessable criteria in the multi-crew co-operation section on managing flight crew incapacitation. The criteria includes the ability to identify when crew members become ineffective or incapacitated and to complete published procedures for landing, taxi, and engine shutdown with flight crew incapacitation as a variable.

Reporting laser strikes

Akin to food poisoning, laser strikes are a form of incapacitation with a sudden onset. Although incapacitation from a laser strike is considerably rarer, it can be

serious enough to affect a pilot's vision. In addition to startling or distracting a pilot, the US Federal Aviation Administration (FAA) (2013), in their report [Lasers in Navigable Airspace](#), found three commonly reported physiological effects associated with laser strikes:

- » **glare:** the obscuration of an object in a person's field of vision due to a bright light source located near the same line of sight
- » **flash blindness:** a visual interference effect that persists after the source of illumination has been removed
- » **after-image:** a transient image left in the visual field after an exposure to a bright light.

The FAA has listed actions to take based on research with pilots who experienced laser strikes to minimise the effects:

- » **anticipate:** when operating in a known or suspected laser environment, the pilot monitoring should be prepared to take control of the aircraft.
- » **aviate:** check aircraft configuration and (if available) consider engaging the autopilot to maintain the established flight path.
- » **navigate:** use the fuselage of the aircraft to block the laser beam by climbing or turning away.
- » **communicate:** inform ATC of the situation. Include location/direction of the beam, your present location, and altitude. Pointing lasers at aircraft is illegal and should be reported to the police and to the Office of Transport Security.
- » **illuminate:** turn up the cockpit lights to minimise any further illumination effects.
- » **delegate:** if another crew member has avoided exposure, consider handing over control to the unexposed crew member.
- » **attenuate:** shield your eyes when possible (hand, clipboard, visor, etc.) Do not look directly at the laser beam and avoid drawing other crew members' attention to the beam.
- » **do not exacerbate:** avoid rubbing of eyes and possibly further injury.
- » **evaluate:** if any visual symptoms persist after landing, get an examination by an eye doctor.

Low capacity air transport

Low capacity air transport operations include RPT, charter, and medical transport. While high capacity operations have multiple pilots so that in the case of pilot incapacitation, there are other crew members available to assume duties, some low capacity operations operate with only one pilot. The CASA Civil Aviation Order (CAO) 82.3 on Conditions on Air Operators' Certificates authorising regular public transport operations in other than high capacity aircraft outline the flights where a minimum of two pilots are required. These include regular public transport operations where the aircraft has more than nine passenger seats fitted or jet aeroplanes with a maximum take-off weight (MTOW) exceeding 3,500 kg. Single pilot flights may have other operational staff such as a flight nurse on board. If the sole pilot becomes incapacitated, other people on board may not possess the same flight skills as a pilot to assume a flying role.

In low capacity air transport operations, there were 12 reported incapacitation occurrences between 2010 and 2014, with eight different causes (Table 1). Similar to high capacity air transport, the most common cause of incapacitation was gastrointestinal illness.

There was little variation in the restriction of duty after incapacitation (Table 1). In seven cases, there was no effect on flight. One aircraft descended below assigned altitude in controlled airspace and four aircraft returned to departure location.

Table 1: Duty restriction in pilot incapacitation types in low capacity transport operations

Incapacitation type	Duty restriction				
	Normal duties	Partial duties	Removed temporarily	Unknown	Total
Gastrointestinal illness		3	1		4
Illicit drugs	1				1
Unknown	1				1
Gall stone	1				1
Laser strike	1				1
Viral infection				1	1
Multiple conditions	1				1
Lack of cockpit ventilation			1		1
Hypoxia	1				1
Total	6	3	2	1	12

Case studies

Food poisoning

Fifteen minutes after take-off from Adelaide on a Saab 340B, the first officer notified the captain they were starting to feel unwell. They repeated shortly after they were unwell.

Once the aircraft had reached its cruising altitude, the first officer began using their oxygen mask. When asked by the captain how they were feeling, the first officer reported feeling dizzy and unwell. The captain noted the first officer looked very pale.

Shortly after, the first officer informed the captain that they could not continue and wanted to return to Adelaide. During the return flight, the first officer reported that they were able to perform flying duties. The captain reported during the descent to Adelaide the first officer continued to look very pale and was intermittently using the oxygen mask.

After the passengers had disembarked, the captain noted the first officer's condition had deteriorated further. After completion of the arrival tasks, the captain noted the first officer's condition had improved. They were subsequently diagnosed with food poisoning.

The ATSB investigation noted that ATC was not notified of the reason the aircraft was returning, and that a PAN call was not made. If the first officer's condition had deteriorated further, this could have led to unnecessary delays for medical assistance in Adelaide ([ATSB investigation AO-2010-046](#)).



Gastrointestinal illnesses (captain)

Prior to a passenger flight from Narrabri to Newcastle, New South Wales, the captain of a British Aerospace Jetstream 32 informed the first officer that they were feeling unwell. The captain believed it was linked to food they had consumed.

During cruise near Tamworth, the captain told the first officer that they were feeling 'really unwell' and to provide a sick bag. Soon after, the captain did not respond when the first officer tried to speak to them.

The first officer believed the captain's illness was more serious than food poisoning so they selected transponder code 7700 (the emergency transponder code). When the first officer was just about to disengage the autopilot to divert to Tamworth, the captain regained consciousness. The crew then decided to continue to Newcastle. The first officer assumed pilot flying duties, while the captain performed pilot monitoring duties until arrival in Newcastle (ATSB occurrence 201105715).

Gastrointestinal illnesses (first officer)

On approach into Mount Magnet, Western Australia on an Embraer EMB 120 Brasilia charter operation, the first officer reported feeling unwell, but able to continue with their duties. The captain took control of the aircraft and continued with the landing. After landing, the first officer reporting feeling much better and a replacement for the sector back to Perth was not needed.

During cruise on the return flight, the first officer vomited and felt unwell for most of the flight. However, they were still able to support the captain for a normal approach and landing into Perth (ATSB occurrence 201209612).

Nausea

En route from Tropicana gold mine to Kalgoorlie, Western Australia the pilot monitoring of a Beechcraft Super King Air 200C reported feeling nauseous, but able to continue with their duties. After landing, the pilot monitoring felt worse to the point to being unable to drive home. The pilot was then taken to hospital for assessment. It is possible the pilot had appendicitis (ATSB occurrence 201307574).

Gallstone (sole pilot)

During the descent, the sole pilot of a Beechcraft Super King Air 200 conducting a charter flight from Cairns, Queensland to Kiunga, Papua New Guinea reported feeling tired and lacking energy. Initially, the pilot attributed their condition to the effects of a long flight.

After initiating descent using the pitch control wheel on the autopilot control panel, the pilot became unconscious. A passenger noticed and tried to wake the pilot by shaking them on the shoulder. The pilot awoke shortly after and when asked how they were feeling, the pilot responded with 'yes...actually no.'

The aircraft had increased its descent and accelerated during this time, indicating 250 kts with a vertical speed of 3,000 ft/min. This speed was the maximum measured by the gauge. The pilot took control of the aircraft by reducing the power and pitched the nose up to decrease the descent rate. The pilot asked the passenger to monitor them until they landed.

After landing, the pilot was physically ill and it was 10 minutes before they could taxi the aircraft to its parking position. Once parked, it took another half an hour before the pilot had the energy to exit the aircraft. The pilot was immediately taken to a clinic in Kiunga and spent a night in observation. It was found the pilot had a large gallstone (ATSB occurrence 201205342).

Sole pilot on medical transport flight

An aeromedical pilot about to commence a shift in Sydney reported feeling tired and decided to have a 45-minute sleep. Afterwards the pilot stated they felt fine.

While preparing for the flight on a Raytheon B200, the flight nurse reported the pilot did not appear their usual self. The nurse recalled that when they asked the pilot how they were feeling, the pilot initially stated that they felt 'average'. Soon after the pilot said they felt 'okay'. The pilot reported feeling emotionally drained at the time due to personal circumstances, although still felt physically fine prior to departing.

During climb, the pilot reported beginning to feel unwell with abdominal pain and nausea. The pilot's condition worsened and they required a sick bag from the nurse. The nurse also noticed that the pilot appeared pale and suggested using the crew oxygen mask, which they did. The nurse then confirmed the aircraft's cabin pressure was normal, placed a pulse oximeter on the pilot to monitor their heart rate⁴, and provided a drink. The pilot reported their condition improved.

The pilot decided to return to Sydney and advised ATC. The pilot reported not feeling well, but did not see a requirement to broadcast a PAN as their condition had improved. At the same time, the nurse contacted the aeromedical operations centre via satellite phone to advise them of the situation.

During descent, the pilot removed their oxygen mask. Soon after, they reported feeling unwell again. After shutdown, the pilot became physically ill.

It was determined that the pilot most likely suffered viral gastroenteritis and recovered 1 week later. Other contributing factors to the pilot's condition was their current roster, which was not standard due to scheduled training and associated travel. In the past 2 days the pilot had finished shifts close to midnight and then had to travel 1.5 hours home afterwards. The pilot had stated it was fatiguing. They also reported experiencing a fair amount of stress as a result of personal circumstances ([ATSB investigation AO-2012-100](#)).

4 Pulse oximeter: A medical device that monitors an individual's oxygen levels and pulse rate. The nurse reported that the pilot's heart rate was considered normal.

Side-effects of illicit drugs

A medical transport flight was being conducted from Bundaberg to Brisbane, Queensland on a Hawker B200. Prior to departure, the pilot reported feeling a little low in energy. During the flight, the flight nurse reported feeling nauseous and the constant communications in the very high frequency (VHF) headset contributed to the nausea so they switched their headset off.

During descent, the nurse became concerned as they had not sighted the normal geographic features. When the nurse switched on the VHF radio, they heard a number of broadcasts from various persons attempting to contact the pilot. The nurse turned towards the pilot and saw their chin was slumped onto their chest and were not alert. The nurse immediately left the seat and attempted to wake the pilot by shaking their arm. At the same time, the nurse observed the aircraft pitch upwards and the stall warning alarm was activated. The pilot then regained alertness and initiated recovery actions. The pilot reported disconnecting the autopilot and applying engine power. The pilot reported climbing the aircraft to 8,300 ft.

Upon approach, the nurse observed that the pilot began to hyperventilate, which led to an increased level of breathing and shaking hands.

During taxi, the nurse reported that the pilot's emotional and physical state had worsened. The nurse provided the pilot with an oxygen mask. Afterwards, the nurse reported the pilot's breathing slowed and their physical condition improved slightly. After shut down, the emotional and physical state of the pilot was reported as poor.

Drug and alcohol management plan (DAMP) testing was conducted and the pilot was transported to hospital for further testing and observation. The DAMP test returned a positive reading for an illicit substance, which affected the pilot's sleep cycle. In the past 4 days prior to the occurrence, the pilot reported sleep disturbances. On the day of the occurrence, it was determined the pilot was experiencing a high level of fatigue ([ATSB investigation AO-2012-147](#)).

Depressurisation incident

During climb at FL 140, the captain, who was pilot flying a Fairchild SA227-AC (Metro III) from Narrabri, New South Wales to Sydney reported feeling unwell. The captain then reported feeling worse as the flight continued through FL 160 and the first officer took over flying duties. At this time, the captain used the oxygen mask and subsequently felt better.

The captain noticed the first officer was taking longer than usual to reply to their request for a check of the cabin altitude⁵ when the cabin altitude warning light illuminated. There was no aural alert fitted on the aircraft, nor was there a requirement for one. After the first officer stated the cabin altitude was at FL 170,

⁵ The purpose of an aircraft pressurisation system is to maintain sufficient cabin pressure for passengers to remain comfortable while the aircraft cruises at high altitudes. Cabin pressure is measured by reference to external air pressure at a given height. From the time a flight is commenced, the cabin altitude progressively climbs to a maximum of 9,000 ft.

the captain took over flying duties, instructed the first officer to perform the stage 1 memory items for emergency descent and to request an immediate descent to 10,000 ft.

The crew processed through the standard checklist and noted that the pressurisation system would not pressurise the cabin in automatic mode. The crew then attempted to pressurise the cabin in manual mode, but the cabin altitude was erratic and difficult to maintain. The crew decided to continue to Sydney below 10,000 ft with the cabin unpressurised.

After the flight, the cabin altitude warning switch was found to be out of tolerance and replaced. At the time of the incident, there was no routine maintenance regime for the cabin altitude warning system ([ATSB investigation AO-2012-127](#)).

Viral infection

During climb, the pilot of a Fairchild-Swearingen SA226-TC (Metro II) charter from Perth to Sandstone, Western Australia started to feel nauseous and lethargic with aching joints. Once the aircraft reached cruising altitude, they felt uncertain how they would feel upon arrival in Sandstone. The pilot decided to return to Perth to be safe. Their DAME confirmed later that they had a viral infection. The pilot noted afterwards the symptoms started over a fairly short period of time and they did not realise how unwell they felt until after landing (ATSB occurrence 201001256).

Cockpit environment

A Sikorsky S-76 helicopter was conducting an offshore charter operation in Western Australia. Upon approach to the ship the pilot was to land on, they began to suffer the effects of overheating and began to sweat profusely. The recorded temperature on the day was 33 °C. At this time, sweat and possibly sunblock ran into the pilot's eyes and temporarily blinded them. As a result, the copilot completed the landing. The pilot commented that this particular aircraft provided little direct ventilation on hot and humid days. Furthermore, although some aircraft are fitted with air-conditioning, they are not very effective on hot days (ATSB occurrence 201100498).



Laser strike

During approach into Bairnsdale from Essendon, Victoria, the crew of a Beechcraft Super King Air B200 conducting a medical transport flight reported two green lasers directed at the aircraft. The pilot reported that their vision was affected and considered conducting a missed approach, but then recovered enough to continue (ATSB occurrence 201002031).

Lessons learned

Emergency training in pilot incapacitation for aeromedical crew

Low capacity air transport operations may have multiple people on board, although they may not be trained to fly. To ensure safety of the flight in the case of pilot incapacitation, other staff on board can still be trained to support the pilot.

In the two medical transport flights investigations, the flight nurses reported they would have benefited from further training in the case of flight crew incapacitation. This is particularly the case for the nurse in [ATSB investigation AO-2012-100](#). They commented that crew resource management training (CRM) would have been beneficial had the pilot's condition deteriorated further. The operator has since provided CRM for flight nurses.

In [ATSB investigation AO-2012-147](#), the flight nurse reported the operator provided cabin safety and emergency training on an annual basis. This included a specific module on pilot incapacitation for flight nurses. The training provided guidance on how to respond to this type of incident, including use of the autopilot, communications system, the flaps, landing gear and power levers. However, the nurses in both investigations felt they would have benefited from practical training in using the aircraft's communication system. The nurse in investigation AO-2012-147 further added that had they needed to use the aircraft's communication system to contact ATC it would not have been straightforward. Since the occurrence, the nurse has received training on the aircraft's communication system. Overall, the emphasis in these investigations was that aeromedical crew should receive some flight operations training in the event of a pilot incapacitation. This is especially relevant if it is a single-pilot operation.

In July 2013, CASA issued a Notice of Proposed Rule Making (NPRM) to reclassify air ambulance flights from aerial work in Part 138 to air transport operations in Part 119. Under the NPRM, flight nurses would be categorised as medical crew members who are defined as 'crew members, with specific aviation medical transport patient care training and additional operator aircraft emergency proficiency training related to their role as a crew member on the aircraft...' The emergency proficiency training can include a module on pilot incapacitation.

Elaboration of drug and alcohol management plans

In 2008, CASA introduced new regulations about alcohol and drug testing in aviation (CASR Part 99). This states that an operator is required to have a drug and alcohol management plan (DAMP) if its employees undertake safety sensitive aviation activities (SSAA). One example of a SSAA is the activities undertaken by a member of the crew of an aircraft in the course of the person's duties as a crew member. Although the operator in AO-2012-147 did have a DAMP, the operator decided upon two safety actions to further extend the DAMP. The first was the preparation of a comprehensive options paper examining the feasibility of introducing internal random sample testing. The second was providing managers with training on identifying the symptoms and behavioural effects of using an illicit substance.

General Aviation

Unlike air transport operations, there is variation in medical requirements for pilots in the general aviation sector depending on the type of operations conducted. For pilots who wish to be eligible to conduct commercial operations, they must hold a current Commercial Pilot Licence (CPL). A CPL requires holders to have a valid Class 1 Medical Certificate, which is to be renewed yearly. This is the same medical standard required for pilots who hold an Air Transport Pilot Licence (ATPL). The other licence that can be held by general aviation pilots of VH-registered aircraft is the Private Pilot Licence (PPL) which requires a Class 2 Medical certificate. This licence is valid for 4 years for applicants under 40 years old on the day of issue or 2 years for pilots aged over 40 years old. This licence is for pilots wanting to fly privately only. These requirements are listed in CASR Part 67.

There are different testing requirements for Class 1 and Class 2 Medical Certificates as outlined in the CASA DAME Handbook. For the initial issue of a Class 1, applicants are required to undergo the following tests:

- » electrocardiogram (ECG) to detect heart abnormalities
- » audiogram to test hearing
- » blood test for cholesterol (known as a fasting serum lipid profile) and for diabetes (blood glucose test)
- » eye test by a CASA Designated Aviation Ophthalmologist.

These tests are required to be completed annually as part of the renewal of the medical certificate.

Applicants for the Class 2 Medical Certificate are not required to undergo these tests unless they have been referred by a doctor. Furthermore, they are only required to provide a medical background form and undergo a standard medical examination.

Recreational Pilot Licence (RPL) for applicants who only fly on recreational aircraft (non-VH registered) during the day using visual flight rules (VFR) have a different medical certificate requirement. This is known as a Recreational Aviation Medical Practitioner Certificate (RAMPC). This is based on a modified driver's licence medical certificate, which are the medical standards applied by Austroads with additional criteria. This is detailed in CASR Part 67. Some of the criteria included is examining for a history of cancer, multiple sclerosis, and stroke.

Given the different licence types and associated medical certification requirements for general aviation pilots, the presence of pre-existing medical conditions is less likely to be known. Additionally, issues such as cardiovascular problems have

been found to be one of the causes of pilot incapacitation (Table 2). It is likely that cardiovascular problems feature more prominently in general aviation accidents, but evidence of this is often difficult to establish with certainty, particularly in fatal accidents.

Table 2: Causes of pilot incapacitation in general aviation

Type of incapacitation	Number of occurrences
Laser strike	4
Loss of consciousness	2
Multiple factors	2
Heart attack	2
Injury sustained during flight	1
Hypoxia	1
Microsleep	1
Dehydration	1
Unknown	1
Total	15

Most general aviation flights are single-pilot operations. In the case of pilot incapacitation, the consequences can be serious. For instance, there were three consequential collision with terrain accidents following incapacitation in the 5-year period (Table 3). Seventy per cent (11 of 15) of the occurrences had a consequential event following the incapacitation.

Table 3: Consequences as a result of pilot incapacitation in general aviation

Consequential event	Number of occurrences
No effect	4
Collision with terrain	3
Return	2
Diversion	2
Airspace infringement	2
Precautionary descent	1
Precautionary landing	1
Total	15

Case studies

Precautionary landing before heart attack

The pilot of a Victa Airtourer 115/A1 took off from Cambridge airport, Tasmania on a private flight heading towards Bruny Island, Tasmania at 1145 Eastern Daylight-saving Time⁶. At 1205, the pilot was heard on the multicom radio frequency reporting they were entering the Bruny Island aerodrome circuit area. The aircraft was seen shortly after performing 'a touch-and-go'⁷ manoeuvre on the runway. The aircraft was last seen on the downwind runway at 1213.

At 1600, the aircraft was reported as missing and a search and rescue operation was initiated. The aircraft was subsequently found on Miles Beach, North Bruny Island with the pilot located deceased about 300 m away from the aircraft.

Information from the aircraft's instrumentation found that the aircraft was shut down on the beach at about 1222. An inspection by the ATSB did not find any problems with the aircraft that may have required a forced landing on the beach.

The pilot's post-mortem found the cause of death was an acute heart attack. Medical information gathered in the investigation found the pilot's DAME had been informed by the pilot of a recent cardiologist's examination that required further assessment. The DAME reported advising the pilot not to fly until a suitable intervention had been identified. It was also reported the pilot's cardiologist had advised the pilot not to fly ([ATSB investigation AO-2010-004](#)).

Victa Airtourer 115/A1 landed on North Bruny Island, Tasmania



6 The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time, as particular events occurred. Eastern Daylight Time was Coordinated Universal Time (UTC) + 11 hours.

7 A 'touch-and-go' is a practice landing whereby the aircraft is permitted to touch the runway briefly before taking off again.

Heart attack in flight

During a private flight with a passenger in an amateur-built Safari Helicopter, the pilot became incapacitated from a heart attack and the helicopter subsequently collided with terrain. The passenger sustained serious injuries (ATSB occurrence 201108241).

Loss of consciousness during aerial work

The pilot and crewman of a Robinson R44 took off from an airstrip 150 km south of Newman, Western Australia to conduct low-level geophysical survey operations in the area. This task involved a survey of a large area of land factoring the curvature of the earth's surface.

During the flight, the crewman in a forward-facing seat directly behind the pilot noted the helicopter veering and descending. At the same time, the crewman observed the pilot slumped in the seat. The pilot's shoulder harness appeared to have prevented their shoulders slumping further forward. The crewman attempted to wake the pilot, but without success and the helicopter's descent rate continued.

The helicopter slowed, veered right, and impacted terrain. The helicopter impacted the ground in a nose-down attitude, resulting in substantial crush damage to the underside of the helicopter's forward fuselage.

Despite being incapacitated and unresponsive prior to impact, the crewman reported that the pilot became responsive enough to offer assistance with the activation of the emergency equipment following the accident. However, the pilot subsequently died from their injuries before the arrival of medical assistance. The crewman sustained serious injuries.

Examination of the wreckage did not identify any defects in the helicopter that would have affected normal flight. The pilot's post-mortem examination did not find any evidence of any medical conditions and the cause of death was from chest injuries sustained in the accident.

The ATSB investigation found many inconsistencies in the pilot's medical history and aviation medical records. The pilot had experienced several loss of consciousness episodes 10 years prior to the accident that were not reported in their aviation medical records. Furthermore, the pilot was prescribed medication 6 years previously that was not reported to CASA. Reporting medication was a requirement of the Class 1 Medical Certificate held at the time. Had the earlier loss of consciousness episodes been recorded, this would have warranted a follow-up by the DAME, who remained unaware of these episodes.

Without evidence of abnormalities in the helicopter prior to collision, it was concluded the pilot experienced a loss of consciousness episode, which prevented them from controlling the helicopter's descent before the collision with terrain ([ATSB investigation AO-2011-109](#)).

Robinson R44 accident site



Experience of fatigue and external pressures

A pilot was conducting a private flight from Port Macquarie to Bankstown, New South Wales in a Cessna 210 Centurion. The pilot reported often flying this route to oversee business in Sydney and was very familiar with the flight path. Prior to the flight, the pilot reported feeling a little tired and unwell. During cruise, the aircraft entered controlled airspace above Williamtown without a clearance. ATC tried to contact the pilot, but no response was received. At this time, an uncertainty phase (INCERFA) was declared and Sydney ATC attempted to contact the pilot. Other flights were assigned higher levels to ensure separation from the Centurion.

About 20 minutes later, the pilot recalled waking up. Believing they may have fallen asleep, the pilot checked the aircraft's instruments to determine their location. The pilot then realised they had entered controlled airspace without a clearance twice. In a state of shock, the pilot decided to descend the aircraft to 2,500 ft to regain the original flight plan track. The flight to Bankstown continued without further incident.

The pilot commented that their sleep pattern had deteriorated over the last few years, which may have contributed to the incident. In hindsight, the pilot realised how tired and unwell they felt, but pressures of the family business during difficult economic times affected this decision to fly ([ATSB investigation AO-2013-155](#)).

Alcohol and dehydration

The pilot of Piper PA-28-180 Cherokee took off on a private flight with one passenger on board from Forbes, New South Wales. Ten minutes after take-off, the pilot appeared to have a seizure and lost consciousness. They remained unconscious for most of the flight. The passenger took control of the aircraft and

ensured the unconscious pilot was clear of the aircraft's controls. They turned the aircraft back towards Forbes.

The pilot of a nearby Piper Pawnee heard the passenger's radio calls on the common traffic advisory frequency (CTAF). The passenger reported they could control the aircraft, but not land. The pilot of the Pawnee instructed aero-club members on the ground at Forbes to contact emergency services.

After orbiting the Forbes aerodrome for 22 minutes, the passenger advised that the pilot was conscious and had taken control of the aircraft to return to land at the aerodrome. The pilot reported they did not recall any of the flight between climb and when the aircraft was lined up for a landing on the runway.

The pilot's doctor determined the most probable cause of loss of consciousness was dehydration. The pilot reported they did feel unwell prior to the flight. This may have been contributed to by the moderate amount of alcohol consumed the evening prior, the high temperatures of that day, which were between 36 °C and 38 °C, and aside from a cup of coffee consumed that morning, no other liquids or food being consumed prior to the flight ([ATSB investigation AO-2014-013](#)).

Microsleep

While conducting a locust spotting operation near Ardlethan, New South Wales, the pilot of a Gippsland GA-8 commented to the observer that they were feeling a bit tired. Later during the flight, the pilot fell asleep momentarily until woken by the observer. The pilot then decided to land at Ardlethan to have a nap.

Since the incident, the pilot was been assessed by a DAME and was cleared to fly. As a result of the incident, the operator implemented a policy of limiting locust spotting flights to a maximum of 2 hours. The operator also noted that the pilot was also a farmer and may have been fatigued due to this farming workload (ATSB occurrence 201008162).

Chest pains and nausea

During a solo flight at Jandakot, Western Australia, the pilot of a Cessna 172 RG Skyhawk declared a PAN, advising of mild chest pains and nausea. They returned to Jandakot and requested an ambulance on arrival (ATSB occurrence 201107198).

Hypoxia

A pilot and navigator on a Reims Aviation F406 departed Emerald, Queensland on an aerial survey task. The aircraft was required to climb to FL 240 to complete the task. Since the aircraft was unpressurised, it was fitted with an oxygen system to allow the crew to operate above 10,000 ft. Prior to the flight, the pilot checked there was enough oxygen in the storage cylinder in the nose of the aircraft and tested the oxygen system was operational. During climb, the crew put on their masks.

After climbing past FL 180, the pilot noticed their blood oxygen saturation on the oxygen pulse meter⁸ had fallen to 77 per cent when it should have been in excess of 90 per cent. As the climb continued, the pilot expressed concern to the navigator about their low blood oxygen saturation levels. The navigator believed the pilot's low blood oxygen saturation levels may have been an effect of hypoxia, a condition where oxygen does not reach tissues in the body. Accordingly, the navigator encouraged the pilot to address the problem and increase their blood oxygen saturation level by adjusting their oxygen system controller. The navigator then began to monitor the pilot's condition closely.

As the pilot attempted to increase the amount of oxygen received, they noticed a problem with the oxygen system connection and tried to resolve the problem by adjusting the supply tubing and connection. The navigator also attempted to assist the pilot.

Due to the lack of supply of oxygen, the pilot's ability to control the aircraft deteriorated. The pilot recalled losing awareness of the situation and prompts from the navigator to maintain the aircraft's attitude. Furthermore, the navigator reported the pilot did not respond to some ATC communications and when they did respond, the responses were non-standard and their speech was slurred. ATC encouraged the pilot to ensure they were receiving a supply of oxygen by transmitting 'oxygen oxygen oxygen' and clearing the pilot to descend.

Despite their apparently hypoxic condition, the pilot was still able to identify an oxygen supply system fitting had become disconnected. The fitting was located beneath the pilot's armrest, and was the same fitting that the pilot had earlier connected during the climb. When they reconnected the fitting, the pilot took a number of deep breaths and sensed almost immediate relief. At this time, the pilot also noticed that the engines were still set to climb power. The pilot reduced power and commenced a controlled descent. The navigator noted the pilot's speech became more coherent and standard radio phraseology returned soon after commencement of the controlled descent. The crew then decided to return to Emerald.

After landing, the pilot noted that their blood oxygen saturation level had increased to 97 per cent, which is within the normal level ([ATSB investigation AO-2014-134](#)).

Laser strike incidents

During cruise, the pilot of a Bell 206B helicopter reported a green laser aimed at the helicopter near Caloundra, Queensland. One pilot reported their vision was momentarily affected by the laser and the other reported no incapacitation (ATSB occurrence 201303882).

8 An oxygen pulse meter allows the wearer to monitor his or her pulse and blood oxygen saturation level (a measure of the concentration of oxygen in the blood). An oxygen pulse meter therefore provides a direct indication of the extent to which a wearer is likely to be suffering the effects of hypoxia.

During initial climb, the pilot of a Piper PA-28 Archer aircraft conducting night circuits at Moorabbin, Victoria was struck by a green laser in the right eye, momentarily blinding them (ATSB occurrence 201006939).

While conducting aerial work near Brisbane, Queensland, a Eurocopter AS350 was struck by a green laser which temporarily blinded the pilot. The aircraft then left the area so the pilot could regain their vision and visual reference point. Once the helicopter returned to the area, they were struck again by the laser, causing further difficulties regaining visual reference. This continued for 10 minutes until the helicopter left the area (ATSB occurrence 201103594).

During aerial work in Jandakot, Western Australia, a green laser struck the pilot of a Cessna 172RG Skyhawk who was momentarily incapacitated (ATSB occurrence 201408503).

Loss of control leading to incapacitation

During landing on a solo training flight in Penfield, Victoria, the pilot of a FlySynthesis Storch S500 reported the aircraft flaring and ballooning on the runway. During this incident, the pilot struck their head and became unconscious. The aircraft then collided with the ground and became inverted. The aircraft sustained damage to the nose wheel leg, lower fibreglass engine cowl, propeller blades and coolant radiator. The pilot sustained minor injuries (ATSB occurrence 201401534).

Hot and unconscious

A SOCATA TB-10 Tobago aircraft was being flown on a solo training exercise from Parafield, South Australia. After completing the first sector to Mildura, Victoria, they reported feeling hot and slightly tired on the ground in Mildura, but reported feeling well enough to continue the flight. The pilot then flew from Mildura to Renmark, South Australia where a circuit was completed.

Upon climb from Renmark, the pilot reported feeling hot and began to sweat. At this time, the pilot also reported that the sun was directly in their eyes and they found it difficult to look out of the windscreen due to the sun glare.

The pilot decided to contact another company pilot who was also departing Renmark on the same flight route and reported their symptoms. The company pilot suggested the pilot check the air vents were open and the cabin heat was selected off. The pilot carried out these actions, but was still feeling hot so they elected to climb to 6,500 ft to allow cooler air into the aircraft. The pilot later recalled being unconscious during climb, with the aircraft operating with autopilot engaged in the heading mode and the elevator pitch setting trimmed for the climb attitude. The pilot recalled selecting full pitch and full throttle which was a normal climb power setting. At this time, ATC declared an INCERFA as they were unable to contact the pilot.

The pilot regained consciousness nearly 1 hour later, over the water and uncertain of their position. The aircraft was established in cruise with climb power still set. The pilot heard a number of radio calls from Adelaide Radar for an unidentified aircraft near Aldinga, South Australia and they responded to the radio call. The controller identified the aircraft and assisted them in returning to Parafield.

The day after the incident, the pilot underwent a medical examination at a hospital and the following day they saw a DAME. All the tests were inconclusive and the cause of incapacitation could not be determined. The pilot's aviation medical records did not indicate any medical conditions which may have contributed to the incident ([ATSB investigation AO-2011-003](#)).

Lost and unwell

During a solo training flight from Bankstown, New South Wales in a Piper PA-28 Cherokee, the pilot reported feeling ill and advised ATC they required an immediate landing. At this time, there was difficulty in ascertaining the aircraft's position and an alert phase (ALERFA) was declared.

Subsequently, the pilot felt slightly better and was identified on the radar. The pilot activated both an emergency squawk and Emergency Locator Transmitter (ELT) while airborne. ATC then provided navigation assistance for the aircraft to divert to Camden (ATSB occurrence 201102661).



Lessons learned

Assessing fitness to fly

Because general aviation flights are likely to be single-pilot operations, it is even more important the pilots assess their fitness to fly and adhere to advice given to medical practitioners. The pilot in ATSB investigation [AO-2010-004](#) was advised not to fly by their cardiologist and DAME until a follow-up and intervention had been established. Ignoring medical advice not only places the pilot at risk, but also other airspace users and people on the ground.

It is also the pilot's responsibility to report any changes to their health condition to their DAME or to CASA. In CASR Part 67, it states that holders of medical

certificates and recreational aviation medical practitioner's certificates are required to tell CASA or their DAME of any medically significant condition as soon as practicable. Had the loss of consciousness episodes in the pilot's medical history mentioned in ATSB investigation [AO-2011-109](#) had been reported in accordance with the licensing requirements, the pilot's licence medical certification and pilot licence may have been reviewed and/or revoked. This investigation is an example of how underreporting medical information can place the pilot and other people, such as crew, at risk.

Fatigue

Another health-related condition that can affect fitness to fly is fatigue. Fatigue is defined as a 'physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety related duties' (International Civil Aviation Organization, 2011, p.1). In [ATSB investigation AO-2013-155](#), the pilot commented that their sleeping pattern had deteriorated over the past few years.

Alcohol

Assessment of fitness to fly also includes evaluating the effects of recent alcohol consumption. CASR Part 256 states a person shall not perform any flying duties within 8 hours after consuming alcohol. There have been numerous studies of the detrimental effects of alcohol while flying. Aside from increased level of blood alcohol concentration, residual effects from alcohol consumption includes dehydration. In ATSB investigation [AO-2014-013](#), it was reported the pilot had consumed a moderate amount of alcohol the previous day, which may have contributed to dehydration. Even beyond the 8 hour requirement detailed in CASR Part 256, the effects of alcohol consumption, including fatigue, dehydration and impaired cognitive function can lead to incapacitation, irrespective of the level of blood alcohol concentration.

Time pressure

Another assessment to be undertaken by pilots is to assess their overall situation, which includes their current environment as well as their current health. A previous research report by the ATSB (2010) titled [Improving the odds: Trends in fatal and non-fatal accidents in private flying operations](#) highlighted the importance of pilots being mindful of pressures being faced while making decisions, both pre-flight and in-flight. These pressures can include arriving on-time, pressures from passengers to continue with the flight, or financial pressures, which is applicable to the circumstances in ATSB investigation [AO-2013-155](#). Although the presence of personal stress may not have directly caused the incapacitation, the pilot in the aforementioned investigation did acknowledge that pressure of the family business in tough economic times influenced the decision to fly while feeling unwell.

IMSAFE Checklist

The FAA has developed the 'I'm safe checklist' (FAA, 2009) for pilots to assess their fitness before flying. It is recommended that if a pilot answers 'yes' to any of the below questions, they should reconsider flying. The causes of incapacitation in the previous investigations and occurrences are listed in the checklist below.

- » **Illness:** Do I have any symptoms?
- » **Medication:** Have I been taking prescription or over-the counter drugs?
- » **Stress:** Am I under psychological pressure from the job? Worried about financial matters, health problems, or family discord?
- » **Alcohol:** Have I been drinking within 8 hours? Within 24 hours?
- » **Fatigue:** Am I tired and not adequately rested?
- » **Emotion:** Am I emotionally upset?

Pressurisation equipment and hypoxia training

At high altitudes, there is less oxygen available in the atmosphere. To compensate for this, aircraft that operate above 10,000 ft are generally pressurised. Above these altitudes, there is a risk of experiencing hypoxia. Hypoxia is a condition where there is a lack of oxygen to the tissues of the body, sufficient enough to cause impairment of function to a person (Newman, 2006). Symptoms of hypoxia include poor muscular control, difficulty speaking, and eventually loss of consciousness, which the pilot experienced in [ATSB investigation AO-2014-134](#).

That investigation highlighted two important safety messages. The first is the importance of proper fitment of aircraft oxygen systems. As demonstrated, an interruption to the supply of oxygen can result in hypoxia which can lead to incapacitation. Despite the fact the pilot was able to reconnect the oxygen supply fitting, the positioning of the connection port required concentration and some awkward manipulation to ensure the fitting was connected. Although, the fitting may have been in place, it was likely that it was not properly secured and locked in place. The supply tube may also have been incorrectly positioned through the armrest and may have been accidentally dislodged. Furthermore, the pilot's oxygen controller was not visible to the pilot or navigator, so the crew would have found difficulty in identifying an oxygen supply problem.

The second safety message is about the importance of hypoxia awareness training. The pilot in the investigation did note that the hypoxia awareness training they undertook was helpful in identifying symptoms. However, this type of training is more prevalent in military than in civil aviation.

Although it is fortunate that most of the pilots in these investigations were able to avoid any serious injury, in most, the consequences could have easily been fatal, as was the case in the Robinson R44 investigation [AO-2011-109](#).

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Australian Transport Safety Bureau

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The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

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