Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT
Aviation Research and Analysis - AR-2009-041

Avoidable Accidents No. 1

Low-level flying

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory Agency. The Bureau is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in:

- independent investigation of transport accidents and other safety occurrences;
- safety data recording, analysis and research; and
- fostering safety awareness, knowledge and action.

The ATSB does not investigate for the purpose of apportioning blame or to provide a means for determining liability.

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

When the ATSB issues a safety recommendation, the person, organisation or agency must provide a written response within 90 days. That response must indicate whether the person, organisation or agency accepts the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

Postal address: PO Box 967, Civic Square ACT 2608
Office location: 62 Northbourne Ave, Canberra, Australian Capital Territory
Telephone: 1800 020 616; from overseas + 61 2 6257 4150
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117; from overseas + 61 2 6247 3117
E-mail: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

Feb10/ATSB60
ISBN: 978-1-74251-035-4

Introduction

This publication is the first in a pilot education series by the Australian Transport Safety Bureau (ATSB) on avoidable accidents. In this report, we will focus on accidents involving unnecessary and unauthorised low flying; that is, flying lower than 1,000 ft (for a populous area) or 500 ft (for any other area) above ground level without approval from the Civil Aviation Safety Authority (CASA).

Between 1999 and 2008, there were 147 fatal accidents in Australia reported to the ATSB involving aerial work, flying training, private, business, sport and recreational flying. Of those fatal accidents, at least six were associated with unauthorised, and unnecessary, low flying. Those six accidents, along with a seventh non-fatal accident, presented here as case studies, were chosen by aviation safety investigators at the ATSB to highlight the inherent dangers of unauthorised low flying and to offer some lessons learnt from each case. It is hoped that these lessons learnt will help pilots make more accurate risk assessments and better decisions before electing to fly at low levels.

At low altitudes, there are many obstacles to avoid and there is a lower margin for error. Recognising the risks and hazards of low-level flying, CASA requires pilots to receive special training and endorsements before they can legally conduct low-level flying. In the accidents below, most of the pilots had neither of these, and none had a legitimate reason to be flying below 500 ft. Some legitimate reasons for flying at low level include aerial stock mustering, crop spraying, and fire fighting operations. For most private pilots, there is generally no reason to fly at low levels, except during takeoff and landing, conducting a forced or precautionary landing, or to avoid adverse weather conditions.

What is sad and unfortunate about the accidents described in the following case studies is that they were all avoidable.

Section of the struck powerline caught in the horizontal stabiliser

Tragedy on Christmas morning

On Christmas morning 2008, witnesses in Kernot, Victoria reported hearing an aircraft '....flying very low over the house' and that the aircraft appeared to have landed on a nearby hill. When the witnesses arrived at the hill, they discovered the aircraft was burning and was seriously damaged. The pilot, who was the sole occupant, was killed.

Powerlines can creep up on you

The aircraft had hit powerlines after flying over the house. The powerlines were only 86 ft (26 m) above the ground. Since the pilot was familiar with the area around the property, he was probably aware of the location of the powerlines. However, powerlines are naturally difficult to see. Normal powerlines are not required to be marked for aviation and are usually unmarked, as was the case in this accident.

Research by the ATSB (2006) found that 39 per cent of the wirestrike accidents studied between 1994 and 2004 involved low-level operations. Additionally, 63 per cent of pilots involved in wirestrike accidents who were surveyed, reported that they were aware of powerlines before hitting them.

No reason to fly low

The private pilot was also the owner of the Cessna 172M aircraft. Information from witnesses suggested that the pilot had a history of low flying, especially over the property every Christmas. In addition, the pilot was under investigation by CASA at the time of the accident regarding previous occasions of low-flying. He also did not have any low-level ratings or endorsements from CASA. There was no operational reason, such as avoiding adverse weather, for the pilot to be flying so low. Given his history of a variety of unsafe acts, including flying low, and no evidence that the aircraft suffered engine or flight control failure, it was likely that the pilot made a deliberate decision to fly low.

Lessons learnt

Just because you know the area and the associated wires, doesn't mean you will always avoid powerlines and other hazards of flying at low level. It only takes a minor distraction to draw your attention from a vigilant lookout. If there is no reason to fly below 500 ft — then don't.

The helicopter during a turn

Crashing the party

In March 2008, a Bell Helicopter 206B Jetranger III was being used to conduct joy rides at a birthday party over a property in Hornsby, New South Wales.

Witnesses reported that the helicopter was making low-level passes, about 100 ft above the ground, over the property. After one of the low passes, the helicopter banked steeply to the left, rolled out and descended. As the helicopter was being operated at a height at which recovery was not possible, it impacted surrounding trees. The helicopter was severely damaged and broke into several parts on impact.

The pilot was not endorsed for low-flying operations and his pilot's licence was suspended by CASA after the accident pending a review.

Seatbelts save lives!

It was reported that only one passenger seated in the back had their seat belt secured during the flight. All five occupants survived the accident with varying degrees of serious injuries, but at least one was thrown from the helicopter during the impact. The pilot reported that he had briefed all passengers on seat belt use before departing.

Main wreckage

Weighty issues

The helicopter had been maintained and inspected appropriately and no mechanical defects were found that would have affected the safe flight of the helicopter. However, it was found that the helicopter was 28 kg over its maximum take-off weight (MTOW) limit at the time of the accident. One of the passengers confirmed they were not weighed prior to departing Bankstown airport.

Lessons learnt

The pilot would have had more time to assess and react to the loss of control situation had he operated the helicopter at the manufacturer's weight limitations and at 500 ft or more above ground level in accordance to civil aviation regulations.

Civil Aviation Advisory Publication (CAAP) 235-1(1) recommends using actual weights of occupants and baggage for light aircraft and helicopters with less than seven seats to avoid overloading <www.casa.gov.au/wcmswr/_assets/main/download/caaps/ops/235_1.pdf>.

In addition, the injuries to the occupants may have been reduced if all had been wearing their seat belts.

Lake Eildon, Victoria

Sightseeing over Lake Eildon

In February 2004, a private pilot was conducting a sight-seeing flight over Lake Eildon, Victoria, with three passengers on a family trip. Witnesses reported that their attraction was drawn to the aircraft because it was so close to the lake's surface. Again, there was no evidence that environmental or operational factors contributed to the choice of flying height.

The Piper PA-28 Cherokee Arrow aircraft struck high-voltage powerlines suspended over the lake. The aircraft was destroyed by the impact with the wire and with the water. All three passengers were fatally injured and the pilot's body could not be found.

Take a long line

The power line involved in the accident spanned a 2 km length across Lake Eildon. The aircraft struck the power cable at the lowest point of the span, which was only 133 ft above the water. Under relevant Australian Standards, the power line was not required to be fitted with marker devices as it was less than 295 ft (90 m) in height.

Lessons learnt

Do not rely on marker devices to alert you to the presence of powerlines. Powerlines under 295 ft (90 m) in height, as was the case in this accident, are not required under Australian Standards to be fitted with marker devices.

Familiarise yourself with the location of power lines by studying maps of the area before flight.

This is another accident in which hazards at low altitudes (in this case powerlines) can be difficult for pilots to spot until it is too late. If flying in a nose-high attitude to allow a slower airspeed, powerlines level with or below the aircraft are going to be even more difficult to sight.

Wreckage of the Auster-J1B

Buzzing on Christmas Eve

On Christmas Eve, 2006, following a maintenance inspection, the owner of an Auster J1/A1 aircraft planned to return the aircraft to his property from a private airstrip at Nelson. Three people had positioned themselves between two hangars near the airstrip to observe the takeoff and to bid the pilot farewell. Just after the aircraft lifted off the runway, the pilot made a low-level turn to the right towards the hangars with the apparent intention of 'buzzing' his friends.

As the aircraft approached the hangars, it climbed suddenly and hit powerlines that passed across the gap between the hangars. Investigation of the wreckage found that the aircraft propeller took the full force of the wirestrike, causing the propeller to disintegrate and the engine to stop. The aircraft aerodynamically stalled at a low altitude, possibly due to the pilot's attempt to avoid trees directly behind the powerlines. Due to the pilot's low altitude, he had little margin to recover from the stall, and the aircraft impacted the ground almost vertically. The pilot sustained serious head injuries, and did not survive.

A pass too low

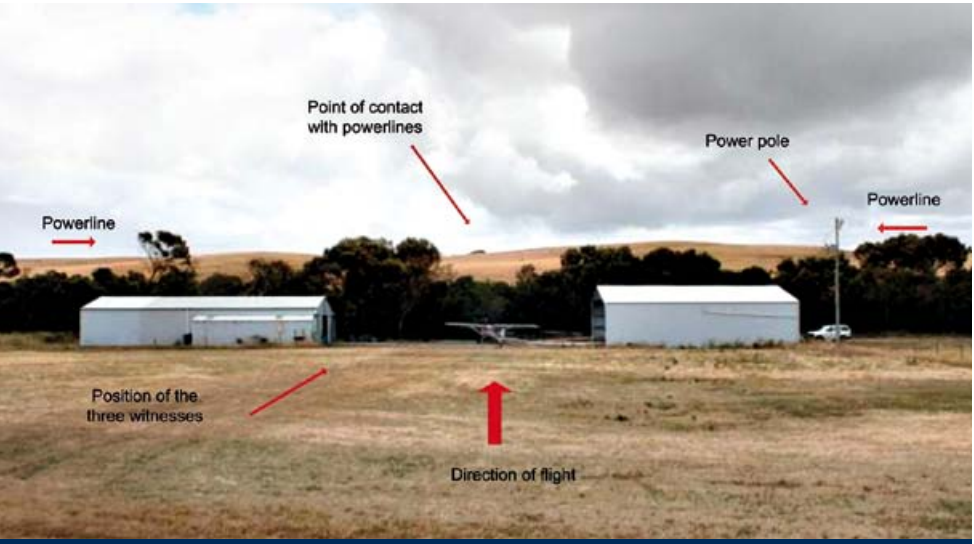
The witnesses' descriptions suggest that the pilot had deliberately initiated a low-level turn shortly after takeoff with the intention of flying directly over them. It was likely that the pilot was focussed on the low-level flight over his friends and anticipated a pull-up manoeuvre to avoid the trees behind the hangars but subsequently forgot about the powerlines.

Although the pilot was familiar with the airstrip and was aware of the location of the powerlines, research by the ATSB has shown that an awareness of powerline location does not guarantee avoidance. The powerline involved was not fitted with high visibility markers, nor was it required to be as it was only 39 ft (12 m) above ground level and well away from the runway or any likely flight path. Had the pilot maintained the runway track until 500 ft above the terrain, he would have greatly reduced the risk of contact with obstacles such as the hangars, trees or powerlines.

Lessons learnt

Flying at low level gives very little or no margin to recover from unexpected events, such as aerodynamic stalls or engine failures.

This accident also illustrates that pilot awareness of powerlines while on the ground doesn't always equate to awareness of them whilst in the air. Powerlines are difficult to see as they can blend in with the background vegetation or the sky and this is especially true while flying at low level.



Accident location

Wreckage of the Cessna 188B Agwagon

Looking out for your mates

In March 2006, the wreckage of a Cessna 188B Agwagon was found in a paddock near Narrandera, New South Wales. The wreckage showed that the aircraft hit the ground heavily, in a nose-down, right wing low position. The pilot was fatally injured. There were no powerlines or other obstacles in the area near the accident site which may have contributed to the accident.

Water skiing

Although there were no witnesses to the accident itself, a number of people witnessed the pilot's flying activities prior to the accident. The pilot had landed in a paddock adjacent to a water-skiing area on a local river, where a large group of local people had gathered and a number of ski boats were operating. The pilot announced an intention to do some low passes over the water-ski area. Before taking off for those low passes, the pilot handed his camera to a friend (also a pilot) so he could take pictures of him flying over the water-ski site. After making four very low passes, the pilot landed in the paddock and retrieved his camera. One of the recovered camera images showed the aircraft's main wheel touching the surface of the water during at least one of the low passes.

Later that evening, the pilot returned to his aircraft just as some of his friends were about to leave the area in their car. The pilot took off to the west, turned back towards the east and conducted a very low pass over the car. The witnesses reported being startled by the pass and so had stopped their vehicle.

Images from the pilot's camera of the day's flying activities

After overflying the vehicle, the pilot '…banked hard…', turned back to the west and overflew the vehicle again. During that second pass, the pilot flew directly toward the front of the vehicle at about '…double the fence height…'. He then conducted two more low passes over the water-ski site before departing in the direction of his property. During both those low passes over the river, the aircraft's main wheels were again reported to have touched the surface of the water.

The occupants of the car continued their drive home and reported that they observed the aircraft to be '…ducking and weaving…' over the water-ski area. It was then seen to head towards the pilot's property in a level attitude and shortly after to be in an attitude described as '…all up on one side…like an X in the sky…and coming around…'. The last time the aircraft was seen, it was described as having '…climbed …up into the air on its side and then banked around pretty hard and ducked down again…'.

There is no evidence that the pilot was trained or approved to conduct aerobatic flight. Moreover, aerobatic flight was prohibited in the Cessna Agwagon aircraft. The pilot was known to conduct 'high risk' aerial activities such as aerobatic flight in an agricultural aircraft, even when the aircraft was not being used for agricultural operations. Investigation of the wreckage and maintenance records found no evidence of mechanical defects that might have contributed to the crash.

Lessons learnt

This accident serves as a salient reminder of the dangers of conducting unauthorised low-flying activities and aerobatic manoeuvres if you are not approved to do so and/or in an aircraft for which those manoeuvres are prohibited.

If you are a pilot and you witness unsafe flying, use your influence to discourage it, and if necessary report it — you may never get a chance later.

Accident site

Wedding day gone wrong

The pilot borrowed an Agusta/Bell 47G helicopter to fly his sister to her wedding at the family property near Holbrook, New South Wales in February 1999. Witnesses reported that the helicopter was flying very low. As it traversed Chinaman's Gap, several kilometres from its destination, the helicopter struck powerlines and impacted the ground. The impact and subsequent fire destroyed the helicopter — brother and sister were killed.

'He was a careful pilot'

Holding a Commercial Pilot Licence, the pilot also had significant low-level helicopter flying experience with the Australian Defence Force. Friends and colleagues said that he was a careful pilot. His civilian logbook showed that he had undertaken civilian helicopter low flying training to allow him to operate below 500 ft, however he was not yet approved to do so (and had not sought permission from CASA to fly low on this occasion). Part of this training alerts pilots to the dangers posed by powerlines during low-level flight and the need to conduct a prior survey of the area.

The pilot had not flown the route before and despite his low-level flying training, there was no evidence that he had conducted a reconnaissance of the area prior to the flight.

Other pilots, who have regularly flown in the area, reported that the powerline involved (which was 102 ft (31 m) above the ground) was difficult to see because the poles were a long way apart and partially obscured by trees and that the cables blended with the background vegetation.

Lessons learnt

Although the pilot was trained and experienced in low-level flying, he did not conduct a survey of the hazards before flying low over the area.

Powerline poles often provide good visual cues to enable a pilot to see the powerline itself. However, when the span between poles is large, and in particular when the poles are partially obscured by vegetation or other obstacles, this important cue is diminished or unavailable. Pilots should therefore never rely on sighting poles as a sole method for detecting powerlines.

Aerial view accident site

In the middle of nowhere

In November 2007, three German tourists, who had hired a Cessna 172N Skyhawk Aircraft as part of a contingent of three aircraft for an around Australia trip, were flying from Katherine to Tennant Creek in the Northern Territory.

There were no eyewitnesses to the accident, but the occupants of a car that was travelling on the Stuart Highway reported seeing the aircraft flying low above the highway moments before the accident. The witnesses recalled seeing an aircraft that was flying about 4 to 5 km to the west of the highway, about 150 ft above ground level. The Cessna made a slow, deliberate turn to line up with the highway, before it disappeared from sight behind a crest in the highway some distance in front of them. Shortly after, they saw the wreckage beside the highway.

Another wirestrike

The aircraft's tail section hit a powerline that spanned the Stuart Highway, breaking the tail, which rendered the aircraft uncontrollable. The aircraft impacted the highway in a steep nose-down attitude and came to rest up-side down about 150 m from the point where it had impacted the powerline. The aircraft was destroyed and the accident was not survivable.

Investigation of the aircraft wreckage determined that the aircraft's ground speed at that time of the accident was at least 72 kts. The powerline involved in the accident was only 49 ft (15 m) above the road surface.

Conscious decision to fly low

Evidence from images and video footage recovered from cameras found among the wreckage, suggests that there was a history of low flying by the group. One week before the accident, camera images show that the aircraft was flown low along a Western Australian beach by the same occupants with the pressure altimeter indicating an altitude of 70 ft above sea level. Video footage showed the aircraft flying below 100 ft along the beach for about 5 minutes.

Examination of the wreckage and previous pilot behaviour suggested that the pilots made a conscious decision to fly low, and were not conducting a forced landing at the time of the accident.

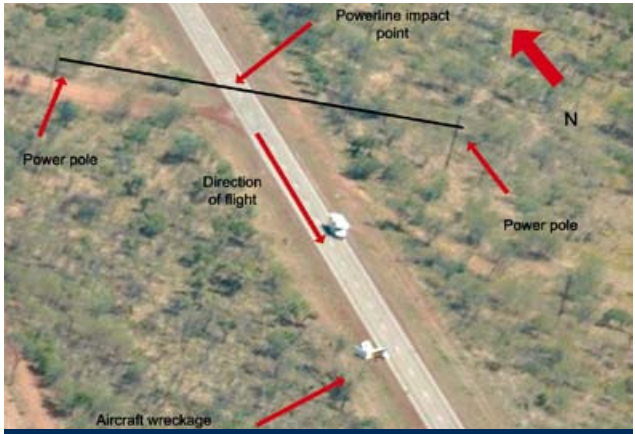
Earlier low flying by the group of tourists

Two of the three occupants held German private pilot licences and were sitting in the front seats. Neither of the pilots were approved to conduct low-level operations, and there was no evidence that either had undertaken any low-level flying training. Without approval to fly low and with no low-level training, the pilots probably had limited awareness of the hazards associated with flying low, such as impact with powerlines. Considering the remoteness of the area where the accident occurred, the pilots may not have expected to encounter man-made obstacles.

Lessons learnt

Don't forget that powerlines can be anywhere — even in the desert.

Don't give in to the temptation to get down low for a better view of the scenery. Passengers may request you to fly lower but they probably don't understand the risks. As the pilot, you are the one who needs to set the height limits.



Earlier low flying by the group of tourists

Conclusion

These case studies serve as salient reminders of the risks associated with low-level flight. Out of the seven accidents documented in this report, only one had survivors. Low-level flying is inherently unsafe for a number of reasons, so it should be avoided at all costs when there is no operational reason to do it (regardless of whether you have been trained and/or approved to do so).

Flying at low level is unsafe because:

- there are more obstacles to avoid, many of which are hard to see until it is too late (e.g. powerlines and birds)
- pilots have a higher workload because there are more hazards to negotiate in the environment
- there may be turbulence and windshear that pilots do not encounter at higher levels and
- there is very little time to recover control of the aircraft if something goes wrong.

From the accidents described here, it is apparent that the two major hazards of low flying are wirestrikes and pilots' reduced opportunity to recover their aircraft from a stall or loss of control.

It is important to keep in mind that powerlines also exist in remote areas where you least expect. For example, the pilots of the Stuart Highway accident probably did not expect powerlines in the remoteness of the Northern Territory, and the pilot of the Lake Eildon accident probably did not expect to encounter powerlines above the expanse of a large lake.

The effects of wirestrikes at low level are obvious — significant damage to the aircraft, usually leading to a loss of control and, because of the lower margin for recovery, subsequent impact with the ground or water. Pilots must keep in mind that not only do powerlines exist at low levels and in remote areas; they are also not easy to identify. Even against a clear blue sky, wires are difficult to spot for a number of reasons. Wires can oxidise to a blue/grey tinge and may blend into the background (ATSB, 2006), or the wire may be obscured by terrain. Single wires are difficult to detect from the air and can be encountered in the most unexpected places in rural areas. Even if a pilot has spotted a powerline, his or her ability to judge its distance from the aircraft can be distorted by optical illusions or a lack of nearby visual reference points.

Pre-flight assessment and planning is an important part of any flight. Make sure you have maps of your intended flight path with you when you fly, and study them before you get into your aircraft to identify any terrain, wire, or other obstacles that you need to avoid should operational circumstances necessitate

flight at low level. If you have been trained and are qualified for low flying, and *low flying is necessary*, ensure that you conduct an aerial survey of the area from an appropriate height before you conduct any low flying.

Low-level flying also presents fewer opportunities to recover from a loss of control compared to flight at higher altitudes. It takes time to react and to regain control of an aircraft, and the closer to the ground you are, the less time and distance you have. Flying at low altitudes is not only risky when things are going right; it becomes downright perilous when things are going wrong.

Before you decide to conduct low-level flying, ask yourself whether there is a legitimate or operational reason for you to do so.

References

ATSB (2006). Wire-strike Accidents in General Aviation: Data Analysis 1994 to 2004 (Re-released September 2006). Retrieved from <www.atsb.gov.au/publications/2006/wirestrikes_20050055.aspx>

Australian Government

Australian Transport Safety Bureau

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608
Australia
1800 020 616
www.atsb.gov.au

The ATSB is Australia's prime agency for independent 'no blame' transport safety investigations.
ATSB's investigations seek to identify safety issues and encourage safety action
to reduce the risk of future accidents and incidents.

Feb10/ATSB60