



Australian Government  
Australian Transport Safety Bureau

# Aerial application safety

2014–2015 year in review



Australia's national transport safety investigator

AVIATION | MARINE | RAIL

Research  
AR-2015-031



**Publication date:** July 2015

### **Publishing information**

**Published by:** Australian Transport Safety Bureau  
**Postal address:** PO Box 967, Civic Square ACT 2608  
**Office:** 62 Northbourne Avenue Canberra, Australian Capital Territory 2601  
**Telephone:** 1800 020 616, from overseas +61 2 6257 4150 (24 hours)  
Accident and incident notification: 1800 011 034 (24 hours)  
**Facsimile:** 02 6247 3117, from overseas +61 2 6247 3117  
**Email:** [atsbinfo@atsb.gov.au](mailto:atsbinfo@atsb.gov.au)  
**Internet:** [www.atsb.gov.au](http://www.atsb.gov.au)

© Commonwealth of Australia 2015



### **Ownership of intellectual property rights in this publication**

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Commonwealth of Australia (referred to below as the Commonwealth).

### **Creative Commons licence**

With the exception of the Coat of Arms, ATSB logo, and photos and graphics in which a third party holds copyright, this publication is licensed under a Creative Commons Attribution 3.0 Australia licence.

Creative Commons Attribution 3.0 Australia Licence is a standard form license agreement that allows you to copy, distribute, transmit and adapt this publication provided that you attribute the work.

The ATSB's preference is that you attribute this publication (and any material sourced from it) using the following wording: Source: Australian Transport Safety Bureau

Copyright in material obtained from other agencies, private individuals or organisations, belongs to those agencies, individuals or organisations. Where you want to use their material you will need to contact them directly.



# Introduction

This is the first publication in a series from the ATSB on aerial application (agricultural spraying and firefighting) accidents during the previous operational year (May 2014 to April 2015). Aerial application operations have a notably high accident rate relative to other aviation sectors. These operations involve inherent risks that are not present in most other types of flying. Risks include low-level flying with high workloads and numerous obstacles, in particular powerlines and uneven terrain. This report will focus on the aerial application accidents that occurred between May 2014 and April 2015 and fatal accident reports published in this period to coincide with the agriculture season in most parts of Australia.

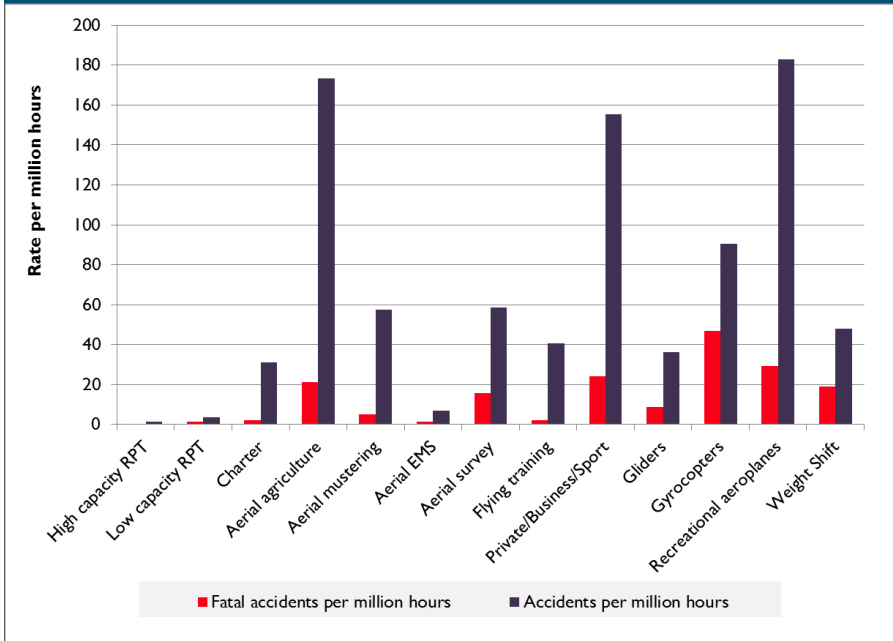




# Statistical trends in aerial agriculture

The 2014 edition of ATSB's annual *Aviation Occurrence Statistics* reported that aerial agriculture, along with (non-VH-registered) recreational aeroplanes and (VH-registered) private/business/sport operations, have the highest accident<sup>1</sup> rate per million hours flown compared with other sectors (Figure 1). These sectors also have a high fatal accident rate relative to the number of hours flown. Among the VH-registered general aviation sector, aerial agriculture had the highest accident rate of all general aviation flying at 173 per million hours flown and a fatal accident rate nearly double the general aviation average of 12.6 per million hours flown at 21.3 per million hours flown.

Figure 1: Rate of accidents and fatal accidents (Australian-registered aircraft only) by operation type, 2004 to 2012



Source: ATSB aviation occurrence statistics 2004 to 2013 (AR-2014-084)

1 Accident is defined by the *Transport Safety Investigation Act 2003* as:

- a) A person dies or suffers serious injury
- b) The aircraft is destroyed, or is seriously damaged
- c) Any property is destroyed or seriously damaged.



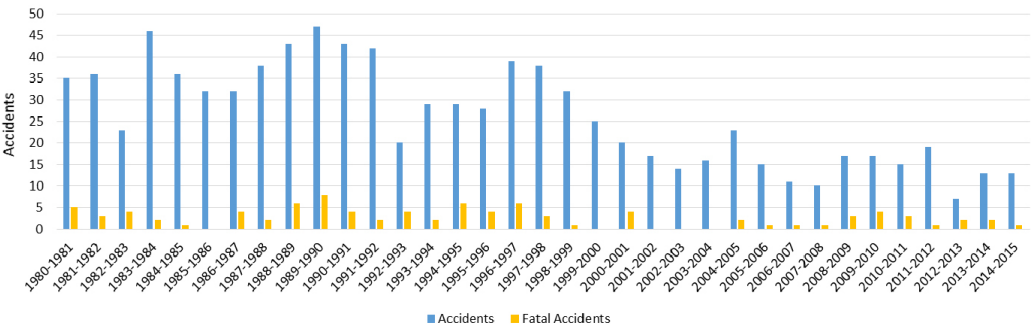


## Aerial application accident and serious incident long-term trends

The accident and fatal accident rate has fluctuated over the past 35 years (Figure 2). The 1980s and early 1990s had the highest number of accidents with the 1989–1990 aerial application year having 47 accidents. More recently, there have been fewer accidents with 2012–2013 recording the lowest number of accidents in the past 35 years with seven accidents. However, two of these seven accidents in 2012–2013 were fatal accidents.

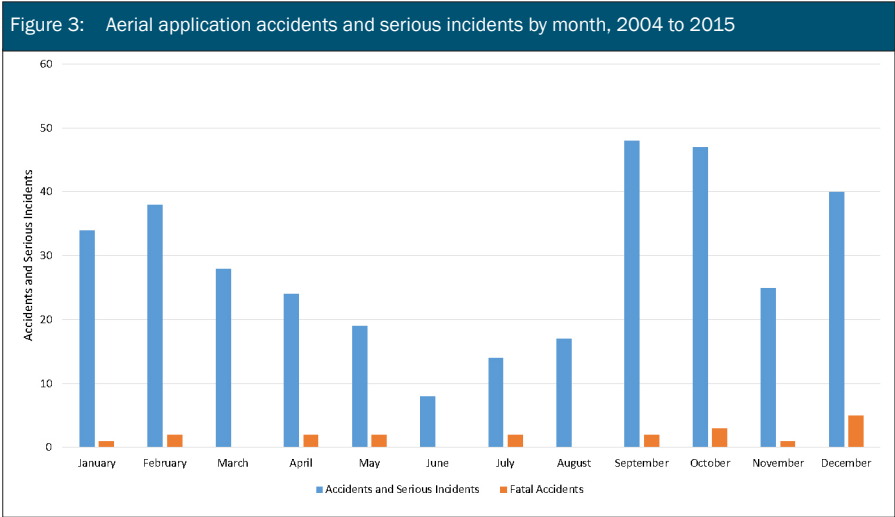
In the 2014–2015 year, there were 13 accidents, one of which was fatal.

Figure 2: Aerial application accident and fatal accident trend, 1980 to 2015

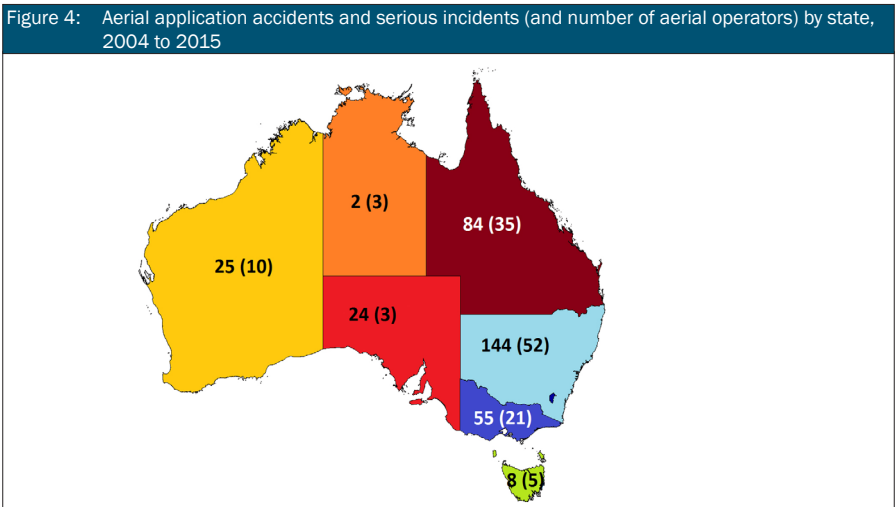




The seasonal nature of aerial application work fluctuating across the year in most parts of Australia is reflected in the numbers of safety occurrences. The highest number of accidents and serious incidents<sup>2</sup> across the past 10 years were in September and November, and the lowest are in June and July (Figure 3).



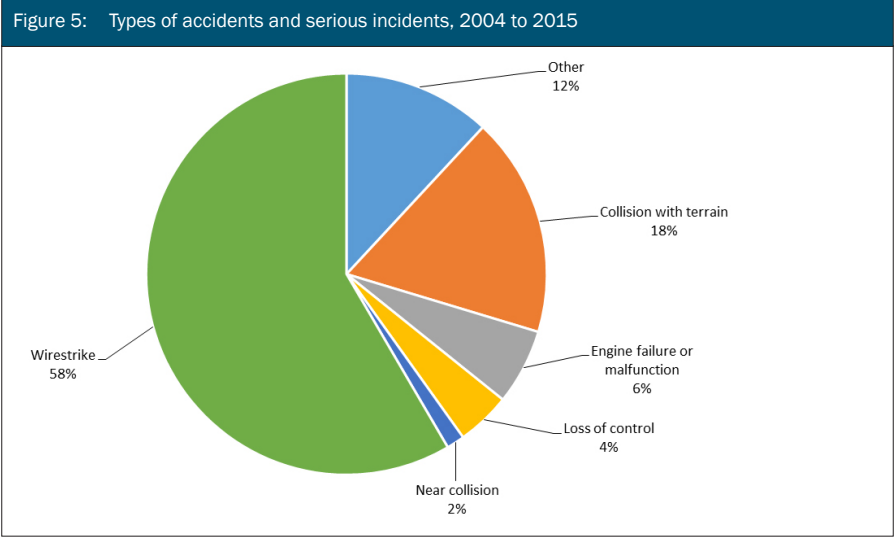
There is a large variation by state (Figure 4). Nearly double the number of accidents and serious incidents have occurred in New South Wales compared with Queensland in the past 10 years, which has the second highest accident and serious incident rate. This coincides with New South Wales having the highest number of authorised aerial application operators, followed by Queensland (numbers in brackets in Figure 4).



<sup>2</sup> Serious incident is an incident involving circumstances indicating that an accident nearly occurred.

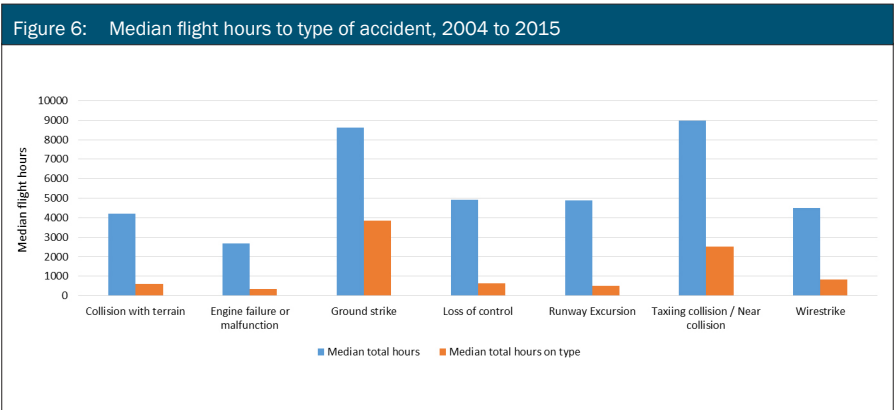


Wirestrike was the most prevalent type of occurrence with more than half of the total accidents and serious incidents involved a wirestrike over the past 10 years (Figure 5). Collision with terrain, engine failure or malfunction, and loss of control were also common types of occurrences.



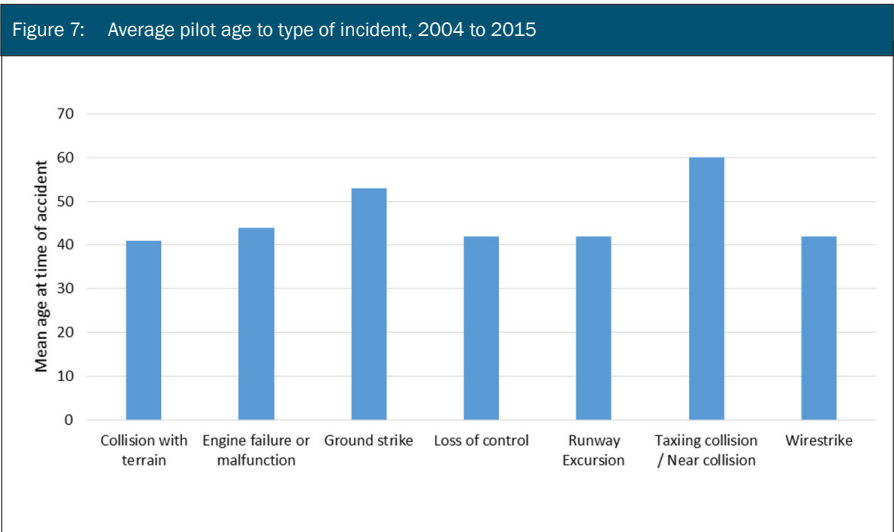
Pilots involved in accidents had a median of 4,625 flight hours, while the median flight hours on the aircraft type involved in the accident was 648 hours.

In terms of accident types, pilots involved in taxiing collisions or ground strikes (generally propeller or tail strikes during landing or take-off) had the highest flight hours (Figure 6). Pilots involved in accidents after an engine failure or malfunction had the lowest median flight hours.





Overall, the average age for pilots involved in accidents was 43 across the past 10 years. Pilots involved in collision with terrain, loss of control and runway excursion accidents tend to be younger (average of 42 years old) (Figure 7). Pilots involved in taxiing collision and ground strikes tended to be older, with an average age of 60 (taxiing collisions) and 53 (ground strikes) at time of accident.



## Aerial application occurrences in 2014–2015

There were 18 accidents or serious incidents (near accidents) reported to the ATSB in 2014–2015. Of these, 13 were accidents with one resulting in fatal injury. Of these 18 occurrences, one resulted in a destroyed aircraft and 12 resulted in substantial aircraft damage.

In total, there were 24 reported accidents and incidents in 2014–2015 involving aerial agriculture and firefighting operations. Nearly two-thirds related to human-related factors such as planning, checking and communicating (Table 1). Overall, one-quarter related to monitoring and checking issues.

Table 1: Safety factors in reported occurrences, 2014 to 2015	
Safety factor	Number of occurrences where safety factor contributed
Pilot assessing and planning	5
Pilot monitoring and checking	6
Pilot communicating and co-ordinating	3
Physical environment	3
Aircraft technical failure	3
Unknown	4
Total	24



# Fatal accident

This section covers fatal accidents involving aerial application operations investigated by the ATSB with final reports published between May 2014 and April 2015.

## **AO-2013-183: Departure from controlled flight and collision with terrain involving Ayres Corporation S2R Thrush**

In October 2013, the pilot of an Ayres Corporation SR2 Thrush was conducting aerial crop spraying operations in Western Australia.

The pilot had completed 14 spray runs that morning before stopping for lunch. After lunch, the aircraft was refuelled and reloaded with chemical mix before recommencing the operation.

The ATSB found that the aircraft departed from controlled flight about a minute after take-off from which the pilot was unable to recover, leading to the collision with terrain. Based on the evidence, it was not possible to discern the cause of the loss of control. The aircraft came to rest about 16 m east of the initial contact point. The initial impact point contained two propeller blades as well as fibreglass and aluminium sections of the nose, engine cowling and hopper. The aircraft impacted the terrain while inverted, in a right wing low attitude. The aircraft wreckage was found soon after. The aircraft was destroyed and the pilot was fatally injured.



Accident site, facing the direction of travel

Source: ATSB



## **Safety factors**

Although no definite reason for the loss of control was identified, there were two safety factors identified: using unapproved fuel mix and flying above the maximum take-off weight.

### **Unapproved fuel mix**

The fuel used in the Thrush was a 70/30 blend of diesel and aviation turbine fuel, with a fuel additive. The engine manufacturer advised that the engine was not approved to use either diesel or the fuel additive (whose purpose was to offset some of the adverse effects of diesel in turbine engines). Furthermore, there was no supplement type certificate allowing them.

Use of unapproved fuel and additive can increase the risk of engine damage and loss of power. The ATSB investigation report lists the risks reported by the engine manufacturer that running on diesel fuel instead of aviation turbine fuel will lead to.

### **Weight and balance**

The maximum take-off weight (MTOW) of a Thrush is 6,000 lbs (2,722 kg). The reported load was 600 L of fuel and 1,200 L of chemical mix. Based on the reported fuel and chemical load, plus the weight of the aircraft and pilot, the ATSB estimated the weight at take-off was about 3,855 kg (1,133 kg above its published MTOW). Additionally, the aircraft's centre of gravity was calculated to be beyond the published aircraft limit.

The effect of increasing the aircraft's weight is increasing the aerodynamic stall speed (in this case, by 12 kt). It also increases the stress on the airframe with the potential for long term structural damage or failure, and adverse aircraft handling.

### **Safety actions**

Although there were no safety issues, the Civil Aviation Safety Authority (CASA) advised that they wrote to all operators of Thrush aircraft as a reminder that there is no provision in the exemption to exceed the highest applicable MTOW as specified in:

- the aircraft flight manual or approved flight manual supplement
- an approved placard in the aircraft approved by CASA, or
- the Type Certificate or Type Certificate Data Sheet for the aircraft.



# 2014 to 2015 occurrences

Below is a summary of all occurrences involving aerial application for the May 2014 to April 2015 season. These have been grouped together based on common contributing safety factors behind the occurrences.

## Assessing and planning

Assessing and planning has been highlighted by the ATSB in all the Avoidable Accidents booklets, including *Wirestrikes involving known wires*. With particular respect to aerial application operations, although pre-flight planning is emphasised mainly due to the risk of wirestrike, other hazards exist for low-level flights, including trees and terrain as will be discussed in the investigation below. Planning includes assessing the risks that may exist during the operation and developing management strategies for those risks to be used in flight. Planning is especially important prior to commencing work in unfamiliar sites.

Effective planning can be undertaken in different ways. On a basic level, planning involves assessing your own physical fitness to fly. For instance, consider whether you have had enough sleep and whether you have consumed alcohol within the previous 24 hours. On an operational level, planning involves obtaining current and detailed maps of the area with all hazards, such as powerlines or rising terrain, clearly marked. In regards to powerlines, the power companies for that area can provide current maps identifying powerlines. The AAAA (Aerial Agricultural Association of Australia) Aerial Application Pilot's Manual also suggests the use of other tools to support maps such as GIS information or Google Earth.

Another important way to plan for the operation is to conduct a thorough briefing of the area with the property owner or other people who are familiar with the area to discuss the presence of known hazards. Planning also extends outside the normal operations, such as planning for emergencies, including suitable landing areas if a forced landing was required. In addition, identifying hazards just outside of the application site, or in the buffer zone, can be done to designate a particular area to fly to if an emergency arises. By planning, less time and effort will be required to make appropriate decisions during the high workload flying following an inflight emergency.

As important as obtaining maps and conducting a thorough briefing pre-operation, these steps should be supported by an aerial reconnaissance to confirm the locations of these hazards. Conducting an aerial reconnaissance provides an opportunity to view the hazards from different perspectives in case you fly in different directions. Furthermore, this can be supported by driving around the property to identify the hazards.



Pre-operation planning also means more time can be spent working on the spraying task in flight. This in turn reduces the operation pressures. As many aerial agriculture operations are conducted at low-levels (under 500ft), pilots have a higher workload as there are more hazards to negotiate. Consequently, there is little time to make a quick decision if the need arises.

If there is a change to the plan, then consider and assess a new plan before continuing. For example, if an unplanned spray run is given, or a planned run is extended, then another risk assessment should be conducted, including an aerial reconnaissance of the area, even if the location is the same. This is because any hazards identified in the pre-operation reconnaissance may look different or obscured if approached from a different direction. The following investigation highlights the importance of planning in aerial application operations.

### **AO-2014-142: Wirestrike involving a Robinson R66**

In August 2014, the pilot of a Robinson R66 helicopter conducted aerial spraying of a corn crop in Queensland. Prior to commencing the operation, he conducted a site inspection in a vehicle and identified powerlines on the three of the four boundaries of the paddock to be sprayed. A reconnaissance flight was then conducted to assess the visibility of the powerlines from above. He confirmed that all the powerlines he identified on the ground could be seen.

At the end of each spray run in both directions, the pilot climbed the helicopter over the powerlines on the paddock boundary. After 14 spray loads over 1 hour 45 minutes, a final clean-up run was undertaken in a perpendicular direction along the paddock boundary parallel to one of the powerlines he had been climbing over at the end of the earlier runs. Towards the end of this run, the pilot sighted approaching powerlines running across his path. By the time he saw them he realised it was too late to fly over



Damage to Robinson R66

Source: Operator



them, so he decided to fly underneath the powerlines. Given that the paddock was full of corn crops that were 6ft tall, there was limited clearance between the helicopter and the powerline. Consequently, the helicopter's main rotor blade hub struck the powerlines. The resulting collision with the ground damaged the tail boom and tail rotor blades, front of the helicopter, Perspex, seats, skids and spray gear. The pilot managed to exit the helicopter with minor injuries.

### **Attention for known hazards**

The pilot reported that he was aware of the powerline involved in the collision as he was spraying parallel to the wire throughout the operation, but forgot its presence during the final run. Furthermore, at the time of the incident, the pilot also reported that his attention was diverted towards the powerlines he had been climbing over after each run that were now parallel to the direction of flight. Although dividing attention to attend to the environment or the task of flying itself is normal, focusing on less relevant tasks or relevant tasks at the wrong time can be a distraction from the operation itself. The AAAA suggests a way to keep focus are to ask yourself:

- Where is the wire/hazards now?
- What do I do about it?
- Where am I in the paddock?

### **Reconnaissance before clean up**

Another distraction can be pressures. These can be external pressures from the client or company by encouraging the pilot to take short cuts by reducing planning, for example. Similarly, internal pressures, known as self-imposed pressure, are where pilots may feel they need to complete the job as quickly as possible and may omit safety checks in the process. This incident illustrates the consequence of possible self-imposed pressure. When under pressure, people are more likely to make mistakes, miss information, and take shortcuts. The AAAA Aerial Application Pilot's Manual suggests ways to manage pressures including giving yourself time to prioritise your day and setting a few key goals and in some cases, even saying 'no' when appropriate.

Although the pilot completed an aerial reconnaissance prior to the operation, it was not conducted prior to the clean-up run. The pilot reported that he would normally conduct an extra check of the paddock, but decided to omit it that day. By being preoccupied with completing the task quickly, a shortcut was taken which contributed to the accident. Had another aerial reconnaissance been conducted, the pilot would have been reminded of the wire and may have taken steps to avoid it. As previously mentioned, actively looking for and reminding yourself of wires before each spray run is also good practice. Cues, like the questions above, can prompt you to refocus. These can include having a note on the instrument panel as a reminder to watch for wires.

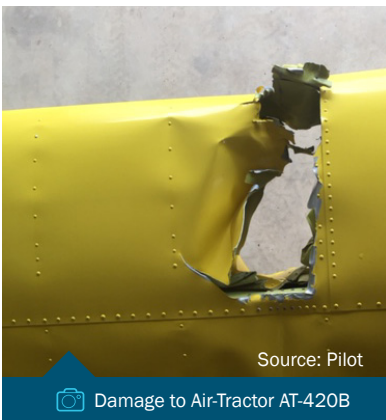
This investigation is an example of the importance of identifying hazards before the final clean-up run. The visibility of powerlines can change depending on factors including position of the sun, changes in weather conditions and the visual background behind a wire, which can change when viewed from different directions and angles.



## Other assessing and planning related occurrences

In the past year, there have also been other occurrences reported to the ATSB where assessing and planning was a contributing factor to the incident. Many of these occurrences resulted in wirestrikes. The four occurrences below all had assessing and planning related factors:

- In Queensland, the pilot of an Air Tractor AT-402B was spraying a banana crop at a new plantation. As the aircraft was descending above the crop for the first run, the left wing struck an irrigation valve controller antenna in the field. The pilot then flew back to the base and landed without incident. The pilot reported that he did not know the antenna was there and did not see it. Pre-operation planning should identify the antenna and aerial reconnaissance should identify any other hazards missed in the pre-flight planning. This incident highlights the importance of asking questions about hazards before flight, especially at new locations, and conducting an aerial reconnaissance as part of pre-operation planning (ATSB occurrence 201500797).



- During spraying operations in Victoria, the pilot of a Thrush SR2-T34 hit a new powerline resulting in a small tear to the wing. Although the pilot had sprayed this field on previous occasions, there was a new powerline in the field which he was not aware of. Planning is still important for locations familiar to pilots as there may be new hazards. Not all power generation companies supply maps of powerlines to help with planning. When not available, maps need to be manually marked with the location of powerlines through the identification by the pilot with the assistance of the land owner or others. Make the property owner aware that they must inform you of any wires that they are aware of (ATSB occurrence 201405168).
- In New South Wales, the pilot of an Air Tractor AT-502B was spraying cotton fields containing powerlines. At a junction, the pilot attempted to pass under two sets of powerlines but pulled up into the second set of powerlines. As a result, the propeller and spray boom were damaged and the three wires were severed. The powerlines



were unmarked, so although the pilot knew they were there, actively avoiding them was made much more demanding as wires are usually difficult to see. Wire markers should be installed where regular low-flying operations take place according to the Australian Standard 3891.2-2008. Furthermore, while it is the responsibility of the property owner or other person requesting the spraying to install the markers, pilots should be satisfied as to the need and effectiveness of markers prior to commencing low level operations (ATSB occurrence 201500004).

- An Air Tractor AT-802 pilot conducting aerial spraying operations in Queensland struck an unknown powerline, leading to minor damage to the aircraft. As well as the overcast weather on the day affecting the conspicuousness of the powerline, the powerline was not marked on the map provided to the pilot and he had not previously been to that farm. Pre-planning with the farmer could have identified the wire prior to any flight, but the conditions on the day would have still made avoidance difficult without markings (ATSB occurrence 201500041).

### Lessons learnt:

*Planning – and adhering to plans – during aerial operations is important to reduce the risk of an incident. As well as hazards being detected in the planning processes (both before flight and during an initial reconnaissance), adhering to plans ensures your concentration is focused on the current operation.*







Damage to air tractor 502B

Source: Pilot

## Monitoring and checking

In addition to planning prior to the operation, it is also important to constantly monitor the environment so the hazards that were identified in pre-planning can be recognised and actively avoided. Previous research on wirestrikes by the ATSB (2005) found 63 per cent of pilots were aware of the position of the wire before they struck it, demonstrating the difficulties of detecting wires. Being aware of the hazards does not guarantee you will not fly into them.

One strategy to reduce the risk of collision is to actively look for the hazards that were identified in planning and remind yourself of them. An artefact of human mental attention is that if a pilot is not specifically looking for the hazard, then it is unlikely they will notice it, even if it can physically be seen and they have been made aware of it previously.

Even when a pilot's attention is directed to noticing powerlines and other low-flying hazards, there are other limitations related to attention. Given that some operations may be monotonous in nature, the chances of noticing hazards is reduced after the first 30 minutes of the task. Vigilance again is reduced towards the end of the job when pilots may start to focus on the next job or a break. A strategy to address this is to treat the aerial reconnaissance before the clean-up run as if you are seeing the site for the first time.

Another limitation is the conspicuousness of powerlines. Because powerlines can oxidise to blue/grey, which blends into the background, it is difficult for pilots to notice them, particularly if they are single wires. Conspicuousness can be further hampered by the environmental conditions, including position of the sun, background camouflage and poor weather. There are also visual limitations, as it is very difficult to judge the distance of the powerline from the aircraft when there are few visual reference points. To address some of the physical limitations, power companies have included wire markers on powerlines and some aircraft have wire-strike protection. Finally, given the difficulties



in noticing wires, do not rely on your ability to detect an unmarked wire visually. This is especially compounded by the speed of the aircraft and the time it takes to recognise the hazard and make a decision.

Wires are not the only obstacle aerial application pilots need to monitor. As seen in the incident above, irrigation infrastructure can be equally hazardous. Sudden changes in terrain height, trees, and other obstacles, as will be seen below, are other low flying hazards whose conspicuousness can similarly be affected by environmental conditions.

### **AO-2014-191: Controlled flight into terrain involving an Air Tractor AT-502B**

In December 2014, the pilot of an Air Tractor AT-502B aircraft was conducting aerial cotton spraying operations in New South Wales, along with two other aircraft. The operation was planned in parallel patterns and the Air Tractor's path included a very large storage dam at the eastern edge of the field. During this time, the sun was rising but otherwise the weather was clear. The pilot passed over the dam wall once while heading east while the sun was behind clouds on a pre-spray run to set up the aircraft's GPS. A westerly spray run was conducted after passing over the dam. The first easterly spray run was conducted with the sun now free of clouds and directly in the pilot's eyes. A shadow on the dam wall's western-side was observable, but the top of the dam wall was difficult to distinguish from the surrounds.

Towards the end of the spray run, the pilot noticed more weeds to be sprayed so he decided to extend the run to include them. The pilot started to climb about 5 ft above the cotton height. At 30 ft, the aircraft's landing gear collided with the storage dam wall, making contact about 60 cm below the top of the earthen wall. He saw that the left flap had partially detached from the wing and was hanging at an angle and that the right flap had detached completely. He also observed a large quantity of fuel escaping from the ruptured left fuel tank.

The pilot then slowly dumped the chemical load while monitoring the flight characteristics of the damaged aircraft. He assessed the options of landing immediately but elected to return to the airstrip on the property about 4 km away, mindful that he





may need to conduct a forced landing at any time. A pilot operating nearby advised that the landing gear was no longer attached.

The aircraft was landed on a dirt road parallel to the airstrip. Both landing gear struts had been detached, which had then broken off the right flap, damaged the left flap and ruptured both fuel tanks. During the landing the propeller was damaged. The pilot was uninjured.

### **Pre-operation hazard identification**

There was some planning undertaken prior to commencing the operation. This included deciding the aircrafts' spraying path and the dam the aircraft collided with was marked on the work order provided to the pilots at the start of the day. However, the wall itself was not marked nor was it even identified as a hazard. Had the hazard posed by the location of the dam wall been made more salient to the pilots pre-operation, the spraying paths could have been organised to avoid the wall. Furthermore, planning should also involve consideration of the environment. It was reported in the investigation that the pilot's spray run was conducted east-west-east to avoid a neighbouring property. However, during this time the sun was rising and the glare made it difficult to see, even with a sun visor.

### **Distractions from changing plans**

Towards the end of the spray run, the pilot sighted weeds south of the aircraft and changed his planned flight to extend the run to spray them. He had also considered spraying them later, on the final spray run. While he considered his options, he had shifted the focus of his attention away from the dam wall, assuming that he would be well clear of it. Not only does keeping with plans mean that the task is more efficient, it also means attention can be maintained on the current task. This is especially evident in this occurrence as the pilot had shifted his focus away from the dam wall when the aircraft collided with it.

### **Other monitoring and checking related occurrences**

The five occurrences below are other examples where monitoring and checking was a factor in the incident:

- Before conducting aerial spraying operations in Victoria, the pilot of a Bell 206B helicopter completed an aerial reconnaissance of the paddock and was aware of powerlines. During the initial spray run, the pilot was attending to the spray boom pressure gauge. As he looked up he noticed approaching powerlines, but it was too late to avoid them and the helicopter struck the wire. The strike resulted in damage to the windscreen, wirestrike kit, main rotor blade, main rotor mast and nose mounted mirror. This incident highlights the dangers of distractions at low levels as there is little time to recover. If you need to adjust the boom pressure or any other action in the cockpit, fly at a height which ensures clearance of any obstacles (ATSB occurrence 201500715).
- A Cessna T188C (Ag Husky) was conducting an aerial application job in Western Australia. The location of the job included powerlines situated among trees and intersecting at various angles making it difficult to plan the operation. The high



number of wires in the treatment area also increased pilot workload. During the operation, the aircraft dropped after coming over some trees and struck one of the powerlines, collecting the aircraft at the top of the windscreen, then cutting through the rudder and kinking the vertical stabiliser. The remaining chemical load was dumped and the pilot returned the aircraft to the closest airstrip. The pilot was uninjured (ATSB occurrence 201406868).

- The pilot of an Air Tractor AT-502 was conducting aerial spraying of a wheat crop in New South Wales. Whilst descending into a field, the pilot lost sight of a powerline as the grey wire blended in with the brown wheat stubble and the wire was subsequently caught in the tyre of the aircraft. The wire was pulled off the pole and it started a small grass fire which was quickly extinguished. There was no damage to the aircraft and the pilot was uninjured (ATSB occurrence 201409806).
- During landing in Victoria, the pilot of the Rockwell S-2R (Thrush Commander) did not notice a car parked inappropriately at the end of the runway until the very short final approach. When it was noticed, the pilot tried to land left of the centre line to avoid flying low over the car. However, due to the runway surface having a new hot mix seal, braking was ineffective and the aircraft veered off the runway, running through a ditch and colliding with a fence resulting in damage to the propeller and landing gear. This occurrence highlights the importance of monitoring for unexpected hazards which will always be more difficult to notice in a timely manner than expected hazards (ATSB occurrence 201500601).
- During aerial agriculture operations in Western Australia, the pilot of an Aerospatiale AS350BA (Ecureuil) helicopter repeatedly flew over a powerline for 2 hours. However, the helicopter struck the powerline on a return run while letting down into the application area over some trees. The aircraft had minor damage to the blades. Lack of concentration was a reported factor. This occurrence highlights the importance in monitoring the presence of previously identified wires (ATSB occurrence 201409518).

### **Lessons learnt:**

*Identifying hazards during planning is essential, but cannot be relied upon if you do not direct your attention towards them during the operation. This is not easy during continued operation and poses an ongoing challenge for aerial application pilots.*





Rockwell S-2R

Source: ATSB

## Communicating and co-ordinating separation

Given the large scale of some aerial agriculture and firefighting operations, multiple aircraft can be involved in completing the task. In addition, despite the often remote locations, even when only one aircraft is being used for spraying, there still may be other aircraft in the vicinity operating for different reasons. In these cases, communication and co-ordination among the relevant parties is important to organise the operation to ensure efficiency and safety. This also allows for parties to confirm plans or pass on new information about the operation.

### **AO-2015-023: Collision after landing involving a Fletcher FU-24 and a Gippsland GA-200 (Fatman)**

In February 2015, the pilot of a Fletcher FU-24 and pilot of a Gippsland GA-200 were conducting aerial agriculture operations in New South Wales. They were working in an alternating sequence to spread fertiliser. To reload, each of the aircraft were landing on different but crossing runways (bearings of 240 degrees and 190 degrees) where the loader was located.

After nearly 3 hours of operation, including re-loading both aircraft at different times, both aircraft returned to the loading area. On final approach, the pilots of both aircraft, now both returning to separate runways, looked to see whether the other pilot was also returning. As they each did not see the other aircraft, they both assumed the other pilot was still spreading fertiliser.

During the landing, the pilot of the FU-24 noticed the loader truck was not in the normal loading position and was momentarily distracted. While on the landing roll, the pilot of the GA-200 sighted the FU-24 about 10m from his right wing. Now also on a landing roll on the converging runway, the pilot of the FU-24 pilot looked back from the loader



to the front of the aircraft just as the propeller collided with the right wingtip and tail of the GA 200. There was substantial damage to both the aircraft. There was damage to the propeller of the FU-24 and damage to the wing tip and tail of the GA-200. Both pilots were uninjured.

### **Communication pre-operation and during the operation**

One of the pilots reported that this incident highlights the importance of conducting a thorough briefing as part of pre-operation planning. Active discussion of the operation pre-flight allows for pilots to discuss their flight paths, the location of any hazards on site and as relevant to this accident, separation requirements. It also allows for the opportunity to confirm the understanding of other parties involved in the operation.

Although both aircraft were equipped with radios, they were switched off to avoid distraction. While this enhanced safety in one area, another factor to consider was the visibility of the aircraft. In this investigation, it was reported that despite both pilots having switched on their aircraft's landing lights, the aircraft also blended in with the brown country side and were difficult to sight. Strobe lighting on the aircraft may have helped with the conspicuousness. Operating without using radios relies heavily on actively looking for and sighting other aircraft without knowing which direction it may be coming from. Notwithstanding the elimination of distractions by turning the radio down or off, using a radio reduces visual search effort needed by the pilots as they can direct their visual scan for other hazards in the relevant direction.



Damage to GA-200

Source: Aircraft operator



The Civil Aviation Safety Authority (CASA) Safety Behaviours Human Factors: Resource Guide for Pilots suggest ways to assist in safety-critical communication that may be relevant in this case:

- using aids (such as logs, computer displays) to help accurate communication
- allow sufficient time for communication
- encourage two-way communication with both the giver and recipient of the information taking responsibility for accurate communication.

Furthermore, the use of radios during the operation also provides the opportunity to reconfirm the flight plans. It was reported that the pilot of the GA-200 had forgotten that the FU-24 was landing on a different runway. This is another example of the importance of monitoring and checking within an operation and means that pilots do not need rely on assumptions. Overall, this investigation highlighted the role of communication as part of both assessing and planning, and monitoring and checking.

### **Other communicating and aircraft separation occurrences**

Communication was also a contributing factor in the two occurrences below:

- During aerial firebombing operations in Victoria, the crew of a Cessna 208 Caravan unexpectedly observed a glider, which was being flown at low level orbiting to gain height over the grass fire which was being fire bombed. It was reported that the glider was also initially in conflict with a helicopter. The crew of the C208 tried to contact the glider through multiple radio frequencies, but all attempts were unsuccessful and they had to manoeuvre to maintain separation (ATSB occurrence 201409424).
- In Victoria, a Bell 206 helicopter returning to aerial spraying operations of a pine tree crop nearby was observed to pass underneath and in close proximity to a hang glider on a reciprocal path. Given that hang gliders use a different radio frequency to aircraft, communication was not possible (ATSB occurrence 201500513).

#### **Lessons learnt:**

*Communication is important in parts of aerial agriculture and firefighting operations, including planning to convey information to relevant parties, and during the operation to reiterate the plan and notify parties of any new information arising during the task. Do not rely on other pilots communicating, and always scan for other aircraft even when you are at remote locations.*



## Other factors

The following occurrences relating to aerial application operations were reported to the ATSB in 2014–2015.

### Environment

The below three occurrences were related to external conditions such as runway conditions and weather.

- During landing on a wet runway in Victoria, the pilot of an Air-Tractor AT-401B was unable to brake sufficiently and the aircraft collided with the loading vehicle resulting in propeller and engine damage to the aircraft (ATSB occurrence 201403849).
- During take-off on a runway with loose gravel in Queensland, the pilot of a Cessna T188C Ag Husky lost directional control of the aircraft. Subsequently the left wing struck sugar cane resulting in substantial damage to both wings, elevator and main landing gear. The pilot was uninjured (ATSB occurrence 201501206).
- During approach to the runway in Queensland, the hopper lid of an Ayres S2R-R1820 detached from the aircraft during turbulent weather conditions (ATSB occurrence 201407819).



Damage to Air Tractor AT-401B

Source: Pilot



## Technical failure

The three occurrences reported to the ATSB below concerned technical issues with the aircraft:

- During landing after spreading fertiliser in New South Wales, the pilot of the Air-Tractor AT-802A applied the rudder-pedal foot brakes. While doing so, a pivot bolt for the right brake failed resulting in brake locking and the left brake releasing. The aircraft veered off the runway and the wing struck a channel bank. There was substantial damage to the right wing, aileron, throttle quadrant and aircraft spreading equipment. The pilot was uninjured (ATSB occurrence 201405994).
- During aerial ignition operations in Tasmania, the crew of the Eurocopter AS350B2 (Ecureuil) received an engine-out and hydraulic system warning and a precautionary landing was conducted. The engineering inspection revealed a hydraulic pressure sensor failed (ATSB occurrence 201404606).
- A Bell AMT UH-1H was conducting fire water bombing operations in New South Wales. When the bucket was being lifted from the dam, the cargo hook malfunctioned resulting in the line and bucket falling from the aircraft into the dam (ATSB occurrence 201409555).

## Communicating in controlled airspace

The following two occurrences were reported by Air Traffic Control involving fire control aircraft flying to/from metropolitan aerodromes. Both involve limitations with communication based on the information reported:

- During departure in New South Wales, the Aerospatiale AS350B2 (Ecureuil) helicopter switched frequencies without clearance and was not able to be contacted by ATC (ATSB occurrence 201404543).
- During landing in Western Australia, a Bell 412 and Cessna 182 Skylane were operating on opposite direction circuits for landing on the same runway. The ATC tower had not opened for operation, but air traffic controllers were in the tower and noticed the conflict and issued a safety alert to the aircraft. The pilot of the Bell 412 adjusted the helicopter's path to maintain separation (ATSB occurrence 201409793).

## Ongoing investigations:

The following investigations are in the preliminary stages. The results of these investigations will be updated in future editions of this publication.

### **AO-2013-187: In-flight breakup involving PZL M18A Dromader aircraft**

In October 2013, the pilot of a PZL Mielec M18A Dromader took off to conduct a firebombing operation in New South Wales with two other aircraft, another firebombing aircraft and a support helicopter. About 25 minutes later the aircraft approached the target point by turning left and once the aircraft's wings were rolled level, the left wing separated. The aircraft immediately rolled left and descended, colliding with terrain. The aircraft was destroyed by impact forces and the pilot was fatally injured.





M18 Dromader outboard left wing (underside of wing visible, lower attach fitting arrowed)

Source: ATSB

On-site examination found the left wing had separated at the attachment joint between the outboard wing and centre wing sections. Preliminary examination of the attach fittings indicated that the left outboard wing lower attachment lug had fractured through an area of pre-existing fatigue cracking in the lug lower ligament. The fatigue cracking reduced the structural integrity of the fitting to the point where operational loads produced an overstress fracture of the remaining lug material.

An interim investigation report was released in December 2013. In that report, the ATSB identified the following safety issue:

Operators of some Australian M18 Dromaders, particularly those fitted with turbine engines and enlarged hoppers and those operating under Australian supplemental type certificate (STC) SVA521, have probably conducted flights at weights for which airframe life factoring was required but not applied. The result is that some of these aircraft could be close to or have exceeded their prescribed airframe life, increasing the risk of an in-flight failure of the aircraft's structure.

The ATSB also issued a safety advisory notice to all M18 operators (Action number: AO-2013-187-SAN-005):

The Australian Transport Safety Bureau cautions M18 operators of the risks associated with not reliably applying service life factoring to any overweight operations in this aircraft type. It is suggested that operators review the extent to which their aircraft may have been operated above 4,700 kg, and whether the correct service life factoring has been applied to such operations throughout its full operational life.





Fire bombing operations

Source: AAAA

#### **AO-2015-030: Collision with terrain involving a Piper PA-25 Pawnee**

In March 2015, the pilot of a Piper PA-25 Pawnee was conducting insect baiting operations in Victoria. Witness reports state the Pawnee rolled left then right before descending. Out of sight of witnesses, the Pawnee impacted terrain about 40 minutes after take-off. The pilot was fatally injured and the aircraft was destroyed by impact forces and a post-impact fire.

#### **AO-2015-037: Wirestrike involving a Robinson R44**

In April 2015, a Robinson R44 helicopter struck a powerline resulting in substantial damage during aerial weed spraying operations in South Australia. The pilot was uninjured.



# Reporting to the ATSB

Accidents and safety incidents such as those presented above are reportable to the ATSB under Section 18 and 19 of the *Transport Safety Act 2003*. Upon receiving notifications of accidents and incidents, the ATSB may choose to conduct a no-blame safety investigation. These aim to improve safety by understanding what contributed to the occurrence and identifying system issues that can be addressed through safety action. Even if it is not investigated, reported incidents are used by the ATSB to monitor trends and look for sector-wide system issues that are shown through multiple reports of similar occurrences. With your reports, the ATSB hopes to identify issues early on before they lead to accidents.

## Immediately reportable matters

Accidents and serious incidents are immediately reportable matters, and must, in the first instance, be notified to the ATSB by telephone toll-free call on 1800 011 034.

Immediately reportable matters include all accidents involving death, serious injury, destruction of, or serious damage to the aircraft or property or when an accident nearly occurred. The reason for this immediate notification requirement is in the cases where the ATSB conduct a safety investigation, ATSB investigators need to act as quickly as possible to preserve evidence and to determine the proximal and underlying factors that led to the occurrence.

Immediately reportable matters must also be reported to the ATSB in writing within 72 hours. This can be done by completing a form online at [www.atsb.gov.au/mandatory/asair.aspx](http://www.atsb.gov.au/mandatory/asair.aspx).

## Routine reportable matters

A routine reportable matter is a transport safety matter that has not had a serious outcome and does not require an immediate report but transport safety was affected or could have been affected. Routine reportable matters must be reported to the ATSB in writing within 72 hours. This can be done by completing a form online at [www.atsb.gov.au/mandatory/asair.aspx](http://www.atsb.gov.au/mandatory/asair.aspx).

Routine reportable matters include a non-serious injury or when the aircraft suffers minor damage or structural failure that does not significantly affect the structural integrity, performance characteristics of the aircraft and does not require major repair or replacement of the affected components.

## Reporting a safety concern confidentially

REPCON (REPort CONFidentially) is a voluntary and confidential reporting scheme. REPCON allows any person who has an aviation safety concern to report it to the ATSB confidentially. Protection of the reporter's identity and any individual referred to in the report is a primary element of the scheme.



The following safety concerns in relation to aircraft operations may be reported under REPCON. The list is not exhaustive:

- an incident or circumstance that affects or might affect the safety of aircraft operations
- a procedure, practice or condition that a reasonable person would consider endangers, or, if not corrected, would endanger, the safety of air navigation or aircraft operations
- any other matter that affects, or might affect the safety of or aircraft operations not reportable under a mandatory reporting scheme above.
- REPCON reports can be submitted on the telephone 1800 020 505, email [repcon@atsb.gov.au](mailto:repcon@atsb.gov.au) or online [www.atsb.gov.au/voluntary/repcon-aviation.aspx](http://www.atsb.gov.au/voluntary/repcon-aviation.aspx).

**Table summary of 2014–2015 aerial application occurrences**

<b>ATSB number</b>	<b>Occurrence types</b>	<b>Safety factors</b>	<b>Aircraft type</b>	<b>State</b>
201403849	Collision with vehicle	Runway / movement area surface	Air-Tractor AT-401	Vic.
201404543	Air-ground-air, Operational Non-compliance	Unknown	Aerospatiale AS350 (Ecureuil)	NSW
201404606	Warning Devices, Forced / Precautionary landing,	Technical failure (Mechanical discontinuity)	Eurocopter AS350 (Ecureuil)	Tas.
201405168	Wirestrike	Assessing and planning, Procedures	Thrush SR2	Vic.
201405994	Landing gear/ indication, Collision with terrain, Runway Excursion,	Technical failure (Fracture)	Air-Tractor AT-802	NSW
201406230 (AO-2014-142)	Wirestrike, Collision with terrain,	Monitoring and checking, Assessing and planning	Robinson R66	Qld
201406868	Wirestrike, Diversion / return	Monitoring and checking, Other physical environment	Cessna T188 (Ag Husky)	WA
201407819	Objects falling from aircraft	Turbulence	Ayres S2R	Qld
201409424	Air-ground-air communication, Aircraft separation issues	Communicating and coordinating - External	Cessna 208 (Caravan)	Vic.
201409518	Wirestrike, Forced / Precautionary landing	Monitoring and checking	Aerospatiale AS350 (Ecureuil)	WA
201409555	Objects falling from aircraft	Unknown	Bell AMT UH-1H	NSW



<b>ATSB number</b>	<b>Occurrence types</b>	<b>Safety factors</b>	<b>Aircraft type</b>	<b>State</b>
201409793	Air-ground-air communication, Aircraft separation issues	Communicating and coordinating – External, Assessing and planning	Bell 412 and Cessna 182 Skylane	WA
201409806	Wirestrike	Monitoring and checking	Air Tractor AT-502	NSW
201409896 (AO-2014-191)	Controlled flight into terrain, Diversion / return	Light conditions, Distractions, Monitoring and checking, Incorrect task information	Air Tractor AT-502	NSW
201500004	Wirestrike	Assessing and planning	Air Tractor AT-502	NSW
201500041	Wirestrike	Assessing and planning, Visibility, Procedures	Air Tractor AT-802	Qld
201500513	Aircraft separation issues	Assessing and planning, Procedures	Bell 206	Vic.
201500601	Runway excursion, Collision with terrain	Runway /movement area surface, Monitoring and checking, Assessing and planning	Rockwell S2R (Thrush Commander)	Vic.
201500644 (AO-2015-023)	Collision (aircraft to aircraft)	Assessing and planning, Monitoring and checking, Distractions	Fletcher FU-24 and Gippsland GA-200 (Fatman)	NSW
201500715	Wirestrike, Forced / Precautionary landing	Monitoring and checking	Bell 206	Vic.
201500797	Controlled flight into terrain, Diversion / return,	Assessing and planning	Air Tractor AT-402	Qld
201501029 (AO-2015-030)	Collision with terrain	To be determined (ongoing investigation)	Piper PA-25 (Pawnee)	Vic.
201501206	Loss of control, Runway Excursion	Runway / movement area surface, Aircraft handling	Cessna T188 (Ag Husky)	Qld
20151355 (AO-2015-037)	Wirestrike	To be determined (ongoing investigation)	Robinson R44	SA



# About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB 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; fostering safety awareness, knowledge and action.

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 fare-paying passenger operations.

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.



## Further reading

Aerial Agriculture Association of Australia. *Aerial Application Pilots Manual*.

Australian Transport Safety Bureau (2005). *Wire-strike Accidents in General Aviation: Data Analysis 1994 to 2004*.

Retrieved from [www.atsb.gov.au/publications/2006/wirestrikes\\_20050055.aspx](http://www.atsb.gov.au/publications/2006/wirestrikes_20050055.aspx)

Australian Transport Safety Bureau (2009). *Avoidable Accidents No. 1: Low-Level Flying*.

Retrieved from [www.atsb.gov.au/publications/2010/avoidable-1-low-level-flying.aspx](http://www.atsb.gov.au/publications/2010/avoidable-1-low-level-flying.aspx)

Australian Transport Safety Bureau (2011). *Avoidable Accidents No. 2: Wirestrikes Involving Known Wires: A Manageable Aerial Agriculture Hazard*. Retrieved from [www.atsb.gov.au/publications/2011/avoidable-2-ar-2011-028.aspx](http://www.atsb.gov.au/publications/2011/avoidable-2-ar-2011-028.aspx)

Australian Transport Safety Bureau (2014). *Aviation Occurrence Statistics 2004 to 2013*. Retrieved from [www.atsb.gov.au/publications/2014/ar-2014-084.aspx](http://www.atsb.gov.au/publications/2014/ar-2014-084.aspx)

Civil Aviation Safety Authority. *Safety Behaviours Human Factors: Resource Guide for Pilots*.

Civil Aviation Safety Authority (2014). *Sector Risk Profile for the Aerial Application Sector*. Retrieved from [www.casa.gov.au/wcmswr/\\_assets/main/media/download/sector-risk-profile-aerial-app-sector.pdf](http://www.casa.gov.au/wcmswr/_assets/main/media/download/sector-risk-profile-aerial-app-sector.pdf)

To view a short video on wirestrikes on ATSB's YouTube channel, visit [www.youtube.com/watch?v=R5UI9YPDuk4](http://www.youtube.com/watch?v=R5UI9YPDuk4)



## **Australian Transport Safety Bureau**

**24 Hours** 1800 020 616

**Web** [www.atsb.gov.au](http://www.atsb.gov.au)

**Twitter** @ATSBinfo

**Email** [atsbinfo@atsb.gov.au](mailto:atsbinfo@atsb.gov.au)