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Aviation Occurrence Statistics 2003 to 2012

Research

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Addendum

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Safety summary

Why have we done this report

Thousands of safety occurrences involving Australian-registered and foreign aircraft are reported to the ATSB every year by individuals and organisations in Australia's aviation industry, and by the public. The aim of the ATSB's statistical report series is to give information back to pilots, operators, regulators, and other aviation industry participants on what accidents and incidents have happened, how often they are happening, and what we can learn from them.

What the ATSB found

In 2012, there were 107 accidents, 195 serious incidents, and over 7,300 incidents reported to the ATSB involving Australian (VH– registered) aircraft, and a further 570 occurrences that involved foreign-registered aircraft operating within Australia or its airspace.

Commercial air transport aircraft were involved in the majority of incidents reported each year, and in 2012 the most common safety incidents reported were animal strikes, non-compliance with publish information or air traffic control instructions, and aircraft system and airframe issues. Most accidents and serious incidents related to reduced aircraft separation and engine malfunction.

General aviation aircraft, such as aircraft conducting flying training, aerial work, or private/pleasure flying, were involved in 38 per cent of occurrences reported to the ATSB in 2012. Airspace incursions, compliance with air traffic control, and birdstrikes were the most common incidents reported, with most accidents and serious incidents involving terrain collisions, engine failures, and a loss of aircraft control. Private/business operations had the highest number of fatal accidents in 2012 out of any year in the last 10 years, with 15 fatal accidents resulting in 22 fatalities. In contrast, commercial aerial work operations recorded the lowest number of accidents in the past 10 years.

In most operation types, helicopters had a higher rate of accidents and fatal accidents than aeroplanes.

A new addition to the ATSB's aviation statistics are data on recreational (non–VH) aircraft safety. In 2012, the majority of the 274 occurrences reported were controlled airspace incursions, engine malfunctions, aircraft control problems, and runway events such as veer-offs.

Over the past 10 years, aerial agriculture had the most accidents and fatal accidents per hour flown, followed by private/business operations. Aerial survey and aerial mustering had the next highest accident and fatal accident rates.

Safety message

Aviation occurrence statistics provide a reminder to everyone involved in the operation of aircraft that accidents, incidents, and injuries happen more often than is widely believed. Some of the most frequent accident types are preventable, particularly in general aviation. Pilots and operators should use the misfortunes of others to help identify the safety risks in their operation that could lead to a similar accident or serious incident.

Timely and thorough reporting of safety incidents is paramount. The ATSB's capability to understand why accidents and incidents happen and to identify the major safety risks in different types of aviation operations is at its best when all aviation participants report all safety incidents. The information the ATSB provides helps everyone in the aviation industry to better manage their safety risk.

Contents

Context

Each year, the Australian Transport Safety Bureau (ATSB) receives accident and incident notifications from pilots, airline operators, air traffic control, maintenance personnel, aerodrome operators, emergency services authorities, and from the general public. The reporting of these aviation accidents and incidents, collectively termed occurrences, assists the ATSB in monitoring safety through its core functions of independent investigation and the analysis of data to identify emerging trends.

The types of occurrences that are required to be reported to the ATSB are detailed in the Transport Safety Investigation Regulations 2003 ('the Regulations'). Depending on the seriousness of the event (in terms of the potential to cause injury or damage) and the category of operation, these occurrences are categorised as either immediately reportable matters (IRMs) or routine reportable matters (RRMs). To see the full list of IRMs and RRMs, visit the ATSB's website at www.atsb.gov.au/about_atsb/legislation.aspx.

Aviation occurrence statistics are updated and published annually by the ATSB, and can be subject to change pending the provision of new information to the ATSB. When using these statistics, it is important to remember that occurrence data is provided to the ATSB by responsible persons as defined in Part 2.5 of the Regulations. The ATSB accepts no liability for any loss or damage suffered by any person or corporation resulting from the use of these statistics.

Activity data

The overall number of safety occurrences alone does not represent a complete picture of aviation safety. For meaningful comparisons to be made between different types of aircraft and the operations they perform, aviation occurrence statistics are often presented as a rate per million hours flown or per million departures.

The Bureau of Infrastructure, Transport and Regional Economics (BITRE) collect and compile this activity data from reports submitted by airlines, and from other aircraft operators through the *General Aviation Activity Survey*.

Activity data used to calculate rates in this report can be found in Table 1 and Table 2. This data is rounded to the nearest thousand hours (or thousand departures) to present the size or magnitude of the data in more general terms.

Activity data for some sports and recreational aviation, such as parachutes and hang gliders, is not tabled in this report. Specific activity data for movements of non-Australian (foreign) registered aircraft is limited, but is tabulated where available.

Departures

Aircraft departures are widely used as a measure of exposure, that is, the opportunity for an event to occur within a certain amount of flying activity. This report uses departure data for calculating accident and fatal accident rates for all air transport operation types and general aviation (as a whole). Where figures are available, departures are considered to be a more appropriate exposure measure than hours flown as most accidents occur either during the approach and landing or departure phases of flight.

Departures data is not available for individual operation types within general aviation (GA). At the time of publication, departures were available to 2012 for Australian registered high and low capacity[1] regular public transport (RPT) operations and for foreign-registered air transport, and to 2011 for other operation types.

[1] A high capacity aircraft refers to an aircraft that is certified as having a maximum capacity exceeding 38 seats, or having a maximum payload capability that exceeds 4,200 kg. See *Appendix A – Explanatory notes*.

Table 1: Departures (thousands), 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
All commercial air transport	1,182	1,225	1,307	1,268	1,317	1,311	1,272	1,372	1,369	N/A
High capacity (VH-registered)	327	380	405	421	439	491	488	528	532	561
Low capacity (VH-registered)	204	204	199	180	168	141	127	132	134	134
Charter (VH-registered, estimated)[2]	616	600	659	623	666	632	608	661	650	N/A
Foreign-registered	35	42	45	44	44	47	48	50	53	54
All general aviation	2,124	1,974	2,261	1,811	1,793	1,958	1,841	1,993	1,861	N/A

Commercial air transport operations have shown a gradual increase in departures across the last 10 years, up until 2011 which at the time of writing was the last year that total flying activity data was available (Figure 1). Within air transport, high capacity RPT departures have increased in most years since 2003, and showed a marked increase in 2012 (over five per cent) when compared to the previous year (Figure 2). Low capacity RPT departures have decreased over the last 10 years, although the number of departures has increased slowly in each year since 2010. Charter departures have remained relatively static. A small, gradual increase in foreign registered aircraft departures has been observed over the last decade.

[2] Charter departures are estimated because departures are not recorded separately for different types of operations in the BITRE *General Aviation Activity Survey.* The estimation model calculates the rate of departures per hour flown for aircraft that only perform charter operations. It then uses this ratio to estimate the number of charter-related departures for all aircraft based on the number of charter hours flown. Ratios are specific to aircraft type (aeroplane or helicopter) and number of engines (single or multi-engine).

As high capacity charter aircraft activity is not routinely separated from RPT operations, the real number of charter departures will be slightly different than those reported here. However, it is unlikely to significantly influence rate-based statistics.

Charter balloon departures are not included in this figure.

Figure 1: Departures by operation type, 2003 to 2011

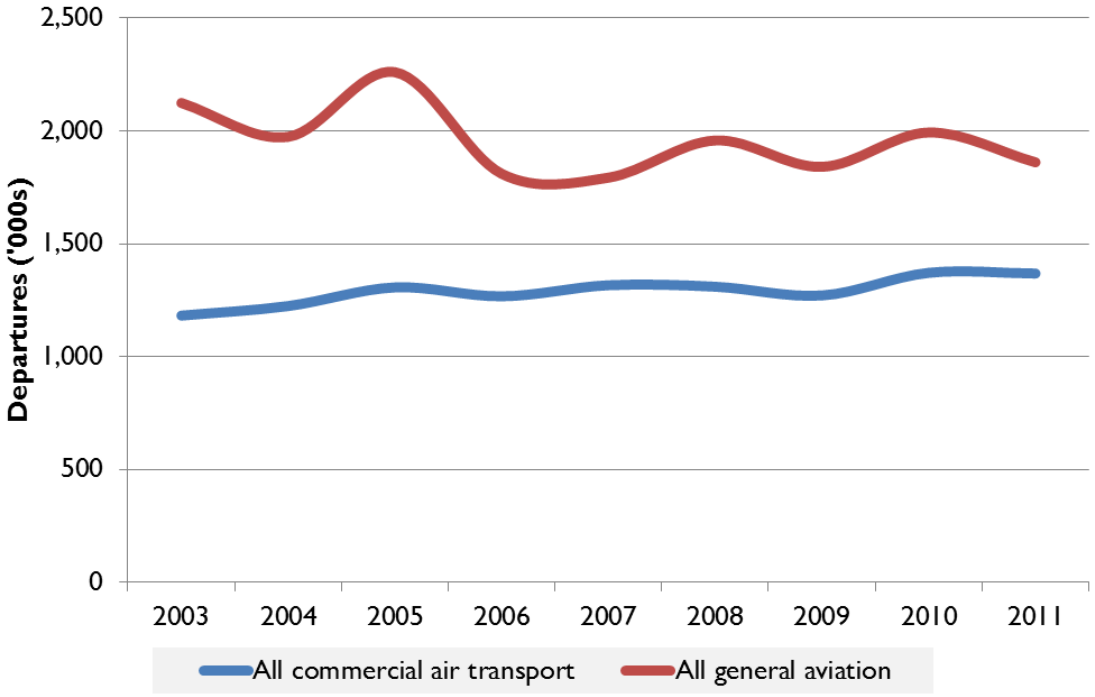
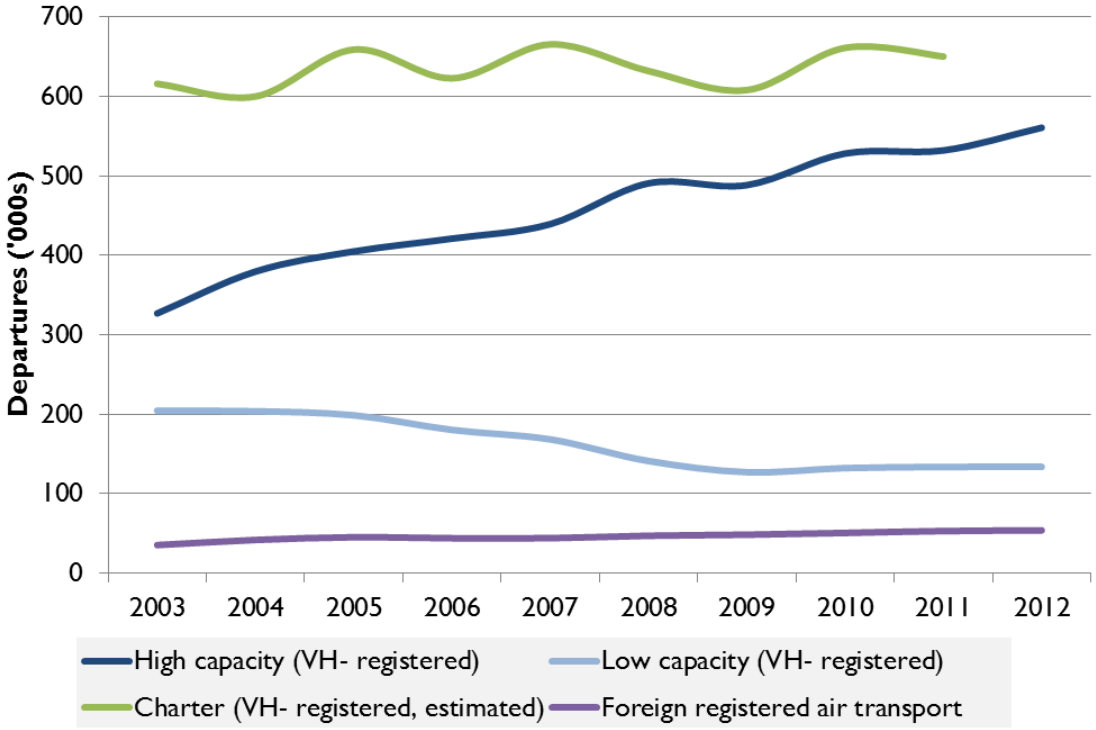


Figure 2: Departures in commercial air transport, 2003 to 2012



Hours flown

While departures are generally used as a measure of exposure for commercial air transport operations, hours flown is considered to be a more useful measure of exposure than departures for some operation types within general aviation because of the higher risk of an accident outside of the approach/landing and take-off phases of flight (for example, agricultural and search and rescue aircraft are required to perform low flying as part of normal operations).

Table 2 records thousands of hours flown by operation type[3] for Australian (VH-) registered aircraft. At the time of publication, hours flown data was only available to the end of 2011 for most operation types, but was available to 2012 for high and low capacity RPT.

Table 2: Hours flown (thousands), 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
All commercial air transport	1,379	1,563	1,623	1,633	1,733	1,768	1,702	1,838	1,862	N/A
High capacity (VH- registered)	759	883	944	979	1,027	1,122	1,129	1,220	1,256	1,307
Low capacity (VH- registered)	197	205	202	181	167	133	109	116	126	128
Charter (VH- registered)	423	475	478	474	539	513	464	502	480	N/A
All general aviation	1,214	1,161	1,238	1,214	1,284	1,337	1,336	1,338	1,284	N/A
All Aerial work	404	412	426	412	445	464	446	514	509	N/A
Aerial Agriculture	70	86	95	62	62	78	73	104	100	N/A
Aerial Mustering	100	103	113	102	113	113	106	118	126	N/A
Aerial EMS	68	69	69	79	75	82	81	90	88	N/A
Aerial Search & Rescue	4	5	7	7	9	9	7	6	7	N/A
Aerial Survey	53	34	33	45	54	64	38	58	68	N/A
Flying training	425	357	420	429	461	490	501	440	391	N/A
Private/Business	385	393	391	374	379	382	390	384	384	N/A

There was little change in commercial air transport flying activity in 2011 when compared to 2010 (in terms of hours flown), while fewer hours were flown in GA (Figure 3). Within air transport, high capacity RPT retained the lion's share of commercial air transport flying, and the number of hours flown increased in every year between 2003 and 2012. The number of hours flown in low capacity RPT increased in 2011 when compared to 2010, but remained static in 2012. Charter hours flown decreased in 2011 by about five per cent when compared to activity in this sector in 2010 (Figure 4).

[3] Hours flown are not recorded individually for all types of aerial work that are reported on in these statistics (such as fire control). Hours flown for several categories of aerial work are not collected by BITRE, so hours flown for 'all aerial work' includes additional types of aerial work categories to those shown in Table 2.

The *General Aviation Activity Survey* collects test and ferry hours as a separate category, but this data is not associated with a type of operation. To take account of this condition, test and ferry hours are distributed across charter, aerial work, flying training and private/business operations, based on the expected proportion of test and ferry flights in those categories. Private/business is assigned 11 per cent, flying training 11 per cent, charter 21 per cent, and aerial work is assigned the remaining proportion.

Figure 3: Hours flown by operation type, 2003 to 2011

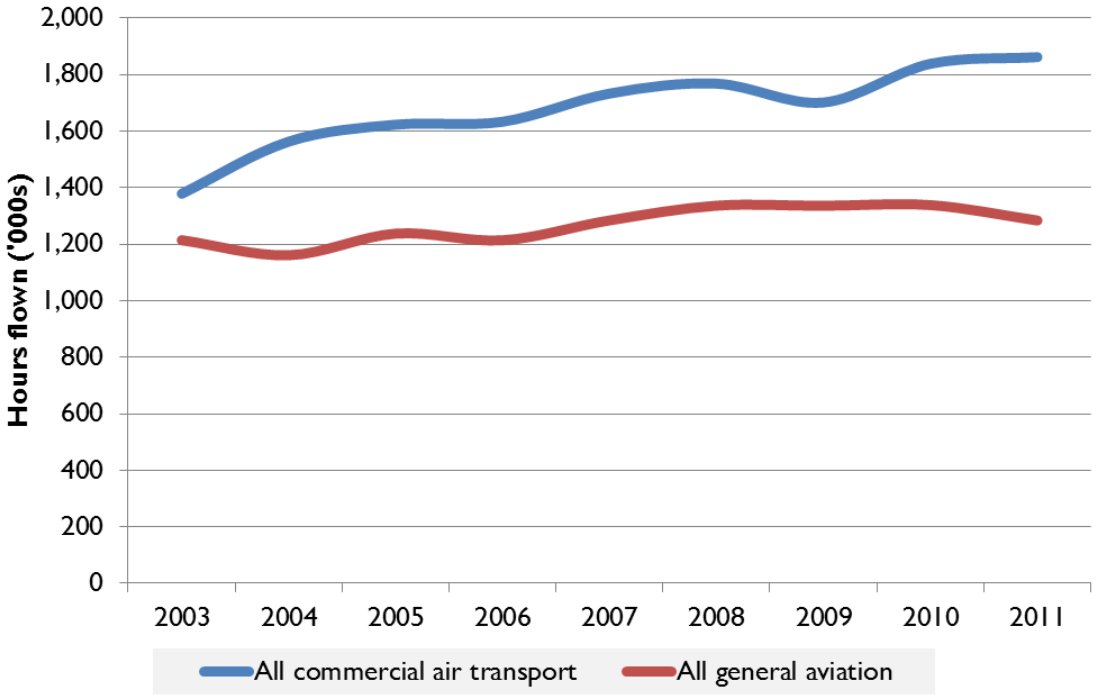


Figure 4: Hours flown in commercial air transport, 2003 to 2012

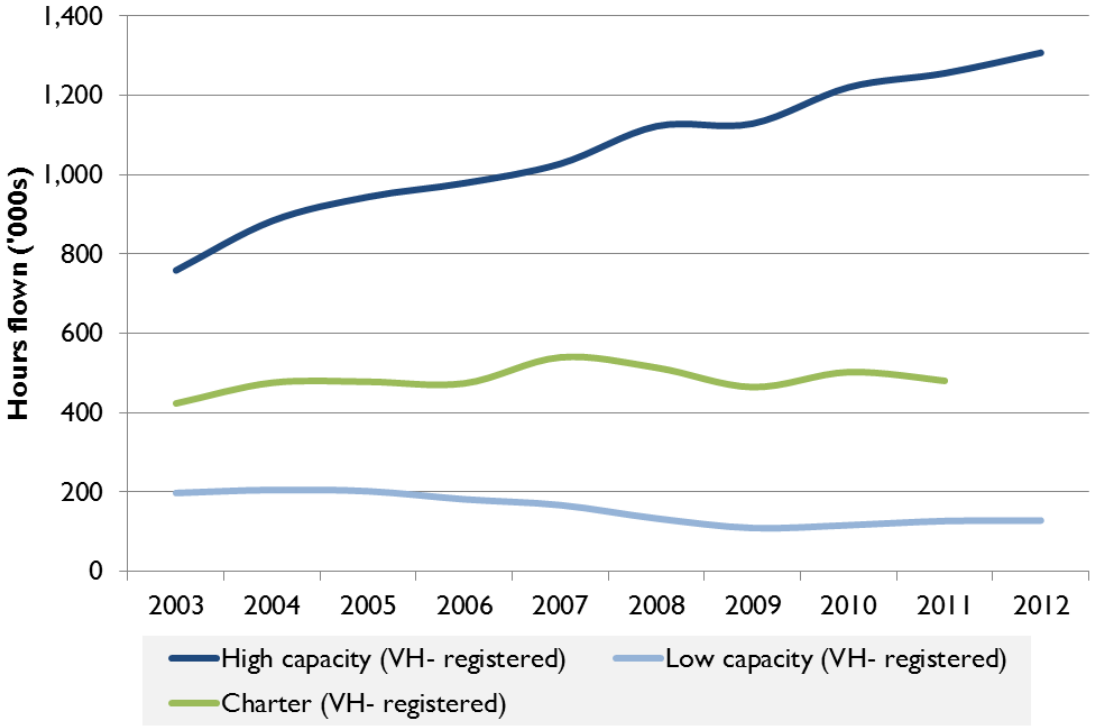
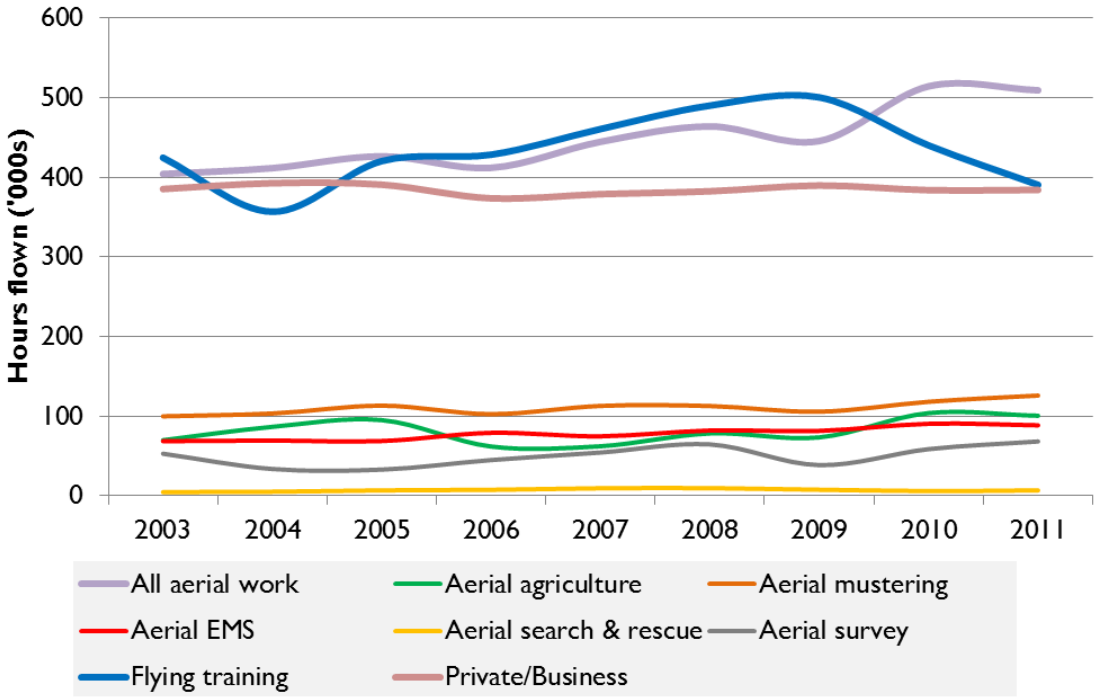


Figure 5 shows a comparison of flying activity across general aviation. The total number of hours flown in GA in 2011 (the most recent year for which data was available at the time of writing) was about the same as the number of hours flown by high capacity RPT operators in the same year. Of the different types of GA flying, aerial work collectively made up about 40 per cent of all GA hours flown in 2011. Flying training and pleasure flights (private, business, and sport aviation) were the largest individual GA operation types.

Flying training has had a marked reduction in flying hours from 2009 (501,000 hours) to 2011 (391,000 hours). Almost all other types of GA operations showed a slight decrease in flying activity in 2011 when compared to the year before. The exceptions to the general decline were aerial mustering (six per cent increase) and survey/photography operations (17 per cent increase in hours flown).

Figure 5: Hours flown in general aviation, 2003 to 2011



More aviation activity statistics are available from the BITRE at www.bitre.gov.au.

Collision with terrain, Guimbal Cabri G2 helicopter (VH-ZZT), Camden Airport, New South Wales (ATSB investigation AO-2012-055)

Occurrences by operation type

Occurrence numbers and rates presented in the statistics in this section relate to the following operational types:

- **Commercial air transport** - high capacity regular public transport (RPT) flights, low capacity RPT flights, and charter flights
- **General aviation** - aerial work operations, flying training, and private, business and sports aviation (VH– or foreign-registered)
- **Recreational aviation –** aircraft being used for recreational flying that are registered by a recreational aviation administration organisation (RAAO).

Aircraft involved in these occurrences included both Australian civil registered aircraft (both VH– aircraft, and aircraft registered by recreational aviation organisations) operating within or outside of Australian territory[4], and foreign registered aircraft operating within Australian territory. For further information on how the statistics in this report were treated, and how these operational types are defined by the ATSB, see *Appendix A – Explanatory notes*.

Table 3 compares the number of fatal accidents and fatalities for commercial air transport, general aviation, and recreational aviation, and each of their subtypes. Fatal accidents in some aircraft operations are more likely to have a greater number of associated fatalities than in other operation types. For example, aircraft used for agricultural operations usually have only the pilot on board (so the number of fatal accidents was the same as the number of fatalities over the last 10 years), whereas survey/photography aircraft generally have a pilot, as well as camera operators or navigators, on board (there were twice as many fatalities as fatal accidents in the last 10 years).

In 2012, private and business aviation continued to have the highest number of fatal accidents and associated fatalities of any type of aviation operation, and the number of fatal accidents increased compared to 2011. Fatal accidents and fatalities in aerial work dropped by two-thirds in 2012 compared to the previous year, notably in survey and photography operations.

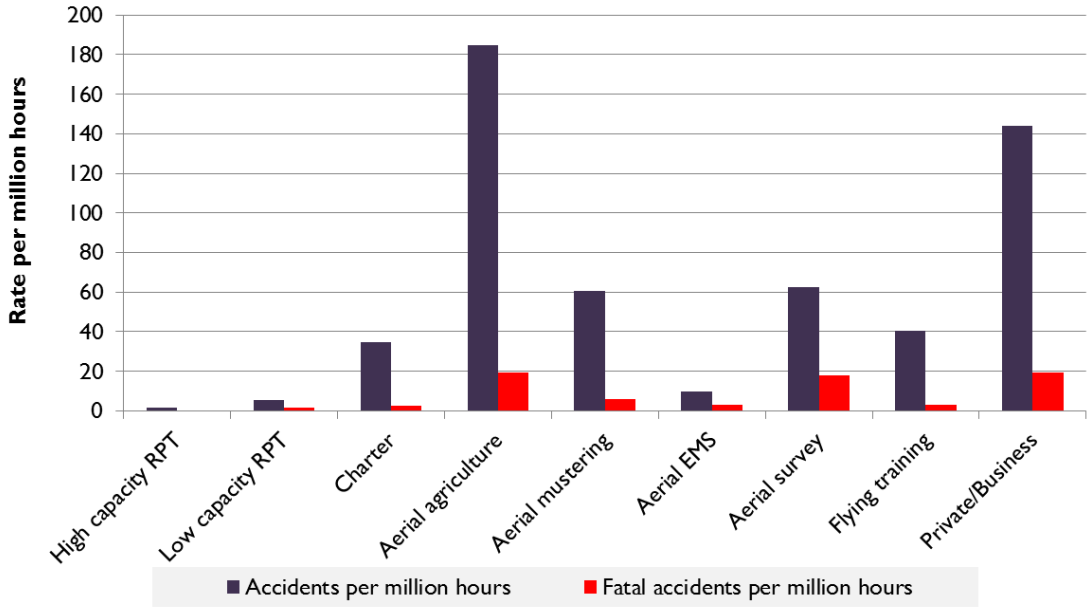
[4] Australian territory refers to mainland Australia, the land areas of Tasmania and Australia's offshore territories. It also includes territorial waters, and coastal waters to the 12 nautical mile limit.

Table 3: Fatal accidents and fatalities by operation type, 2003 to 2012

Operation type	Number of aircraft associated with a fatality	Number of fatalities
Commercial air transport	**14**	**41**
High capacity RPT	0	0
Low capacity RPT	2	17
Charter	12	24
General aviation	**158**	**249**
Aerial work	42	57
Agriculture	*16*	*16*
Mustering	*6*	*7*
Emergency medical service (EMS)	*2*	*4*
Fire control	*2*	*2*
Survey and photography	*8*	*16*
Other/unknown	*8*	*12*
Flying training	13	19
Private/Business/Sport	101	170
Private/Business	*82*	*147*
Sport aviation	*19*	*23*
Foreign registered general aviation	2	3
Recreational aviation	**72**	**89**

Figure 6 below shows the rate of accidents and of fatal accidents for each of the specific operation types[5] over this period per million hours flown. General aviation operation types had higher accident rates when compared to air transport operations, with aerial agriculture and private/business flights the most likely to be involved in an accident. These operation types were also the most likely to result in a fatal accident when considering the amount of flying activity, although aerial survey and photography flights were involved in a much higher proportion of fatal accidents than other types of operations. More detailed information on accident rates for each operation type is provided in the following sections of this report.

Figure 6: Rate of accidents and fatal accidents (VH- registered aircraft only) by operation type, 2003 to 2011[5]



[5] Activity data for each operation type is provided by the Bureau of Infrastructure, Transport and Regional Economics (BITRE), except for the following where information on hours flown and number of departures was not collected between 2003 and 2011: Fire control, Other/unknown GA, Sport aviation, Foreign registered GA.

Accident and fatal accident rates are based on those accidents from 2003 to 2011 only, as activity data was not yet available for 2012 at the time of writing.

Commercial air transport

In 2012, there was a notable increase in the number of serious incidents involving commercial air transport aircraft when compared to the year before (Figure 7). This increase was driven by more serious incidents involving aircraft conducting charter work. Serious incidents are indicators of events that almost led to accidents. As such, they represent occurrences which could have had more serious consequences.

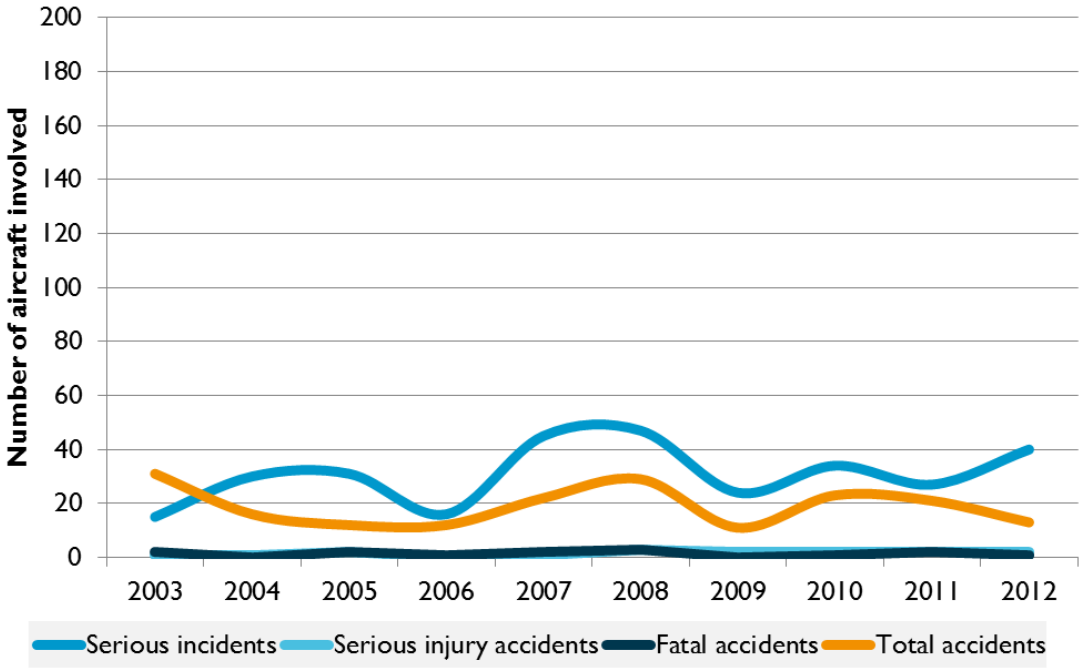
While there was a small increase in the number of fatal accidents in charter operations (no fatalities or serious injuries occurred in high or low capacity RPT in 2012), the number of accidents overall in commercial air transport in 2012 was one of the lowest recorded in the last 10 years. There was a corresponding fall in the commercial air transport accident rate in 2012 when compared to 2011 (Figure 8).

Table 4 shows that the number of commercial air transport incidents reported to the ATSB in 2012 was the highest in the last 10 years (and the highest on record).The year on year increase in incidents reported involving commercial air transport aircraft reflects more flying activity in this sector of aviation, changes to industry reporting requirements over the last 10 years, as well as improvements in reporting culture and awareness.

Table 4: All commercial air transport occurrences (VH- and foreign registered aircraft), 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	2,692	3,458	4,116	3,709	3,915	4,047	3,867	4,532	4,931	5,067
Serious incidents	15	30	31	16	45	47	24	34	26	40
Serious injury accidents	1	1	2	0	1	3	2	2	2	2
Fatal accidents	2	0	2	1	2	3	0	1	2	3
Total accidents	31	16	12	12	22	29	11	23	21	13
Number of people involved										
Serious injuries	4	1	2	0	1	15	3	2	2	2
Fatalities	8	0	18	2	2	6	0	2	2	3
Rate of aircraft involved										
Accidents per million departures	26.2	13.1	9.2	9.5	16.7	22.1	8.7	16.8	15.3	N/A
Fatal accidents per million departures	1.7	0	1.5	0.8	1.5	2.3	0	0.7	1.5	N/A

Figure 7: Commercial air transport occurrences and injuries, 2003 to 2012



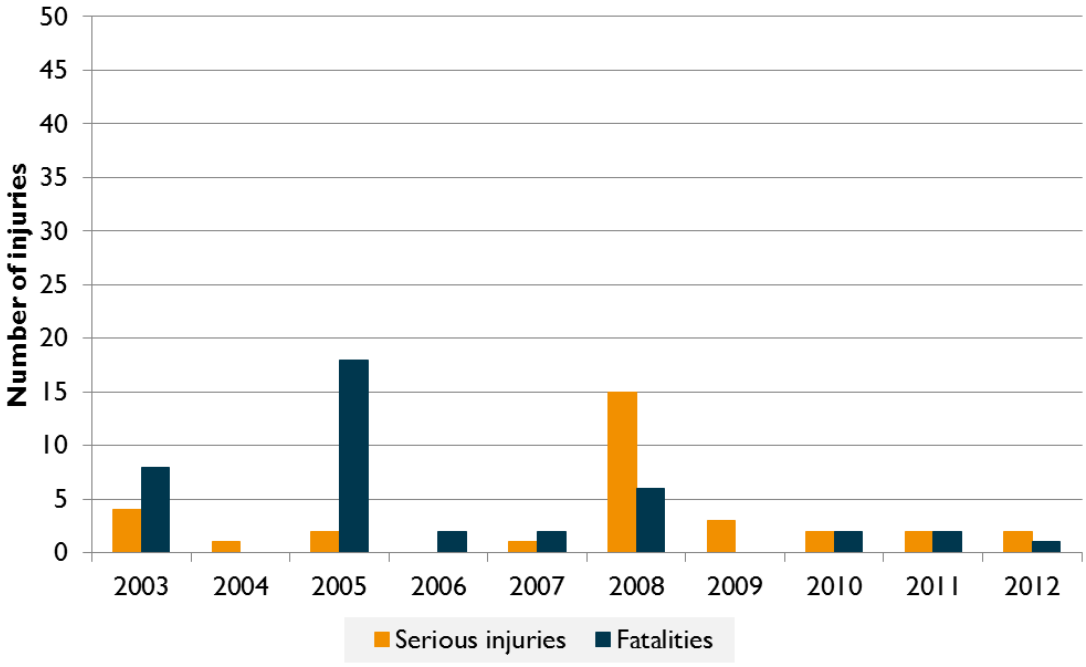
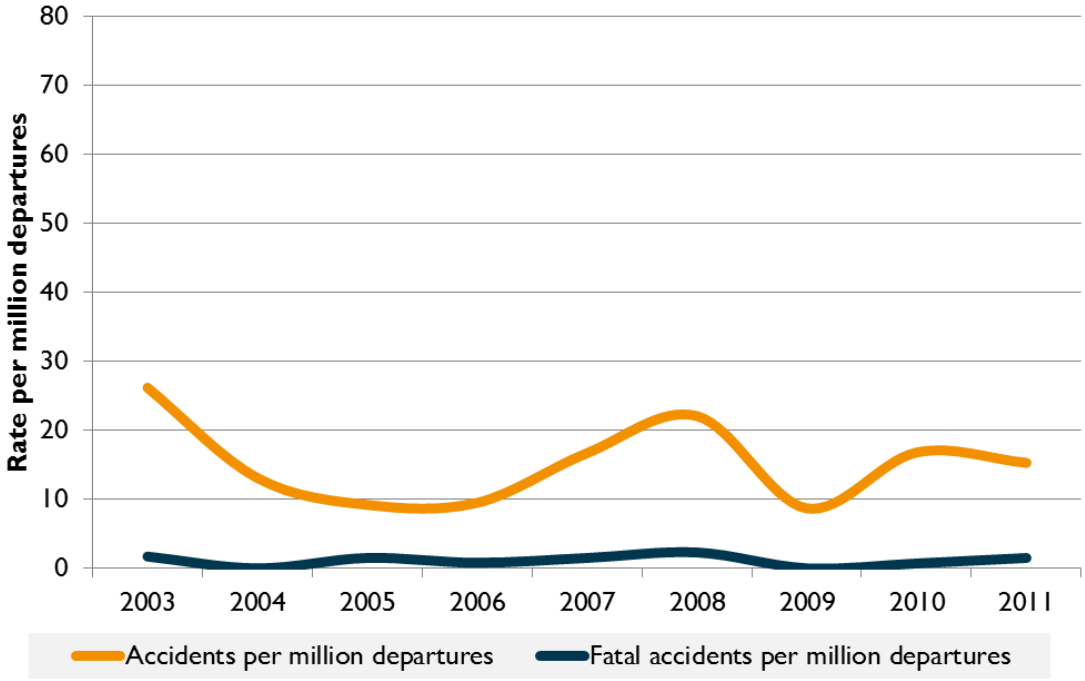


Figure 8: Commercial air transport accident and fatal accident rate (per million departures), 2003 to 2011



High capacity RPT (VH- registered)

The number of incidents reported to the ATSB by Australian airlines over the last 10 years has risen significantly, with more than twice as many occurrences involving VH- registered high capacity RPT aircraft reported in 2012 when compared to 2003 (Table 5). When considering this increase, it is important to note that flying activity in high capacity RPT has increased steadily across this period (in fact, departures rose 72 per cent from 2003 to 2012).

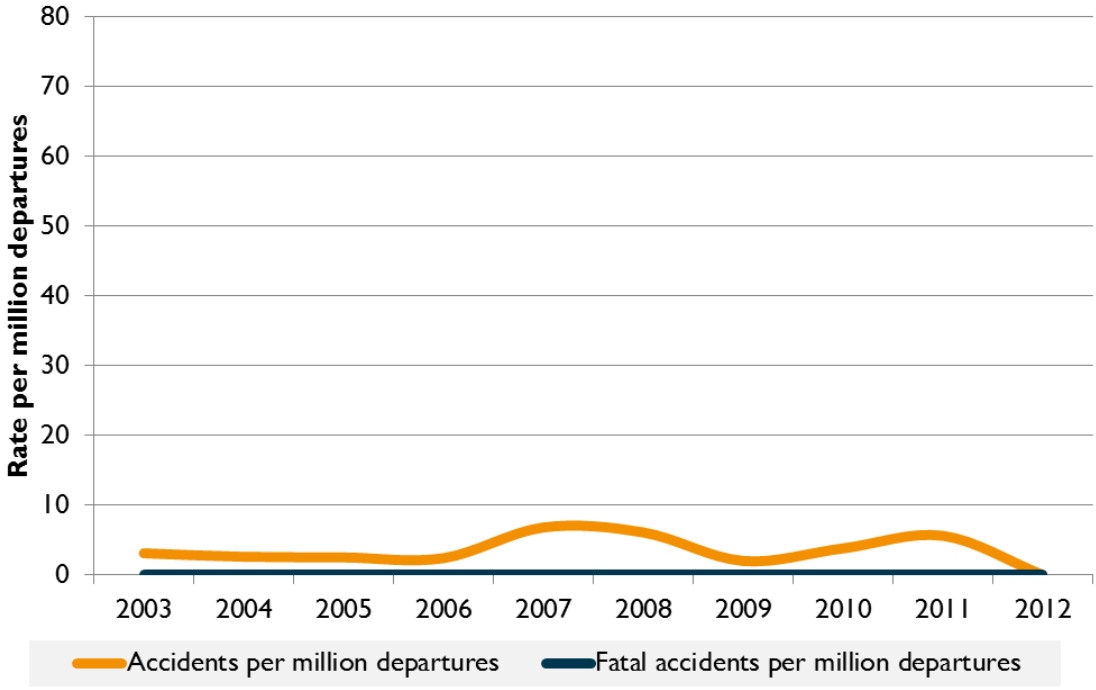
No fatalities involving VH- registered high capacity RPT aircraft have occurred in almost 40 years. The last fatal accident, which occurred in 1975, involved the collapse of a Boeing 707 nose gear during pushback at Sydney Airport. The nose of the aircraft fell onto the roof of the tug cabin, crushing the driver.

While there were no accidents in this operation type in 2012 (Figure 9), the number of aircraft involved in serious incidents has remained fairly constant across the past three years.

Table 5: High capacity RPT (VH- registered aircraft) occurrences, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	1,478	1,976	2,392	2,184	2,244	2,455	2,407	2,880	3,264	3,468
Serious incidents	6	10	11	4	16	20	9	13	11	12
Serious injury accidents	1	0	1	0	1	1	1	2	1	0
Fatal accidents	0	0	0	0	0	0	0	0	0	0
Total accidents	1	1	1	1	3	3	1	2	3	0
Number of people involved										
Serious injuries	4	0	1	0	1	12	1	2	1	0
Fatalities	0	0	0	0	0	0	0	0	0	0
Rate of aircraft involved										
Accidents per million departures	3.1	2.6	2.5	2.4	6.8	6.1	2	3.8	5.6	0
Fatal accidents per million departures	0	0	0	0	0	0	0	0	0	0
Accidents per million hours	1.3	1.1	1.1	1	2.9	2.7	0.9	1.6	2.4	0
Fatal accidents per million hours	0	0	0	0	0	0	0	0	0	0

Figure 9: Accident rate for high capacity RPT aircraft (VH- registered) (per million departures), 2003 to 2012



There were 10 serious incidents across all high capacity RPT operations in 2012 (involving 12 VH-registered aircraft, and three foreign-registered high capacity RPT aircraft). These primarily involved situations where the separation procedure being used by air traffic control was not maintained or correctly applied, resulting in a reduced safety margin between a high capacity RPT aircraft and another aircraft. Those that involved foreign-registered aircraft are discussed separately on page 29. Those involving Australian VH- registered aircraft are discussed below:

- A Boeing 737-800 was on a required navigation performance approach (ARBEY STAR) for runway 27 at Melbourne Airport, while a GAF N22 Nomad was conducting bushfire management survey work 15 NM to the north east of the airport. Air traffic control (ATC) advised the Nomad flight crew, who were operating under visual flight rules (VFR) and tracking westbound, to remain clear of the 737 on approach, but the controller did not correctly assign a visual separation standard. Shortly afterwards, the 737 flight crew received a traffic advisory on the aircraft's traffic collision avoidance system (TCAS) with an aircraft 600 ft below and 3 NM away, followed by a resolution advisory to adjust vertical speed. The autopilot disconnected, and the flight crew reduced their vertical speed until the aircraft had passed. The ATSB is investigating this serious incident (ATSB investigation AO-2012-029).
- A Boeing 737-800 was enroute from Sydney to Darwin, and a foreign registered Airbus A330 was enroute from Melbourne to Shanghai. Both aircraft were operating at FL360, and on converging northbound tracks. As the aircraft approached Tindal, Northern Territory, a loss of separation occurred when the distance between the aircraft reduced to about 3.5 NM before vertical separation was established. The incident occurred about 16 minutes after a handover to the air traffic controller responsible for the sector. The ATSB conducted a short investigation into this serious incident, and as part of that investigation, a number of incidents involving handovers were identified. Airservices Australia advised the ATSB that they had amended the handover procedure to require supervision and for the relinquishing controller to remain at the console to provide assistance until the accepting controller indicated that assistance was no longer required. The incident highlighted the importance of separation assurance and thorough handovers between air traffic controllers (ATSB investigation AO-2012-048).
- Near Chinchilla, Queensland, the flight crew of an Airbus A320 cruising at FL260 from Brisbane to Darwin received a TCAS resolution advisory to descend, and advised ATC. As the flight crew descended the aircraft, they saw a Beech King Air beneath them flying in the opposite direction. The controller passed traffic information on the King Air, but by this stage the aircraft had already passed. There was no other traffic nearby. The ATSB did not investigate this serious incident, but Airservices Australia reviewed audio and radar data and determined that no ATC issues contributed to the loss of separation (ATSB occurrence 201207686).
- An Airbus A330 travelling westbound near Narrogin, Western Australia at FL380 came within 4.9 NM of an eastbound A330 climbing to FL410 on reciprocal tracks. The aircraft were separated by 700 ft vertically. At 15 NM separation, ATC noticed that the aircraft were in conflict, and both were given avoiding action. This serious incident was investigated by the ATSB (ATSB investigation AO-2012-161).
- Separation was lost between a Bombardier DHC-8 and an opposite direction Cessna 560 at the same level overhead Thangool, Qld. After receiving a short term conflict alert (STCA), ATC issued traffic information and turn instructions to both aircraft to re-establish separation. This serious incident was not investigated by the ATSB (ATSB occurrence 201211284).

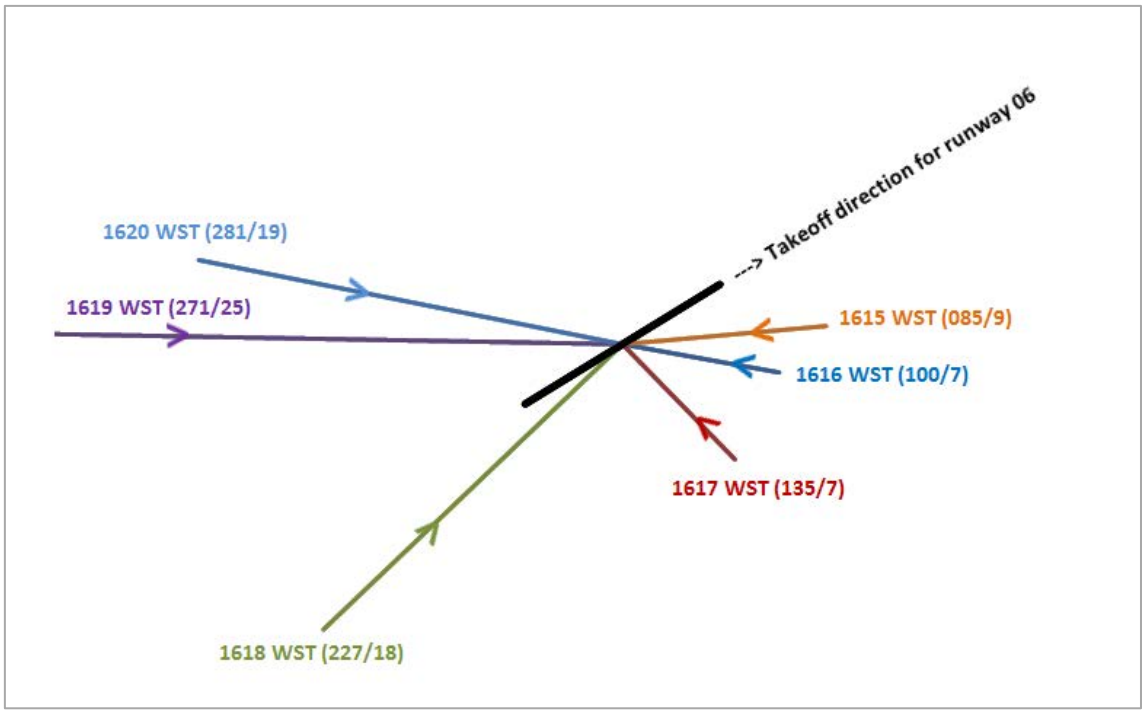
In October 2013, the ATSB will release a review into all loss of separation occurrences in Australia since 2008. That investigation looked at trends and common elements across loss of separation occurrences (locations, control areas, and type of separation being provided), and common actions by pilots and air traffic controllers that led to those occurrences.

Other serious incidents involving VH- registered high capacity RPT aircraft in 2012 were related to near misses on the ground, and severe weather or turbulence affecting aircraft. None of these resulted in injuries to passengers, crew, or persons on the ground:

- A Boeing 737 that had arrived at Melbourne Airport was cleared to gate E-5 and was taxiing towards the apron. Meanwhile, a Sydney-bound 737 was cleared to pushback from gate E-3. The pushback procedure from gate E-3 required a right turn followed by a left turn, rather than a straight back push. The arriving 737 began to make a right turn into the apron earlier than gate E-5, and noticed the 737 commencing pushback from gate E-3. The 737 captain checked

with ATC that they had clearance to taxi to gate E-5, which was confirmed. Concerned about the proximity of the two aircraft, the pushback ground crew at gate E-3 halted the departing 737, which was turning towards gate E-5. This action by the ground crew, as well as the arriving Boeing 737 making a turn onto the apron earlier than was usual, narrowly prevented the wings of the two 737's colliding. This serious incident was not investigated by the ATSB (ATSB occurrence 201202912).

- During taxi at Horn Island, Qld, the Bombardier Q400 was holding at the runway holding point to wait for a Piper Chieftain to taxi to the end of the runway. Once the aircraft was past, the Q400 entered the runway. The flight crew then noticed the Chieftain still taxiing to enter the apron. The Chieftain passed beneath the wing of the Q400. The ATSB did not investigate this serious incident (ATSB occurrence 201207758).
- A Boeing 737 operating from Bali International Airport in Indonesia was cruising at FL350 when it encountered wake turbulence from an opposite direction Airbus A380, which was about 1,000 ft above and slightly offset. The 737 rolled left about 40° and the flight crew received a bank angle warning. As the roll to the left commenced, the flight crew imemdiately responded by applying full right aileron deflection. After 5 to 10 seconds, the crew regained normal control. This serious incident was investigated by the ATSB, and a review of ATC surveillance data indicated that there was about 2.1 NM lateral and 1,400 ft vertical separation and the correct ATC separation standards were being applied at the time. This incident demonstrated the value of periodic recurrent training, allowing the flight crew to respond to the wake turbulence encounter intuitively and promptly (ATSB investigation AO-2012-121).
- At a late stage in the takeoff from runway 06 at Perth Airport when a Boeing 737-800 was approaching rotation speeds, the flight crew noticed that the aircraft had stopped accelerating. The crew then noticed that there had been a significant wind shift to a quartering tailwind of 20 to 25 kts. The crew applied full power and continued the takeoff. During the initial climb, the first officer performed a windshear escape manouevre, and air traffic control temporarily suspended departures from runway 06.This serious incident was investigated by the ATSB. Interviews with the pilots indcated that both had checked the visible windsocks before takeoff, and both confirmed that headwind conditions existed. As the performance calculations for takeoff had assumed no wind components, the significant tailwind encountered during the takeoff roll resulted in the aircraft failing to achieve the predicted takeoff performance. This incident is a reminder to pilots that significant wind changes can occur during takeoff, can be difficult to predict, and can occur in the absence of thunderstorm activity. The wind conditions at each end of a runway may differ significantly, such that headwind conditions can exist at one end and tailwind conditions at the other end (ATSB investigation AO-2012-168).



Significant wind change during take-off, Boeing 737-800 (VH-VZL), Perth Airport, Western Australia (AO-2011-080) – diagram shows changes in wind direction and magnitude recorded just prior to and during the aircraft's take-off

None of these serious incidents resulted in serious injuries to the aircraft occupants. Across the last 10 years, there were two accidents in particular which involved serious injuries to a number of passengers and crew on Australian high capacity RPT aircraft:

- On 2 July 2003, a Boeing 747 arrived at Sydney in the early morning during the airport's curfew period. For the landing, the pilot flying selected auto brake setting three and idle reverse thrust in accordance with the curfew requirement. During the landing roll, the reverse thrust was inadvertently de-selected, and when the aircraft arrived at the terminal, the flight crew noticed a brake temperature advisory message and notified the ground engineers. At that point, a fire ignited in a right wing landing gear brake unit. The flight crew were advised and ordered an evacuation of the aircraft. The cabin crew commenced the evacuation drill, deploying the aircraft's escape slides. In the process of evacuating, one flight crew member and three passengers were seriously injured (ATSB investigation 200302980).
- On 7 October 2008, an Airbus A330 enroute to Perth was at cruising altitude when the autopilot unexpectedly disconnected. The flight crew received various aircraft system failure indications, and while the crew were evaluating the situation, the aircraft abruptly pitched nose-down and descended 650 ft. After returning the aircraft to cruising altitude, the crew began to respond to multiple aircraft system failure messages. Shortly thereafter, the aircraft commenced a second uncommanded pitch-down event and descended about 400 ft. One flight attendant and 11 passengers were seriously injured, and many others experienced minor injuries. Most of the injuries involved passengers who were standing, or who were seated without their seatbelts fastened (ATSB investigation AO-2008-070).

Low capacity RPT (VH- registered)

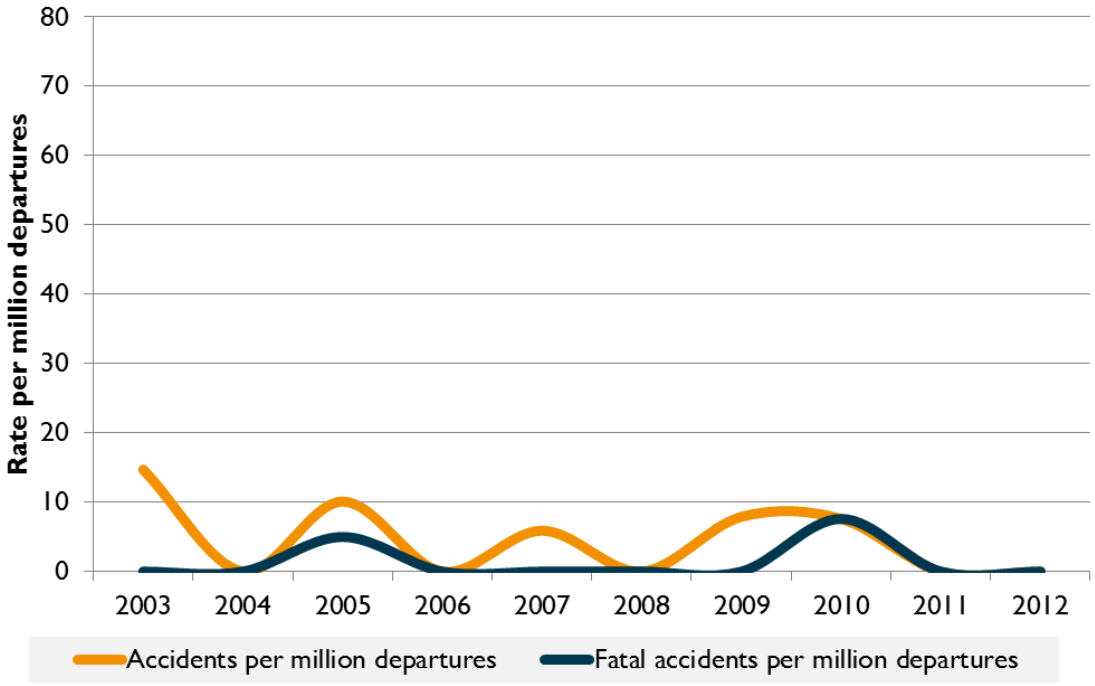
Where reports of incidents have been increasing over time in other types of commercial air transport, the number of incidents reported to the ATSB involving low capacity RPT aircraft since 2003 has declined somewhat (Table 6). The number of incidents reported in 2012 was the lowest in the last decade, and this has been influenced by a decline in flying activity over this period (hours flown by low capacity RPT aircraft have almost halved since 2003, and the number of departures was 35 per cent lower in 2012 than in 2003). This decline is a combined result of Australia's mining boom (larger aircraft are needed to move more people to regional cities and mining communities), regional airlines using newer turboprop aircraft equipment with a larger seating capacity (moving many former lower capacity flights into the high capacity aircraft range), and the additional regional travel options provided by new low cost airlines using larger jet aircraft.

While the number of incidents was at a low in 2012, there was a rise in the number of serious incidents. There were no accidents, and none of the serious incidents resulted in injuries (Figure 10).

Table 6: Low capacity RPT (VH- registered aircraft) occurrences, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	579	636	691	540	606	493	470	535	529	471
Serious incidents	6	10	7	5	8	11	4	6	2	5
Serious injury accidents	0	0	0	0	0	0	0	0	0	0
Fatal accidents	0	0	1	0	0	0	0	1	0	0
Total accidents	3	0	2	0	1	0	1	1	0	0
Number of people involved										
Serious injuries	0	0	0	0	0	0	0	0	0	0
Fatalities	0	0	15	0	0	0	0	2	0	0
Rate of aircraft involved										
Accidents per million departures	14.7	0	10.1	0	5.9	0	7.9	7.6	0	0
Fatal accidents per million departures	0	0	5	0	0	0	0	7.6	0	0
Accidents per million hours	15.2	0	9.9	0	6	0	9.2	8.6	0	0
Fatal accidents per million hours	0	0	5	0	0	0	0	8.6	0	0

Figure 10: Accident rate for low capacity RPT aircraft (VH- registered) (per million departures), 2003 to 2012



The five serious incidents involving low capacity RPT aircraft in 2012 were:

- Shortly after departure from Moree, New South Wales, the Cessna 404 crew were advised of an inbound Fairchild Metro. The flight crews of the two aircraft were unable to communicate due to radio transmission congestion on the common traffic advisory frequency (CTAF), which was being used by aircraft operating at several nearby aerodromes. In anticipation of a possible conflict, both crews adjusted their vertical profiles. Communication was established just prior to the aircraft passing with about 400 ft vertical separation. The ATSB did not investigate this serious incident (ATSB occurrence 201201301).
- As a Van's RV-10 was taking off from runway 22 at Taree Airport, NSW, the pilot observed a Saab 340 enter runway 22 and turn right for the threshold of runway 04. The RV-10, which was just becoming airborne, passed directly overhead the Saab at about 300 ft. After the incident, the captain of the Saab established contact with the pilot of the RV-10, and neither aircraft experienced problems communicating with the other. As a result of the incident, the operator of the Saab 340 amended procedures to more clearly define radio procedures for both flight crew and ground staff at those non-towered aerodromes without an Aerodrome Frequency Response Unit (AFRU), which allows pilots broadcasting on a CTAF to determine if there have been other recent broadcasts from other traffic. This serious incident was investigated by the ATSB, and highlighted the need for pilots to apply all available methods to maintain separation with other aircraft when operating outside controlled airspace. These methods include the using both alerted and un-alerted see-and-avoid principles, the use of on-board collision avoidance systems where fitted, and all available aircraft lighting (ATSB investigation AO-2012-043).
- An MBB-Kawasaki BK117 helicopter departed Townsville on a flight to Cairns under VFR. The pilot requested a clearance from Townsville ATC to track outbound via the Rollingstone VFR route at 1,000 ft. At about the same time, a Cessna 404 was inbound to Townsville under instrument flight rules (IFR). The Cessna was cleared by ATC to enter the Townsville military controlled airspace via the Rollingstone VFR route, at 1,500 ft visual. When outside the Townsville Class C airspace, the helicopter pilot elected to commence a slow climb to 1,500 ft. Shortly after, Department of Defence (Defence) radar surveillance data showed that the BK117 was at 1,400 ft and the Cessna was at 1,500 ft, with 0.1 NM lateral separation. At that time, the

helicopter pilot observed an aircraft ahead (the Cessna) and immediately descended. The Cessna pilot also observed a 'flash' (the BK117) at an estimated 6 ft below, and initiated a climb. A Defence investigation determined that the Townsville Approach trainee, Training Commander, and Approach Supervisor were prioritising the provision of air traffic services to aircraft operating in Class C over the provision of a flight information service to aircraft operating in Class G airspace. While this led to compromised safety between the BK117 and the Cessna 404, this was not evident to the controllers as the prioritisation of tasks in Class C reduced their situational awareness of the developing situation in Class G (ATSB investigation AO-2012-080).

- On approach to Alice Springs Airport at the end of a flight from Papunya, NT, the pilot of the Cessna 210 did not conduct a complete finals check, and ommitted to ensure the landing gear was down. As a result, the aircraft landed with the wheels up, skidding along the runway on its underbelly and sustaining minor damage. The ATSB did not investigate this serious incident (ATSB occurrence 201209394).
- On approach to Mount Magnet, Qld, the first officer of the Embraer EMB-120 Brasilia reported not feeling well. The captain took control of the aircraft and the aircraft landed safely. After landing, the first officer reported feeling fine. On climb for the next sector, the first officer began vomiting and was unable to continue duties. This serious incident was not investigated by the ATSB (ATSB occurrence 201209449).

There have been two notable fatal accidents in low capacity air transport in the last 10 years - one in 2005, and the other in 2010. These two accidents resulted in a total of 17 fatalities:

- On 7 May 2005, Transair was operating a Fairchild SA227-DC Metro 23 with two pilots and 13 passengers in far north Queensland on a flight from Bamaga to Cairns, with an intermediate stop at Lockhart River. On approach to Lockhart River, the aircraft impacted terrain in the Iron Range National Park on the north-western slope of South Pap, a heavily timbered ridge, which is approximately 11 km north-west of the Lockhart River aerodrome. The aircraft was destroyed and there were no survivors (ATSB investigation 200501977).
- On 22 March 2010, an Airnorth Embraer EMB-120ER Brasilia aircraft with two flight crew onboard departed from runway 29 at Darwin Airport on a training flight. Immediately after becoming airborne, the training captain carried out a simulated engine failure (asymmetric flight), but the aircraft rolled left and entered a steep nose-down attitude before impacting the ground. Both pilots were fatally injured (ATSB investigation AO-2010-019).

Charter (VH- registered)

With the exception of a spike in 2007 and 2008, the number of incidents reported to the ATSB involving Australian-registered aircraft conducting charter work has been stable for most of the last 10 years. Of all air transport operations, charter had the highest total number and highest rates of accidents and fatal accidents over most years (Figure 11). The accident and fatal accident rate per million hours was higher than for departures (12), which reflects the short duration of most charter flights and hence a greater exposure to approach and landing accidents (due to more departures per hour flown).

The number of accidents involving charter aircraft has varied significantly from year to year, and showed a large decrease in 2012 compared to the previous two years (Table 7). In contrast, the number of serious incidents reported in 2012 was the highest since 2003, and there was a slight increase in those accidents where fatal or serious injuries occurred.

Table 7: Charter (VH- registered aircraft) occurrences, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	370	439	518	578	686	708	596	498	547	552
Serious incidents	3	9	6	6	16	13	10	14	12	20
Serious injury accidents	0	1	1	0	0	2	1	0	1	2
Fatal accidents	2	0	1	1	2	3	0	0	2	1
Total accidents	26	15	9	10	18	26	8	20	18	12
Number of people involved										
Serious injuries	0	1	1	0	0	3	2	0	1	2
Fatalities	8	0	3	2	2	6	0	0	2	1
Rate of aircraft involved										
Accidents per million departures	42.2	25	13.7	16.1	27	41.1	13.2	30.2	27.7	N/A
Fatal accidents per million departures	3.2	0	1.5	1.6	3	4.7	0	0	3.1	N/A
Accidents per million hours	61.5	31.6	18.8	21.1	33.4	50.7	17.2	39.8	37.5	N/A
Fatal accidents per million hours	4.7	0	2.1	2.1	3.7	5.8	0	0	4.2	N/A

Figure 11: Accident rate for charter aircraft (VH- registered) (per million departures), 2003 to 2011

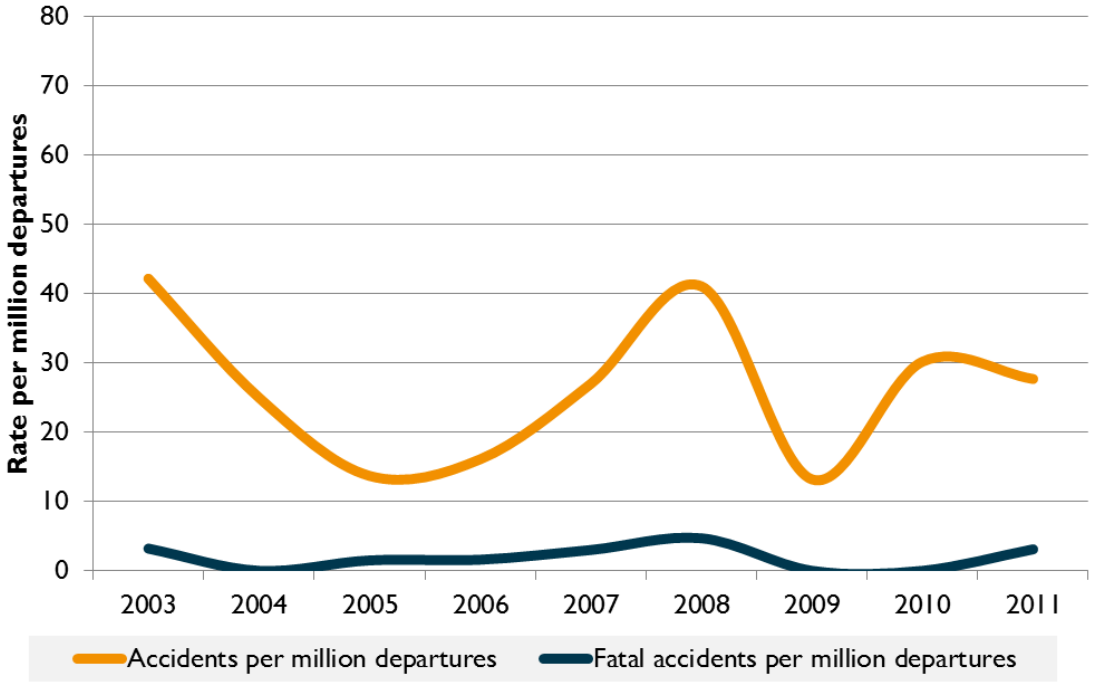
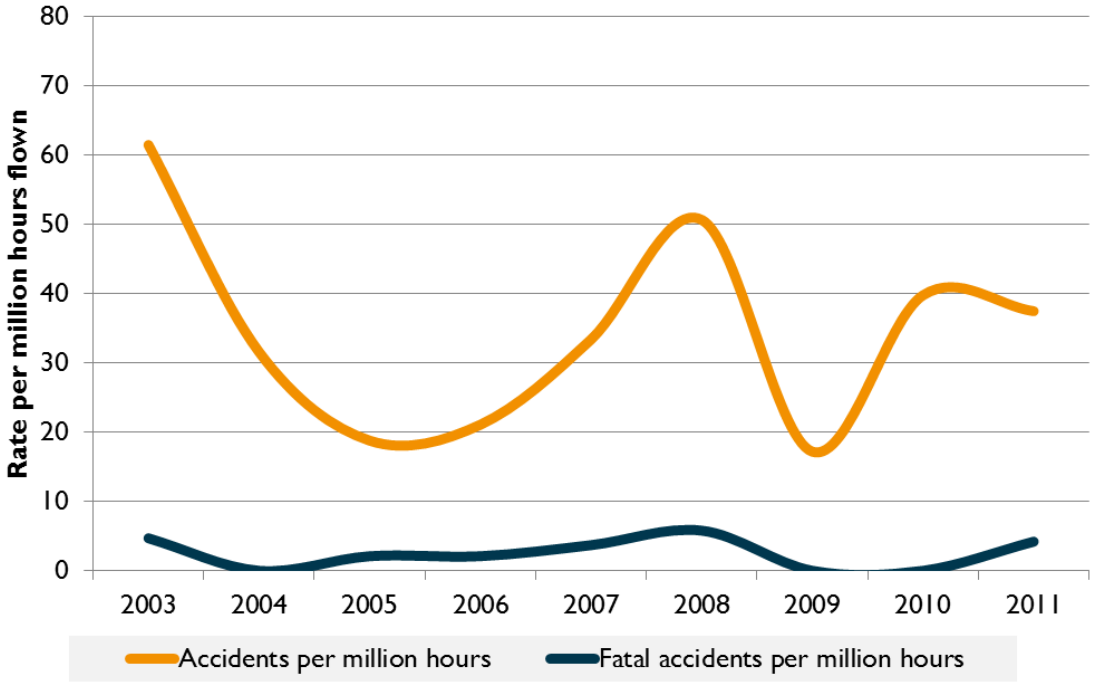


Figure 12: Accident rate for charter aircraft (VH- registered) (per million hours flown), 2003 to 2011



In 2012, there were 12 VH- registered aircraft conducting charter work that were involved in accidents. Three of these accidents resulted in a serious or fatal injury to the pilot. Two of these accidents also resulted in minor injuries to other crew or passengers on the aircraft:

- On landing at Nyirripi airstrip, NT, the Cessna 210 Centurion being flown by a pilot in command under supervision (ICUS) on a line training flight ballooned twice. The supervisory pilot took control of the aircraft with the intent of recovering from the balloon to a normal landing. A dust devil caused the aircraft to yaw significantly to the left, and the supervisory pilot applied full

power to go-around but the aircraft did not climb. The supervisory pilot rolled the aircraft into a 30° right bank to remain over clear ground, closer to the runway. Realising that the aircraft was going to impact the ground, the supervisory pilot rolled the wings level. The aircraft impacted fairly hard and skidded about 100 m before coming to rest north of the runway and about 600 m from the threshold. The supervisory pilot was seriously injured with possible spinal injuries, and the pilot ICUS had minor injuries. This accident was investigated by the ATSB, and following the accident, the aircraft operator issued guidance notes on windshear recognition and recovery to all flight crew. This accident demonstrated that if an approach becomes unstable, conducting a go-around early is usually the safest course of action. A Bureau of Meteorology Research Centre report has noted that not all dust devils are visible and that they pose a major hazard to light aircraft during landing (ATSB investigation AO-2012-056).

Collision with terrain, Cessna 210 Centurion (VH-TWP), Nyirripi aircraft landing area, Northern Territory (ATSB investigation AO-2012-056)

- While providing support and aerial filming for a competitor participating in the annual Finke Desert Race, a Robinson R44 helicopter lost power and collided with terrain near Maryvale, NT. About an hour after departing the starting line with a pilot and three passengers on board, the pilot lowered the collective lever and reduced power to perform a gentle flare to slow the R44 from 80 to 60 kts. After levelling off at 200 ft above ground level at 60 kts, the pilot increased collective, but engine power did not increase. The helicopter began to sink, and despite lowering the collective and applying full throttle, the pilot was unable to increase rotor revolutions per minute (RPM) and decrease the rate of descent. The R44 impacted the ground, collapsing on its skids and seriously injuring the passenger seated behind the pilot. The ATSB investigated this accident, but a definitive reason for the reported loss of engine power could not be determined. However, a review of the carburettor icing chart revealed that the temperature / dew point spread at the time and location of the accident put the helicopter in the “Serious Icing – Descent Power” operating realm. The helicopter manufacturer had previously issued a safety notice in regard to the use of the carburettor heat assistance system, warning that if used it would reduce carburettor heat on lift off and may require adjustment in flight (ATSB investigation AO-2012-078).
- Shortly after takeoff from runway 28 at Broome Airport, WA, a Piper Seneca collided with terrain. The aircraft was on the outbound leg of a regular freight-carrying flight between Broome and Port Hedland, WA. A company employee, who was familiar with the aircraft and near the airport at the time of the accident, heard the engines during the initial takeoff roll and thought they sounded normal. Several witnesses reported that, during the period after the

takeoff, they heard unusual noises from the engines. Other witnesses that were closer to the accident site reported hearing the engines cut out and that they watched as the aircraft descended steeply towards the ground. Emergency services commenced a search for the missing aircraft and pilot and the wreckage was found during the latter part of the evening in sand dunes, about 880 m beyond the upwind end of the runway and close to the extended runway centreline. The pilot sustained fatal injuries and the aircraft, although substantially intact, was destroyed by impact forces. There was no post-impact fire. Damage to the wreckage was consistent with the aircraft descending steeply into terrain at relatively low forward speed and a high rate of descent. There was no evidence of in-flight structural failure. The fuel tanks ruptured on impact, the cockpit and cabin were severely disrupted and the landing gear was retracted. This accident was investigated by the ATSB (ATSB investigation AO-2012-093).

Collision with terrain, Piper PA-34-200 Seneca (VH-LCK), near Broome, Western Australia (ATSB investigation AO-2012-093)

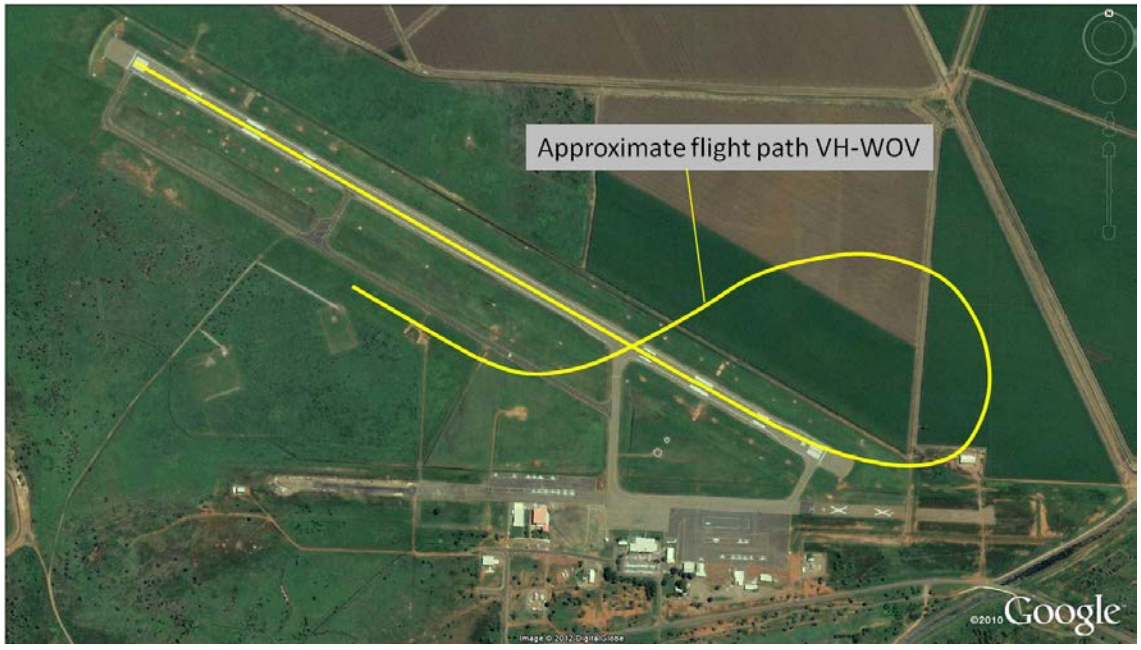
The remaining accidents (and an additional 19 serious incidents involving 20 charter aircraft) most commonly involved engine malfunctions causing power loss, and hard landings or collisions with terrain due to inadequate climb performance after takeoff, or due to windshear on landing. There were also several serious incidents where a near collision occurred because of communication problems between flight crews or with ATC.

Some notable accidents and serious incidents in 2012 involving charter operations were:

- A Cessna 210 Centurion was backtracking on runway 18 at Darwin Airport for the general aviation parking area. At the same time, a Cessna 310 was holding at taxiway Echo 2 for an intersection departure from runway 29. The surface movement controller instructed the Centurion pilot to cross runway 29 at about the same time as the aerodrome controller cleared the Cessna 310 for takeoff on runway 29. It was estimated both visually and by radar that the Cessna 310 overflew the Centurion crossing the runway by between 150 ft and 500 ft. Runway incursions are recognised as an ongoing safety concern for the aviation industry and have

been cited in numerous accidents world-wide. They can be the result of many different factors and involve pilots, controllers and vehicle drivers. This serious incident was investigated by the ATSB, and highlighted the need for controllers to remain vigilant in monitoring and scanning the runway, both prior to, and after issuing takeoff and runway crossing clearances to pilots (ATSB investigation AO-2012-030).

- The pilot of a Piper PA‑34 submitted a flight plan from Archerfield to Cairns via Townsville. Prior to departure, Archerfield ATC updated the flight plan from VFR to IFR at the pilot's request. The updated flight plan was transmitted via a change message to the various ATC agencies responsible for the aircraft. Townsville ATC, operated by the Department of Defence, used computer printed flight progress strips, and the strip for the PA-34 was printed prior to the change message being processed. As a result, Townsville ATC thought that the PA-34 was a VFR flight.When the pilot of the PA-34 contacted Townsville Approach, he requested a runway 01 instrument landing system approach. The Approach controller cleared the aircraft to track direct to the initial approach fix and, once the aircraft was within 36 NM, to descend to 4,000 ft. Shortly after, the controller became concerned about the pilot being able to maintain visual meteorological conditions given the weather in the area, and queried the pilot on the aircraft's flight category. When the pilot advised that they were conducting an IFR flight and were in cloud, the controller immediately instructed the pilot to stop the descent at 5,500 ft. By the time the pilot was able to arrest the aircraft's descent, it had reached 5,200 ft. Although the aircraft did not descend below the lowest safe altitude on the aircraft's track, terrain clearance on track was not assured until the pilot climbed back to 5,500 ft. Shortly after, the pilot became visual and the PA-34 landed without further incident. The ATSB investigated this serious incident, and as a result of this occurrence, the Department of Defence now requires controllers to check flight progress strips thoroughly prior to passing them to Approach, ensuring that the data is correct (ATSB investigation AO-2012-042).
- During takeoff and initial climb from Kununurra, WA on a sightseeing flight with six passengers, the engine of the Gippsland GA-8 Airvan did not generate full power, despite the pilot applying full throttle. The aircraft failed to climb, and the engine manifold pressure continued to decrease to the point where the aircraft could not longer maintain level flight. The pilot initially intended to conduct a forced landing but after discovering that the surface of the selected field was unsuitable and that sufficient power was available to remain airborne, the pilot elected to return to Kununurra. The aircraft landed safely on a grassed area of the airport adjacent to the parallel taxiway. The partial power loss was the result of a turbocharger system malfunction. This serious incident was investigated by the ATSB, and highlighted the importance of understanding the complexities of engine turbocharger systems. A turbocharger system malfunction may result in unpredictable engine power and aircraft performance. Furthermore, a turbocharger system malfunction does not necessarily mean that the engine will behave like a normally aspirated engine. Although this incident was the result of a turbocharger system malfunction, it is a reminder to pilots that abnormal manifold pressure indications may be symptomatic of a serious problem, such as an engine exhaust system leak. This incident also highlighted the importance of pre-flight preparation. Self-briefing may help pilots respond to abnormal takeoff indications more effectively, and help manage the influence of perceived pressure when confronted with a time-critical decision (ATSB investigation AO-2012-062).



Flight path of the Gippsland GA-8 Airvan (VH-WOV) following a partial power loss, Kununurra airport, Western Australia (ATSB investigation AO-2012-062)

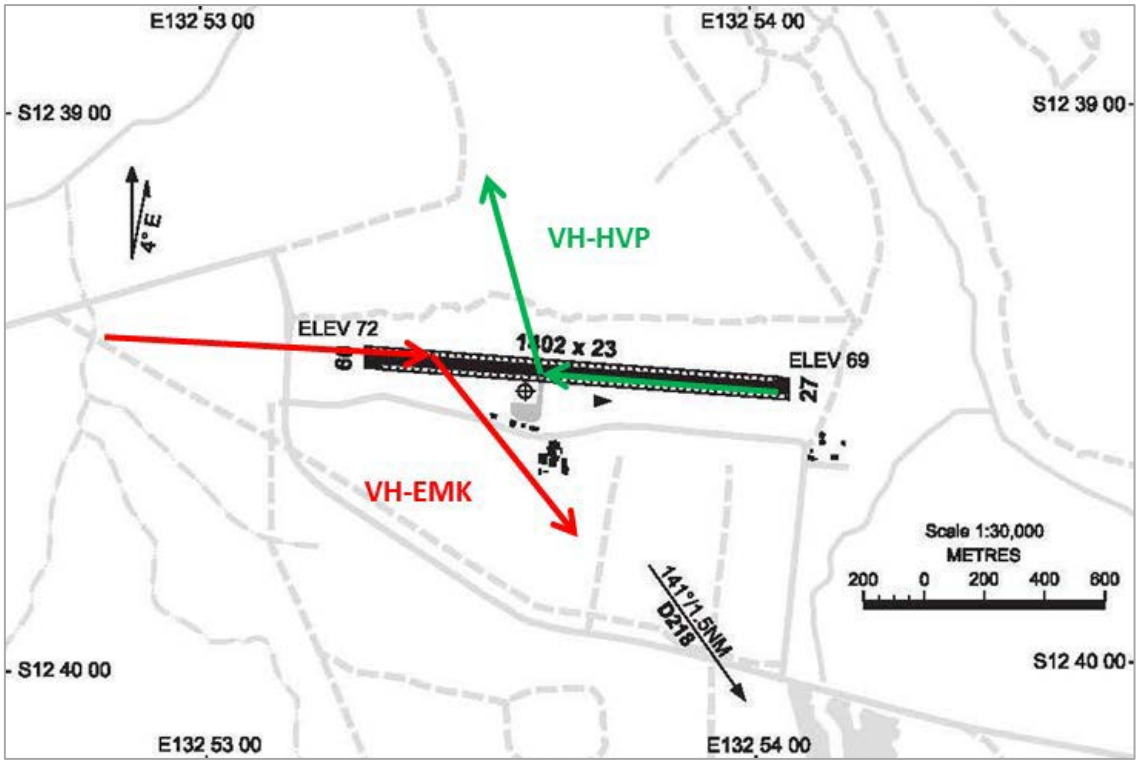
- On arrival at Granny Smith Aerodrome, WA on a flight from Perth, the flight crew of a Fairchild Metro joined the circuit and extended the landing gear. In the circuit and again on approach to land, the flight crew confirmed that the three green down-locked lights ('three greens') were illuminated. During the landing flare, the left wing suddenly dropped. The first officer immediately applied right aileron in an attempt to counteract the wing drop and the aircraft touched down. After shutdown, the crew inspected the aircraft and determined that the left propeller had contacted the ground. The aircraft operator examined the aircraft and believed that there was uncommanded retraction of the left landing gear on, or just after touchdown, which resulted in the left wing dropping. Right aileron was applied, which raised the left wing, and with the forward momentum of the aircraft, the left landing gear extended. The flight crew could not recall hearing the landing gear warning horn activate during the landing. The left landing gear was later examined and ground tested and found to be working correctly. This occurrence was investigated by the ATSB, but the reason for the uncommanded retraction could not be determined (ATSB investigation AO-2012-106).

Propeller (left) and landing gear door (right) strike, Fairchild SA227-DC Metroliner (VH-WBQ), Granny Smith Aerodrome, Western Australia (ATSB investigation AO-2012-106)

- A Beech 1900 was on final approach to Jabiru, NT, while an Airparts FU-24 was taking off from the reciprocal runway. The Beech 1900 flight crew made appropriate broadcasts on the CTAF during the approach to announce their intentions, but did not hear any other broadcasts.

During the approach, the Beech 1900 flight crew observed a 'glint' on the runway. At the time, the captain believed it may have been from a car operating on a road near the runway or an aerodrome officer completing a runway inspection, so the approach was continued. Due to haze and sun glare, the Beech 1900 crew did not see the FU-24 until reaching 500 ft on final approach, at which point the FU-24 was at the point of takeoff on the reciprocal runway. The pilot of the FU-24 had been broadcasting, but had not checked his radio, which was not correctly set and was therefore was not transmitting. Both aircraft turned right for evasive action, and separation reduced to about 300 ft vertically and less than 250 m horizontally. The ATSB investigated this serious incident, and as a result, the operator of the FU-24 arranged for all pilots to re-visit company standard operating procedures on radio transmissions and low-level survey flying. This serious incident demonstrated the importance of checking the serviceability of radio equipment prior to flight. In particular, the use of available resources such as an AFRU to ensure the radio is transmitting (ATSB investigation AO-2012-134)

- A Cessna 210 was departing from Cape Leveque, WA on the return leg of a scenic charter. On board were the pilot and five passengers. Early in the takeoff run, the aircraft veered to the left, and the pilot applied right rudder. The pilot elected to continue the takeoff. At about 45 kts, the aircraft again veered to the left. With the aircraft about one metre off the centreline of the runway, the pilot attempted to re-align the aircraft, but it did not respond. The aircraft main wheels were now in contact with washout on the edge of the runway. The aircraft's left wing clipped trees and the Cessna swung almost 90°, striking the right wing on the ground (ATSB occurrence 201212504).



Aircraft proximity event between a Beech 1900 (VH-EMK) and an Airparts FU-24 (VH-HVP), Jabiru Airport, Northern Territory (ATSB investigation AO-2012-134)

There was also one accident in 2012 that involved a foreign-registered aircraft conducting charter work in Australia. This accident, which was a hard landing, is described in the next section.

Foreign-registered air transport

In the last 10 years, no foreign-registered air transport aircraft operating in Australia have been involved in fatal or serious injury accidents.

There are, however, about 500 incidents reported to the ATSB per year involving foreign-registered air transport aircraft (Table 8).

Table 8: Occurrences involving foreign-registered air transport aircraft in Australia, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	251	389	504	403	366	376	383	563	518	509
Serious incidents	0	1	7	1	5	3	1	1	1	3
Serious injury accidents	0	0	0	0	0	0	0	0	0	0
Fatal accidents	0	0	0	0	0	0	0	0	0	0
Total accidents	1	0	0	1	0	0	1	0	0	1
Number of people involved										
Serious injuries	0	0	0	0	0	0	0	0	0	0
Fatalities	0	0	0	0	0	0	0	0	0	0

There was one accident in 2012 involving a foreign registered aircraft operating a charter flight:

- A Portuguese registered Airbus A340 aircraft was operating on a chartered service from Sydney to Darwin. On approach into Darwin, the flight crew noted heavy rainfall near the threshold of runway 29 and requested wind information from the Darwin tower air traffic controller. At that time, the windsock at the threshold was indicating a 5 kt tailwind, and the flight crew continued the approach on that basis. In the final stages of the approach, the rainfall increased significantly and the aircraft deviated below the glideslope. On touchdown, the wind suddenly increased to an 18 kt tailwind, possibly due to a microburst, and the aircraft landed heavily. This accident was investigated by the ATSB, and subsequent engineering inspections identified damage to the engine attachment fittings and main landing gear. As a result of this serious incident, the operator introduced additional simulator training for go-arounds during the flare and after touchdown, and developed an awareness program to increase the ‘go-around mindset’ of flight crew (ATSB investigation AO-2012-036).

In 2012, there were also two serious incidents involving a total of three foreign-registered air transport aircraft in Australia (one incident involved two aircraft). One involved a loss of separation with a high capacity air transport VH- registered aircraft and was described above (ATSB investigation AO-2012-048). The circumstances of the other serious incident was as follows:

- Over the Indian Ocean, an Airbus A320 travelling southbound from Singapore to Perth at FL350 and an Airbus A340 heading west from Sydney to Abu Dhabi, United Arab Emirates were approaching the same IFR reporting waypoint (TANEM). The A340 flight crew had been cleared by ATC to operate in an altitude block between FL340 and FL360. The intention was that the A340’s track would cross that of the A320 at TANEM, with the required separation standard to be 15 minutes between the arrival of each aircraft at TANEM. However, the A340 crew had reported an estimated time of arrival only 2 minutes after that reported by the A320 crew. Controller 1, who approved the block level clearance, did not detect the traffic confliction prior to handing over to controller 2. After a short break, controller 2 handed back to controller 1, and the confliction was detected by controller 2 during the handover. Compromised separation recovery techniques were applied to re-establish vertical separation. The ATSB

investigated this serious incident, and found that the two controllers were experiencing a high workload due to a range of factors, including traffic levels, weather diversions and the airspace configuration. The investigation found that controller 1 had limited opportunity to consolidate their training and skills before being rostered onto more complex sectors and situations. The ATSB found that Airservices processes for monitoring and managing controller workloads did not ensure that newly-endorsed controllers had sufficient skills and techniques to manage the high workload situations to which they were exposed. In addition, the provider had limited formal guidance regarding how to determine appropriate consolidation periods for en route controllers on one sector before they were transitioned to commence training on another sector. Further safety issues were also identified relating to the application of block level clearances, and the continuing absence of an automated air traffic conflict detection system available for conflictions involving aircraft that were not subject to radar or ADS-B surveillance services (ATSB investigation AO-2012-012).

In the last 10 years, a number of accidents have occurred in Australia that involved foreign registered air transport aircraft. One of the most serious occurred in 2009, and involved an Emirates Airbus A340-500 aircraft. The Airbus commenced the take-off roll on runway 16 at Melbourne on a flight to Dubai in the United Arab Emirates. The aircraft failed to rotate as expected and sustained a tail strike and overran the end of the runway, with the captain applying additional thrust to get the aircraft airborne. The tail strike damaged the aircraft, airport lighting and the instrument landing system. The aircraft subsequently returned and landed at Melbourne with no reported injuries. The take-off weight inadvertently used for take-off performance calculations was 100 t below the actual take-off weight of the aircraft (ATSB investigation AO-2009-012).

General aviation

General aviation is considered to be all flying activities outside of scheduled (RPT) and non-scheduled (charter) passenger and freight commercial air transport operations. It also excludes recreational aircraft that are administered by RAAOs and do not have an Australian civil (VH-) registration, such as light sport aeroplanes up to 600 kg, hang gliders, trikes, gyrocopters, and powered parachutes. These aircraft are reported on separately in these statistics.

General aviation is further broken down into aerial work (ambulance and emergency medical services, agriculture, mustering, search and rescue, fire control, and survey and photography), flying training, and private/business and sports aviation (see *Appendix A – Explanatory notes*).

Conservative estimates place at least 90 per cent of the Australian VH- registered aircraft fleet into the category of general aviation. General aviation also accounts for over half of all aircraft movements across Australia (see Figure 1 on page 5). In comparison, large air transport aircraft operated by major airlines make up less than three per cent of Australian-registered aircraft. General aviation aircraft also make up about 40 per cent of the total hours flown by Australian-registered aircraft (as shown in Figure 3 on page 7).

Despite the larger size of general aviation compared to air transport in both fleet size and number of departures, there are comparatively few occurrence reports sent to the ATSB involving general aviation aircraft. In 2012, there were 3,134 GA aircraft involved in 3,000 occurrences reported to the ATSB (representing about 30 per cent of GA aircraft on the VH- register at the time of writing) (Table 9). Although there is a less comprehensive reporting requirement for aircraft not engaged in commercial air transport, the reporting rate is small when compared to 5,120 commercial air transport aircraft involved in 5,004 occurrences in 2012 (at least six occurrences for each air transport aircraft on the VH- register, when considering the number of incidents involving foreign-registered air transport aircraft).

Table 9: All general aviation occurrences (VH- and foreign registered aircraft), 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	2,413	2,679	3,061	3,501	3,542	3,534	3,684	3,563	3,147	2,878
Serious incidents	49	74	58	71	95	108	98	135	131	158
Serious injury accidents	11	14	4	8	7	16	10	15	11	8
Fatal accidents	12	12	16	19	12	22	16	13	16	20
Total accidents	117	143	118	91	118	126	119	127	109	99
Number of people involved										
Serious injuries	19	21	5	13	9	23	13	19	20	11
Fatalities	26	24	21	34	21	34	16	16	28	29
Rate of aircraft involved[6]										
Accidents per million departures	54.6	71.9	52.2	49.7	64.1	63.8	64.6	62.7	58	N/A
Fatal accidents per million departures	5.6	5.6	7.1	10.5	6.7	11.2	8.7	6	8.6	N/A
Accidents per million hours	95.5	122.3	95.3	74.1	89.5	93.5	89.1	93.4	84.1	N/A
Fatal accidents per million hours	9.9	9.5	12.9	15.6	9.3	16.5	12	9	12.5	N/A

A major challenge for the ATSB in its charter to improve transport safety is that there is a lower level of awareness in the general aviation community of the need to report safety matters, and what constitutes a reportable transport safety matter. Underreporting of safety matters has been identified as one of the ATSB's *SafetyWatch* priorities for improving transport safety in Australia. Future amendments to the *Transport Safety Investigation Act* 2003 (TSI Act) and Regulations intend to clarify what industry needs to report, in order to make reporting clearer and less onerous for pilots and operators alike. It is hoped that these changes, along with improved engagement with the general aviation community by the ATSB (through programs such as the popular *Avoidable Accidents* series) will help to reduce underreporting of incidents.

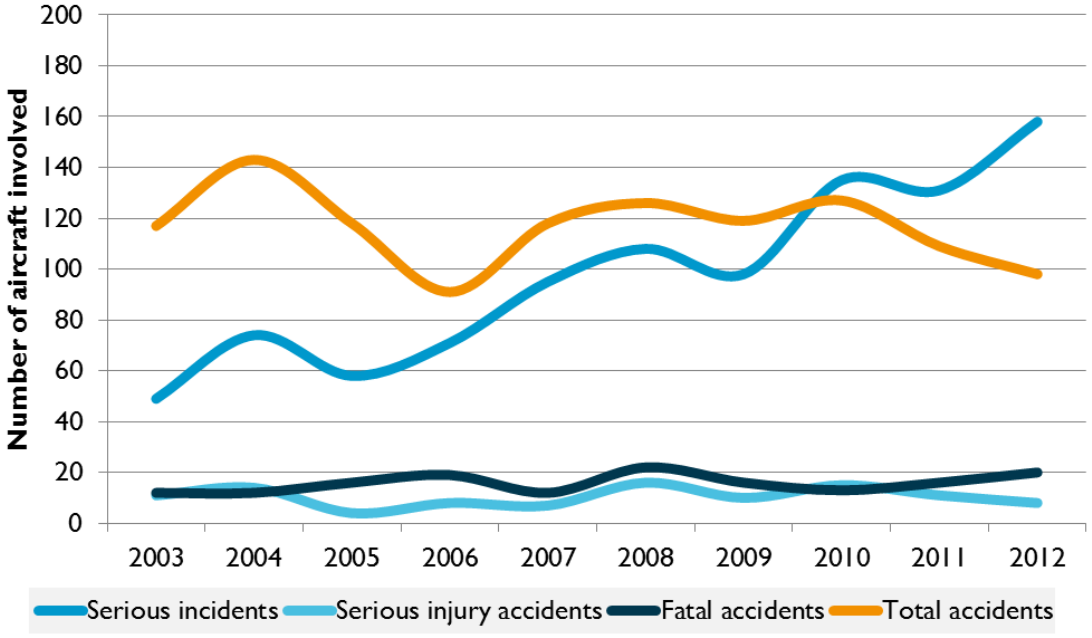
Aircraft conducting aerial work (emergency medical service (EMS) operations in particular) and flying training tended to report more occurrences, or were individually associated with more occurrence reports. While this could suggest that certain general aviation operations involve a greater level of risk, it is more likely that the reporting cultures and safety management systems of the operators involved in these types of flying is stronger than in other areas of general aviation. In a large proportion of reported general aviation occurrences (55 per cent in 2012), the type of flying that the aircraft was involved in was not reported to the ATSB. In these occurrences, the ATSB was notified by someone other than the pilot(s) of the aircraft involved (such as air traffic control, the public, pilots of nearby aircraft, or aerodrome-based staff). A review of 'unknown' general aviation occurrences found that most were associated with:

- airspace-related occurrences (airspace incursion, aircraft separation, operational non-compliance, and regulations and standard operating procedures)
- ground operation-related occurrences
- bird and animal strikes.

[6] Foreign registered general aviation departures and hours are not known. VH- registered aircraft hours are used as a proxy denominator. The real rate per departure or hour will be slightly smaller than the figures presented in this table. This equates to 13 accidents over the period between 2003 and 2012 (including three fatal accidents) where aircraft hours are not known and are not included in the denominator figures.

Figure 13 shows that with the increase observed in incidents in 2012, so too has there been an increase in serious incidents and fatal accidents. Conversely, there were fewer serious injury accidents, fewer aircraft involved in accidents generally, and about the same number of fatalities as in 2011. As a result, the gap between the GA accident rate and fatal accident rate per million departures narrowed (Figure 14).

Figure 13: General aviation occurrences and injuries (VH- and foreign registered aircraft), 2003 to 2012



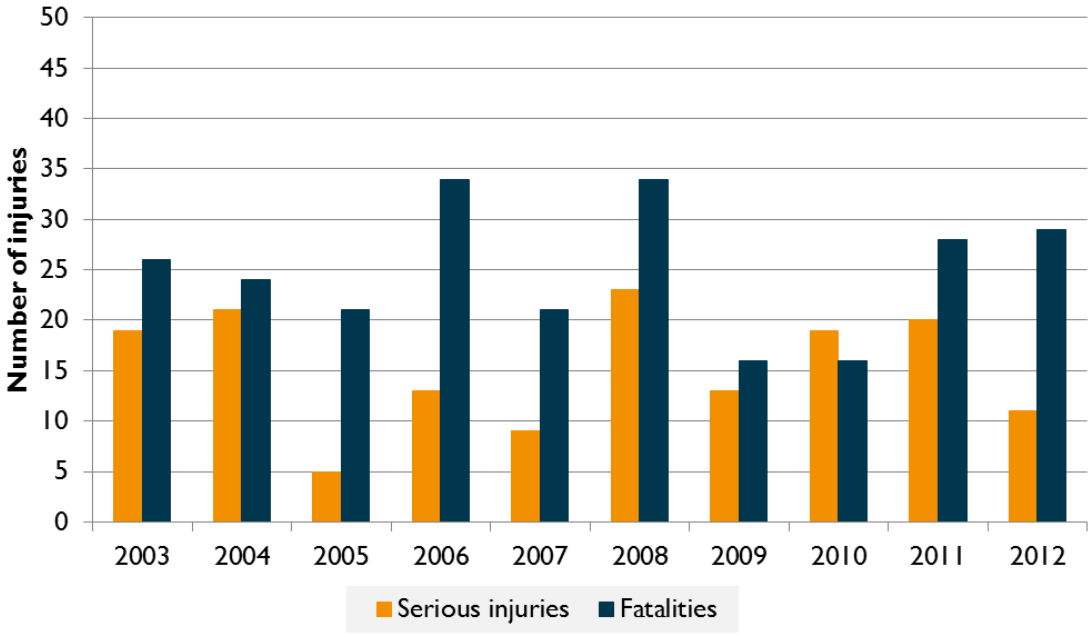
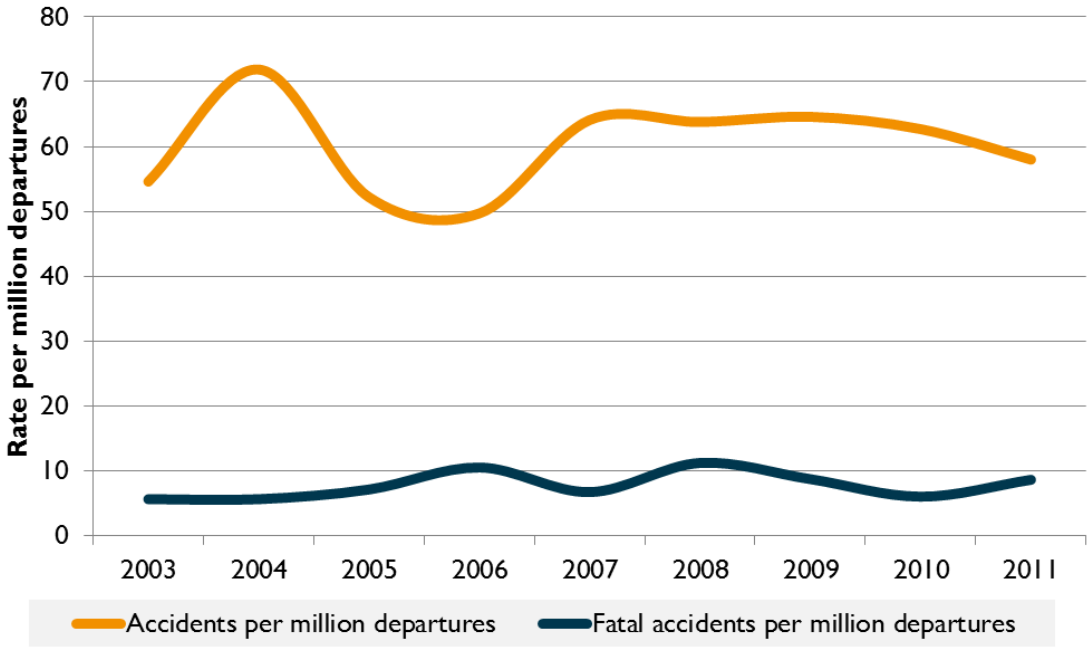


Figure 14: General aviation accident and fatal accident rate (per million departures, VH- registered aircraft only), 2003 to 2011



For each fatal accident in the last 10 years, on average, there were nearly two people who received fatal injuries. This is different from air transport, where fatal accidents are associated with more deaths because of the size of the aircraft involved. Of the 1,166 general aviation aircraft involved in accidents between 2003 and 2012, almost one in 10 were fatal accidents, with 250 lives lost. The general aviation accident rate per million departures is lower than per million hours flown. In the most recent year where departures information was available (2011), the accident rate per million departures was almost four times as large in GA as in commercial air transport. The fatal accident rate was a little over eight times[7] larger in GA.

Accident types and severity varies across different types of general aviation flying, as some types of operations involve a greater level of accepted operational risk (like low flying in aerial agriculture and mustering). The following trends are of note when considering the rate of all general aviation accidents and serious incidents reported over the 10 year period from 2003 to 2012, per million hours flown:

- Emergency medical services and flying training had the lowest accident rate (10 and 44.7 accidents per million hours flown respectively).
- The accident rate for aerial work was almost twice that of flying training, and for private/business flying it was about three and a half times higher.
- Aerial agriculture had the highest accident rate of all types of GA flying (198.4 accidents per million hours flown).
- Emergency medical services and flying training also had a low rate of fatal accidents (2.8 and 3.3 fatal accidents per million hours flown respectively).
- The fatal accident rate for aerial mustering was twice that of EMS or flying training. For survey and photography operations, the fatal accident rate was six times higher than EMS or flying training, and for aerial agriculture and private and business flying it was almost 10 times higher.

[7] There have been very few fatal accidents involving commercial air transport in Australia in recent times. Over the 10 years ending 2012, there were 14 air transport aircraft involved in fatal accidents (mostly involving charter operations). The most serious fatal accident during this time was the Lockhart River accident in 2005, in which 15 people died.

- Aerial agriculture and private and business flying had similarly high fatal accident rates compared to all other types of general aviation flying (21.9 and 22.5 fatal accidents per million hours flown respectively).

Aerial work

Aerial work is made up of a number of different commercial activities, including aerial agriculture, mustering, surveying and photography, emergency medical services, search and rescue, check and training flights, and aerial fire control. Some of these activities require aircraft to regularly operate in conditions with inherent risks, such as manoeuvring at low level (such as crop spraying and aerial mustering), which should be considered when comparing aerial work occurrence data with that of other operation types.

While there was a large variation in the number of aerial work aircraft involved in accidents per year over the last decade, the number of aircraft involved in accidents in 2012 (20) was the lowest recorded in more than 10 years (Table 10). There was also an associated decline in the accident and fatal accident rate in 2011 (the last year for which data was available) after several years of increase (Figure 15). The lower number of accidents involving aerial work aircraft in 2012 was due to fewer accidents in aerial agriculture, mustering, and survey and photography operations. In association with this decrease, there number of serious injuries and serious injury accidents was at an equal 10 year low, although there were a lot more serious incidents than in 2011.

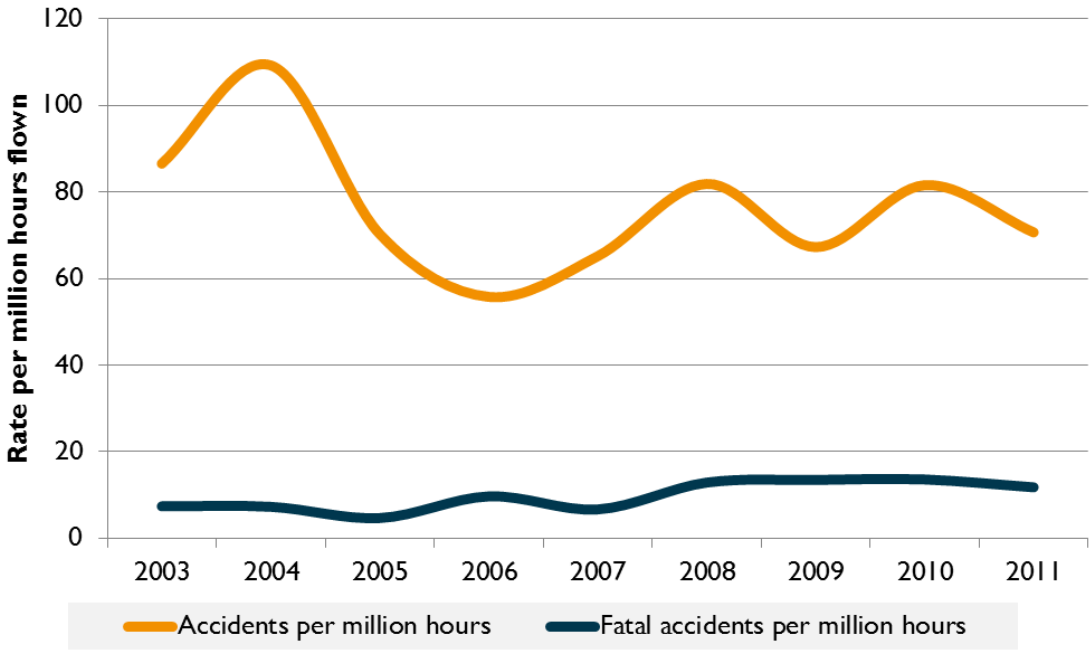
The number of aerial work aircraft involved in serious incidents in 2012 (37) was the highest of the decade. Driven by aerial agriculture and EMS aircraft, the number of aircraft involved in serious incidents over the last 3 years of the period (2010 to 2012) has resulted in an annual average (30) that is twice that of the previous 7 years (2003 to 2009) (15).

The number of aerial work aircraft involved in incidents increased by more than 50 per cent between 2003 (207) and 2012 (321). This increase was primarily due to more reports from EMS and survey and photography operators.

Table 10: Aerial work (VH- registered aircraft) occurrences, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	207	208	275	279	257	279	299	284	311	321
Serious incidents	15	15	15	9	14	18	16	31	23	37
Serious injury accidents	4	6	2	2	2	7	3	5	5	2
Fatal accidents	3	3	2	4	3	6	6	7	6	2
Total accidents	35	45	30	23	29	38	30	42	36	20
Number of people involved										
Serious injuries	9	9	2	2	2	9	5	6	8	2
Fatalities	7	4	2	9	3	7	6	8	9	2
Rate of aircraft involved										
Accidents per million hours	86.6	109.3	70.3	55.8	65.2	81.9	67.3	81.6	70.7	N/A
Fatal accidents per million hours	7.4	7.3	4.7	9.7	6.7	12.9	13.5	13.6	11.8	N/A

Figure 15: Accident rate for aircraft (VH- registered) involved in aerial work (per million hours flown), 2003 to 2011



Over the last 10 years, there have been several notable accidents involving aerial work that resulted in multiple fatalities:

- On 21 February 2006, a Robinson R44 helicopter was being used for a series of aerial survey flights to the north of Mt Isa, Qld when it collided with terrain. The pilot and three passengers on board were fatally injured. The ATSB investigated this accident, and came to the conclusion that the helicopter probably descended contrary to the pilot's intentions, possibly influenced by a partial engine power loss or downdraft. This was likely to have induced the pilot to apply collective, which developed into overpitching and ultimately main rotor stall. The helicopter was being operated at gross weights that exceeded the specified maximum take-off weight. The investigation also found that the operator's procedures did not provide a high level of assurance that a relatively low time pilot could conduct aerial survey operations safely (ATSB investigation 200600979).
- On 5 May 2009, two Robinson Helicopter Company R22 helicopters collided in mid-air near Springvale Station, WA. Both helicopters had departed the station just prior to sunrise that morning to conduct mustering operations. The first helicopter departed to the east in order to make radio contact with an adjoining station prior to heading for the mustering area. The other helicopter departed about 10 minutes later to the south-east, towards the mustering area. The helicopters were due to refuel a few hours later, but when the pilots failed to respond to radio calls, a pilot from a nearby station was tasked to conduct a search by helicopter. The wreckage of the helicopters was subsequently located south-east of the station, about 2 km from the planned mustering area. The circumstances of the accident were consistent with a mid-air collision while the pilots were positioning to commence the muster. The ATSB investigated this accident, and found that the converging flight paths of the helicopters, pilot fatigue and sun glare from the rising sun all contributed to the collision (ATSB investigation AO-2009-018).
- On 18 August 2011, an Aérospatiale AS.355 Twin Squirrel helicopter was operating in an area east of Lake Eyre, South Australia. The helicopter was being used to film footage for an Australian Broadcasting Corporation documentary. On board were the pilot and two passengers. The helicopter landed on an island in the Cooper Creek inlet, about 145 km north of Marree, SA, at about 1715 Central Standard Time, so that the occupants could meet and interview a tour group. At about 1900 (after the end of civil twilight), the helicopter departed the island to return to a property 48 km north of Marree where the pilot and passengers were

staying for the night. Soon after takeoff, the helicopter collided with terrain. All of the occupants were fatally injured, and the helicopter was destroyed by the impact forces and a fuel-fed fire. At the time of writing, this accident was still under investigation by the ATSB (ATSB investigation AO-2011-102).

Accidents, serious incidents, and injuries that occurred in 2012 in the different types of aerial work are explored in the following sections.

Aerial agriculture

There were 295 aircraft conducting aerial agriculture that were involved in occurrences reported to the ATSB between 2003 and 2012 (Table 11). Almost half (49 per cent) were involved in accidents, including 16 accidents that resulted in fatalities and 15 where the pilot was seriously injured. A further 30 per cent of these aircraft were involved in serious incidents, almost half of which occurred in the last three years.

Table 11: Occurrences involving general aviation aircraft conducting aerial agriculture, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	11	6	7	2	4	5	6	3	8	8
Serious incidents	8	9	9	3	5	7	5	17	13	15
Serious injury accidents	1	4	1	1	1	4	0	0	3	0
Fatal accidents	0	1	1	1	0	3	3	4	1	2
Total accidents	15	22	18	8	10	18	10	16	18	10
Number of people involved										
Serious injuries	1	4	1	1	1	4	0	0	3	0
Fatalities	0	1	1	1	0	3	3	4	1	2
Rate of aircraft involved										
Accidents per million hours	215.1	254.4	189.5	129.6	161	230.2	136.5	154.2	179.3	N/A
Fatal accidents per million hours	0	11.6	10.5	16.2	0	38.4	40.9	38.5	10	N/A

Loss of control, Robinson R44 helicopter (VH-WOH), 20 km SW of Mudgee, New South Wales (ATSB investigation AO-2012-165)

There were 10 aerial agriculture aircraft involved in accidents in 2012, the lowest number since 2006. Two of these were fatal accidents:

- The pilot of a Piper PA-25 Pawnee aircraft was conducting agricultural operations from a local airstrip near Hallston, Victoria. Shortly after takeoff, the aircraft collided with terrain near the base of a gully and was destroyed by a post-impact fire. The pilot was fatally injured. The ATSB investigated this accident, and determined that the aircraft likely sustained a partial power loss shortly after takeoff, resulting in the pilot being unable to continue climbing or maintain altitude. Damage sustained during the accident and post-impact fire prevented an identification of the specific reasons for the power loss, however, atmospheric conditions at the time were favourable for carburettor icing. The operation of the aircraft over hilly terrain probably limited the pilot's emergency landing options and increased the severity of the terrain impact following engine power loss (ATSB investigation AO-2012-061).
- A pilot was conducting weed spraying operations on a property south-west of Mudgee, NSW in a Robinson R44 helicopter. The intention was to complete spraying activities on the property followed by further spraying on a neighbouring property. The operation required a loader to remain at a refilling station on the property to mix the required chemical prior to loading into the helicopter.The pilot completed seven spray runs before reloading with chemical mix and fuel, and departing on the eighth spray run. About half an hour later, the loader and another witness became concerned that the helicopter had not returned and initiated a search. The helicopter was found on steep terrain about 450 m from the refilling station, and the pilot had been fatally injured. The ATSB investigated this accident, and analysis of the recovered GPS data identified that immediately before the accident the helicopter was climbing up a hill and that the speed decreased below about 10 kt. The ATSB found that at the time of the accident, the helicopter was over its maximum allowable weight. As a result, it was too heavy to hover out of ground effect and as the speed decreased, the power required exceeded that available from

the engine. This resulted in a probable reduction in main rotor RPM (an overpitch condition) and a descent. The time between this point and the first contact with a tree was insufficient for the pilot to complete a recovery action (ATSB investigation AO-2012-165).

The eight remaining accidents included two wirestrikes, three engine failures (one due to fuel exhaustion), and three loss of control accidents associated with abnormal aircraft performance or wind shifts when operating at low level. Some of those accidents investigated by the ATSB were:

- While applying chemicals in a field, a Cessna A188B developed a high sink rate as a result of a downdraught and the left wing impacted trees. The subsequent post-impact fire seriously damaged the aircraft and the pilot was injured. The ATSB investigated this accident, and the pilot reported that he had difficulties activating the emergency dump control system to lighten the aircraft. This accident highlights the risks associated with executing a turn when in close proximity to the ground. Such manoeuvres require heightened pilot vigilance regarding controlling the aircraft. In addition, pilots must be prepared to immediately identify the situation and act to control the aircraft, in order to compensate for a change in wind direction or downdraughts (ATSB investigation AO-2012-003).
- The pilot of a Schweizer 300C helicopter was returning to his home base after completing a day of aerial spraying at a farm near Scottsdale, Tasmania. While flying over heavily timbered country, the helicopter's engine power reduced, and it collided with the tree canopy before coming to rest on the ground. The pilot was wearing a helicopter safety helmet and was uninjured. He immediately exited the helicopter and described seeing "steam or smoke" coming from the helicopter, which subsequently was destroyed by fire. The pilot made his way to a small clearing and called his employer on a mobile phone to notify him of the accident, who arrived shortly after in another helicopter to pick him up. The ATSB investigation of this accident highlights the value of pilots wearing helicopter safety helmets. The pilot reported impact damage to both sides of his helmet. The pilot stated that he was of the opinion that 'the helmet saved my life' (ATSB investigation AO-2012-016).

Collision with terrain, Cessna A118B/A1 (VH-ZAP), 40 km S of Forbes, New South Wales (ATSB investigation AO-2012-003)

Although there was a decrease in 2012 in the number of aerial agriculture accidents when compared to the year before, there were more serious incidents (15). Almost all of these serious incidents (13) were wirestrikes that occurred during spraying runs in which the aircraft sustained damage, but the pilot was able to make a precautionary landing, air return, or continue operating.

The remaining two serious incidents occurred when an aircraft collided with an object on the ground:

- During the take-off run, the Air Tractor AT-502 encountered a willy willy. The pilot dumped the load but the aircraft struck a fence at the end of the strip before becoming airborne. The aircraft diverted to Dalby, Qld (ATSB occurrence 201200584).
- As the Air Tractor AT-502B transited between two fields near Narrabri, NSW, the aircraft struck a tree branch resulting in minor damage (ATSB occurrence 201201470).

In 2011 (the last year for which flying activity data was available at the time of writing), aerial agriculture operations had the highest accident rate (179 per million hours flown) and the third highest fatal accident rate (10 per million hours flown) of all types of general aviation flying.

The high accident rate, and common nature of many accidents and serious incidents (wirestrikes, collisions with ground objects, and control problems at low altitude) should be a reminder to pilots conducting spraying and other types of aerial agricultural operations that pre-flight planning and risk assessments are important to identify hazards in operating and manouvering areas. Improper loading of chemical tanks and hoppers can cause aircraft stability and control problems, especially when manouvering, or if the aircraft is affected by windshear or gusts.

Aerial mustering

As with aerial agriculture, the number of commercial aerial mustering incidents and accidents is small when year-on-year comparisons are made, and the number of occurrences varies significantly between years. In the 10 years ending 2012, there were 66 aircraft involved in aerial mustering that had accidents, six of which were fatal (Table 12).[8]

Over the same period, only 16 aerial mustering incidents and serious incidents were reported to the ATSB. When compared to general aviation as a whole (where in 2012, there were almost 30 incidents reported for every accident reported), the low number of incidents recorded each year suggests that they are significantly under-reported by aerial mustering operators.

Table 12: Occurrences involving general aviation aircraft conducting aerial mustering, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	0	0	1	4	1	0	3	0	2	0
Serious incidents	0	0	1	1	0	1	0	2	0	0
Serious injury accidents	1	1	0	0	1	1	0	4	1	1
Fatal accidents	1	0	0	0	1	0	2	1	1	0
Total accidents	8	7	5	4	8	3	5	14	6	6
Number of people involved										
Serious injuries	1	1	0	0	1	1	0	4	1	1
Fatalities	2	0	0	0	1	0	2	1	1	0
Rate of aircraft involved										
Accidents per million hours	80.2	67.8	44.2	39	70.9	26.6	47.4	118.6	47.7	N/A
Fatal accidents per million hours	10	0	0	0	8.9	0	18.9	8.5	7.9	N/A

[8] In addition to the commercial aerial mustering accidents reported in Table 12, between 2003 and 2012 there were also 12 accidents, six of which were fatal leading to seven fatalities, involving private (not for reward) aerial mustering. In 2012, there were two accidents, one of which was fatal (involving a single fatality). These accidents are reported under *Private/business* on page 54.

In 2012, there were six aerial mustering aircraft involved in accidents reported to the ATSB, but no reported incidents or serious incidents. The number of accidents in 2012 was the same as the year before, and was about average when considering an average year in the last 10 years. Of the six accidents, none were fatal, and one resulted in serious injury:

- While conducting low-level aerial work along the Dutton River near Richmond, Qld at low speed and low altitude, the pilot felt a 'kick' to the Robinson R22 helicopter and the machine suddenly yawed to the left. Shortly after, a second 'kick' and yaw occurred, followed by the sounding of the low rotor RPM warning horn. The pilot entered autorotation, and attempted to recover forward airspeed with the little height he had available (less than 250 ft). The pilot was unable to arrest the R22's descent, and it impacted the sandy river bed heavily and rolled onto its right side. A fire commenced immediately after impact, but the pilot was able to escape with minor burns. The ATSB investigation suggested that the 'kicks' and yaw experienced may have been due to environmental effects at low altitude, such as the effect of the gusting and swirling winds and mechanical turbulence. This accident highlights the need for helicopter pilots to be mindful of conducting operations with a combination of forward airspeed and altitude which may place the machine in the 'avoid' area of their helicopter's height-velocity diagram. The pilot in this accident was not wearing a helicopter safety helmet. The investigation determined that the post-impact fire initiated at the head height of the pilot, and that a helmet and visor may have reduced the severity and extent of the burns sustained (ATSB investigation AO-2012-006).

Collision with terrain, Robinson R22 helicopter (VH-FHR), 45 km ENE of Richmond Airport, Queensland (ATSB investigation AO-2012-006)

The remaining five aerial mustering accidents also involved helicopters, and included four collisions with terrain and one collision with water. While two of these occurred due to collision with a wire or with a tree (similar to accidents involving other aerial work where low-level flying is

normal, such as aerial agriculture), two accidents were due to a power loss, most likely from carburettor icing.

The first of these accidents involved a Robinson R22 helicopter conducting aerial mustering near Miranda Downs, Qld. During the mustering, the right skid struck a tree and the helicopter crashed. The pilot, the only occupant, was seriously injured and the helicopter sustained substantial damage. Both the ATSB and the helicopter's operator conducted an investigation into the accident and, using Global Positioning System (GPS) data, determined that the R22 had climbed to about 2,500 ft above sea level before commencing a left spiral descent. Bureau of Meteorology data, obtained by the operator, indicated that the temperature was 14.7° C and the dew point 1.3° C. The operator determined that this combination of temperature and dew point would indicate a moderate carburettor icing risk at cruise power and a serious icing risk at descent power. As a result of this occurrence, the aircraft operator advised the ATSB that they reminded their pilots of documentation in relation to carburettor icing and auto-rotations. This accident was a good reminder to all pilots of the importance of maintaining awareness of the weather conditions that are conducive to carburettor ice formation, and to closely monitor aircraft performance during times when the risk exists (ATSB investigation AO-2012-091).

The second aerial mustering accident was a case of spatial disorientation, due to reduced visibility and distraction. A pilot was conducting mustering operations at Innamincka Station, SA on a hot, cloudless day. The helicopter had been assisting ground personnel to move a large mob of cattle through sandy and swampy terrain. The pilot's job was to fly a low-level east-west grid pattern well behind the main herd, checking for stray cattle. Due to a build-up of dust, sand and mud on the helicopter's windscreen during the course of the day, the pilot's visibility had deteriorated. During the final run, the pilot conducted a right turn from west to east over the short of a lake, and although he was wearing sunglasses, the pilot's vision was affected by significant sun glare from the water. He became disoriented, and did not detect that the helicopter was descending during the turn. The helicopter contacted the water and sank, but the pilot was able to escape without injury and swam to shore (ATSB investigation AO-2012-146).

All operations at low-level require the pilot to be vigilantly aware of the speed, altitude, and decent rate of the helicopter, be aware of all ground hazards and their location with respect to these hazards, and have a well-rehearsed plan for situations where something unusual occurs (such as an engine malfunction or power loss). Any pilot distraction, aircraft or systems failure, adverse weather, aircraft performance loss, or handling inattention can reduce the margins for continued safe flight.

Collision with terrain, Robinson R22 helicopter (VH-STK), 23 km NE of Miranda Downs authorised landing area, Queensland (ATSB investigation AO-2012-091)

Emergency medical services

There has been a steady increase in the number of incidents reported involving aircraft engaged in EMS operations over the last 10 years. In 2012, 187 aircraft conducting EMS operations were involved in safety incidents, the highest number in the last 10 years (Table 13). This increase is consistent with the growth in activity in this aviation sector (the number of EMS hours flown increased by 30 per cent between 2003 and 2011, but decreased slightly in 2011 when compared with 2010).

Of all types of aerial work where information on flying activity is recorded, accident rates for EMS operations were the lowest of any category. This is in spite of the sometimes higher safety risks and difficulty associated with EMS when approaching and landing at remote or hazardous places to rescue people or provide medical relief.

The high number of incidents reported to the ATSB involving EMS aircraft over the last 10 years (including in 2012, where 187 incidents were reported) relative to accidents suggests there is a strong safety reporting culture in EMS operations compared to other aerial work categories.

Table 13: Occurrences involving general aviation aircraft conducting emergency medical services (EMS) operations, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	105	104	137	139	136	165	160	152	171	187
Serious incidents	2	1	1	0	2	5	3	3	1	7
Serious injury accidents	0	0	0	0	0	0	2	0	0	0
Fatal accidents	1	0	0	0	0	0	0	0	1	0
Total accidents	2	0	0	0	1	0	3	0	1	0
Number of people involved										
Serious injuries	0	0	0	0	0	0	3	0	0	0
Fatalities	3	0	0	0	0	0	0	0	1	0
Rate of aircraft involved										
Accidents per million hours	29.2	0	0	0	13.4	0	36.8	0	11.3	N/A
Fatal accidents per million hours	14.6	0	0	0	0	0	0	0	11.3	N/A

In 2012 there were no accidents, but seven EMS aircraft were involved in serious incidents, which was also the highest number in the reporting period. These serious incidents included three aircraft proximity events in the vicinity of non-towered aerodromes, where crews were not aware of another's aircraft presence due to communication issues or non-broadcasting on the CTAF. Other serious incidents included a loss of separation in controlled airspace, a pilot incapacitation associated with illicit drug use, a runway excursion, and a fire emanating from on-board medical equipment burning a patient. Those investigated by the ATSB included:

- During a normal landing at Horn Island, Qld, after returning from an EMS operation, the pilot flying a Dornier 328 released the power levers from the reverse thrust position. The right propeller moved to a ground idle position but the left propeller remained in the reverse thrust position, and the aircraft veered off the side of the runway.The first officer attempted to correct the deviation through rudder input; however, despite full right rudder, the aircraft continued to veer to the left. At the same time, the nose-wheel weight-on-wheels sensor showed the nose wheel alternating between ground and air modes, resulting in the nose-wheel steering not being operational. A subsequent engineering inspection found that the left power lever appeared not to spring as far forward as the right power lever when released from reverse thrust. In the course of the ATSB investigation into this serious incident, the operator reported that the thrust levers required positive handling to move from the reverse thrust to the ground idle position, rather than relying on the spring tension. The first officer did not recall receiving specific instruction on operating the power levers. The operator took a number of safety actions in response to this serious incident, including alerting flight crew to potential difficulties with the operation of power levers, and reviewing its safety system and check and training program (ATSB investigation AO-2012-009).
- The flight crew of a Bombardier DHC-8 was on descent into Broome, WA under ATC procedural separation when they received a TCAS resolution advisory. The flight crew descended in response to the TCAS, reported the event to Broome Tower, and saw a Pilatus PC-12 about 1 NM ahead which passed less than 300 ft to the right and slightly above them. The Pilatus pilot, who was departing Broome, only became aware of the loss of separation when the DHC-8 flight crew had reported a TCAS traffic advisory. At this time, the Pilatus pilot observed the DHC-8 on his TCAS, behind and on a reciprocal heading. The Pilatus pilot did not recall hearing a TCAS audible alert. The ATSB investigated this serious incident, and determined that the Pilatus pilot had not selected automatic direction finding as one of the

active navigation aids in the aircraft's Electronic Flight Instrumentation System (EFIS). As a result, upon programming new information into the EFIS after departure, the PC-12 unintentionally deviated from the desired outbound track and conflicted with the inbound track of the DHC-8. As a result, the operator of the PC-12 checked all aircraft in its fleet to ensure that the audio level of the TCAS could be heard above engine noise and radio traffic; the aircraft involved was the only one that required the audio level to be increased. This incident highlighted the need for pilots to cross check aircraft navigation performance to ensure accurate track keeping, particularly when operating in a procedural separation environment (ATSB investigation AO-2012-018).

There were no accidents involving EMS aircraft in 2012 and only seven that occurred in the last 10 years. The most recent fatal accident occurred in 2011 and is outlined below:

- On 24 December 2011 an Agusta Westland AW139 helicopter departed Bankstown Airport in response to an emergency personal locator beacon in the Budderoo National Park on the south coast of NSW. On board the helicopter were a pilot, an air crewman, two paramedics and a doctor. On locating the emergency beacon at the Bridal Veil Falls, the crew identified a seriously injured person on a rock ledge near the bottom of the waterfall. They assessed that it would not be possible to winch emergency personnel directly to the patient. In response, the crew landed at a nearby clear area and devised a plan to access and retrieve the patient. During the retrieval, the patient and one of the paramedics hit rocks at the base of the waterfall, and the paramedic died from the impact. The patient was subsequently transported to hospital for treatment. In its investigation, the ATSB identified that, due to reduced light, the paramedic and patient were accidentally pulled from the rock ledge as the helicopter was manoeuvred in preparation to lift them out using its winch. The ATSB also identified several safety issues relating to training and use of the helicopter’s lighting and radios. A number of organisational issues that could adversely influence the way crews act in similar circumstances were also identified (ATSB investigation AO-2011-166).

Helicopter winching accident involving an Agusta Westland AW139 helicopter (VH-SYZ), Bridal Veil Falls, New South Wales (ATSB investigation AO-2011-166)

Search and rescue

The ATSB is notified of very few accidents and incidents involving aircraft conducting search and rescue operations. In the last 10 years, there were no accidents in aerial search and rescue, and only five serious incidents (two were near collisions with other aircraft) reported to the ATSB (Table 14).

The low number of occurrences reported to the ATSB is likely due to the very small amount of search and rescue flying activity (relative to other types of general aviation). In 2011, search and rescue flying contributed 6,610 hours to the total number of hours flown in general aviation, representing about one per cent of all aerial work in Australia for that year.

Table 14: Occurrences involving general aviation aircraft conducting search and rescue operations, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	4	4	8	7	10	6	5	6	7	10
Serious incidents	0	0	0	0	0	1	0	3	0	3
Serious injury accidents	0	0	0	0	0	0	0	0	0	0
Fatal accidents	0	0	0	0	0	0	0	0	0	0
Total accidents	0	0	0	0	0	0	0	0	0	0
Number of people involved										
Serious injuries	0	0	0	0	0	0	0	0	0	0
Fatalities	0	0	0	0	0	0	0	0	0	0

In 2012 there were two serious incidents (one involving two search and rescue aircraft) and 10 incidents involving aircraft conducting search and rescue operations. The serious incidents were:

- During the initial climb on a State Emergency Service flood relief flight, a Bell 407 helicopter struck a powerline and conducted a precautionary landing at Walgett Airport, NSW. The helicopter sustained minor damage in the wirestrike. This serious incident was not investigated by the ATSB (ATSB occurrence 201201734).
- During a low level search pattern near the Solomon Islands, the flight crew of the Learjet 45 received a TCAS resolution advisory and sighted a Bell 412 helicopter about 500 ft below, and climbing on a crossing path. The crew of the Learjet conducted an immediate climb to avoid the helicopter. Separation between the aircraft reduced to about 80 m horizontally as the aircraft tracks crossed at the same altitude. The ATSB did not investigate this serious incident (ATSB occurrence 201207467).

Fire control

Aerial firebombing operations have been conducted in Australia since the early 1960s. There are generally few accidents associated with this type of operation (none since 2009), despite potential hazards associated with reduced visibility, spatial disorientation, low-level manoeuvring, and high operating weight (Table 15). Activity data (in terms of hours flown) is not available for this type of aerial work.

Table 15: Occurrences involving general aviation aircraft conducting fire control operations, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	4	3	2	11	4	2	8	3	0	6
Serious incidents	0	1	2	1	1	1	3	0	0	1
Serious injury accidents	1	0	0	0	0	0	1	0	0	0
Fatal accidents	0	0	0	1	0	0	1	0	0	0
Total accidents	3	1	0	3	1	0	4	0	0	0
Number of people involved										
Serious injuries	1	0	0	0	0	0	2	0	0	0
Fatalities	0	0	0	1	0	0	1	0	0	0

In 2012, there was one serious incident reported to the ATSB involving an aircraft conducting fire control work. This was the first serious incident reported since 2009, and involved an Air Tractor AT-802 that struck a powerline during firebombing operations near Bombala, NSW. There were also six incidents reported in fire control operations in 2012, including two unauthorised incursions into restricted airspace, an aircraft climbing above its assigned level, a hydraulic pipe failure, a loss of lateral control and a passenger door being closed with the shoulder strap outside the aircraft.

Of the few accidents that have occurred in fire control operations in the last 10 years, those that involved fatalities are described below:

- On 16 February 2006, a PZL M-18A Dromader was performing firebombing operations near Cootamundra, NSW. While manoeuvring the aircraft, the pilot made a left turn at an estimated height of 300 ft and banked left at nearly 90°, inducing a stall with wing drop. There was insufficient height for the pilot to attempt recovery action, and the aircraft collided with terrain. The ATSB investigation into this accident could not conclusively determine why the pilot did not adequately recognise the impending stall, but noted that given the high operating weights at the time of the accident, and that the pilot had not jettisoned the load of retardant, that the pilot might have been distracted by a technical issue with the aircraft or the fire doors. Despite being an experienced agricultural pilot with previous firebombing experience, the pilot had limited experience on type, and had not recorded any firebombing flights in the previous three years (ATSB investigation 200600851).
- On 9 December 2009, the pilot of a Bell 206L-1 LongRanger was conducting a VFR fire operations flight on behalf of the NSW Rural Fire Service and National Parks and Wildlife Service from Dorrigo, NSW, with one passenger on board. Shortly after take-off, the pilot encountered reduced visibility conditions due to low cloud. Subsequently, all visual reference with the horizon and the ground was lost. The pilot attempted to land by entering a hover over the designated helicopter landing area, but lost control of the helicopter, which impacted the ground with significant vertical force. The passenger was fatally injured, the pilot was seriously injured, and the helicopter was seriously damaged. The ATSB investigation into this accident found that after the pilot established the hover, the helicopter entered the rapidly fluctuating cloud. The pilot lost visual reference and became spatially disoriented and the helicopter impacted the ground in an uncontrolled state. Following the accident, a full review of the operational procedures affecting the operation was conducted jointly by the then Department of Environment, Climate Change and Water; the NSW Rural Fire Service; and other NSW fire-fighting authorities. An action plan was implemented to make several safety enhancements to those operational procedures. In addition, the National Parks and Wildlife Service ceased operations at the Dorrigo helicopter landing site (ATSB investigation AO-2009-077).

Survey and photography

Very few occurrences are reported to the ATSB involving aircraft conducting survey and photography aerial work. Despite this, 2012 was the first year since 2004 where there were no reported accidents involving this type of operation. The number of incidents reported in survey and photography operations was also the lowest in 5 years (Table 16).

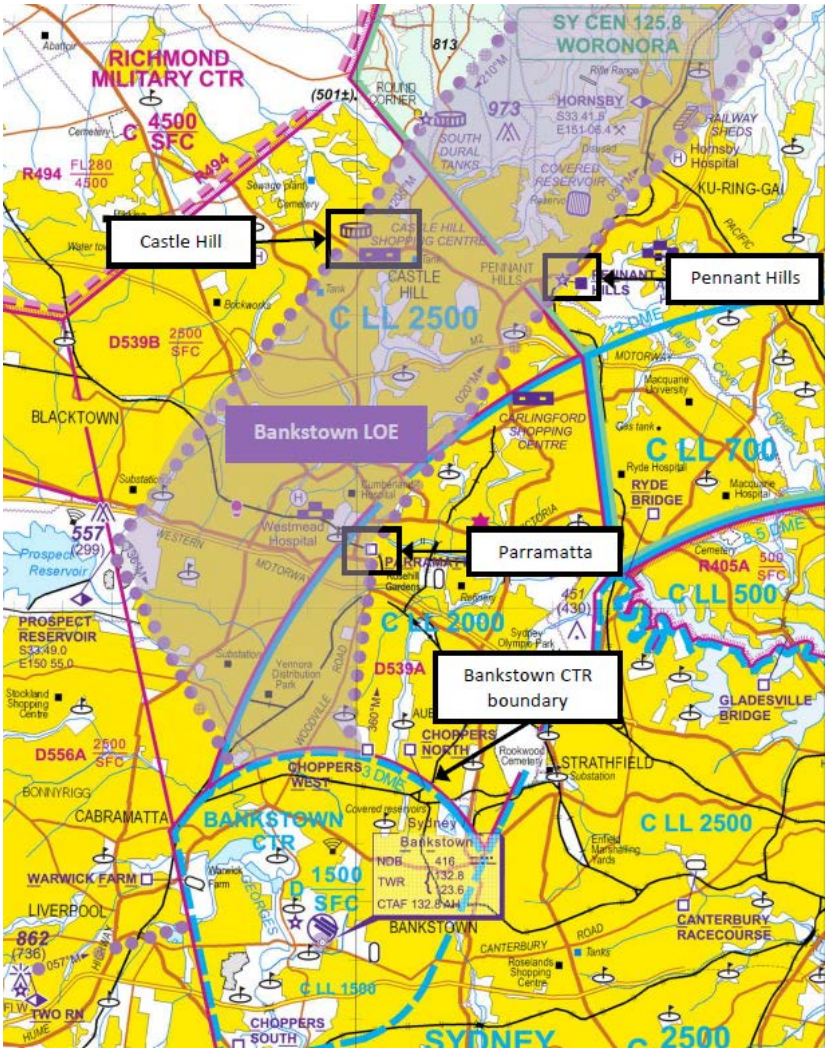
Table 16: Occurrences involving general aviation aircraft conducting survey and photography operations, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	4	8	14	17	18	24	38	38	35	30
Serious incidents	0	0	0	1	1	1	2	3	3	6
Serious injury accidents	0	0	1	1	0	1	0	1	0	0
Fatal accidents	1	0	0	2	1	2	0	0	2	0
Total accidents	2	0	2	3	2	7	3	5	4	0
Number of people involved										
Serious injuries	4	0	1	1	0	3	0	2	1	0
Fatalities	2	0	0	7	1	2	0	0	4	0
Rate of aircraft involved										
Accidents per million hours	37.9	0	61.2	67	36.9	108.6	78.2	85.5	58.7	N/A
Fatal accidents per million hours	19	0	0	44.7	18.4	31	0	0	29.4	N/A

In contrast, the number of survey and photography aircraft involved in serious incidents in 2012 (6) was the highest in the last 10 years, and included five aircraft separation issues (four near collisions outside of controlled airspace, and one loss of separation in controlled airspace). Four of these serious incidents were investigated by the ATSB:

- The pilot of a Robinson R44 helicopter was conducting a routine gas pipeline inspection flight between Parramatta and Castle Hill, NSW. Prior to crossing the lane of entry (LOE) to Bankstown Airport, the R44 pilot advised his intentions on the Sydney Centre frequency, and after looking for traffic departing Bankstown for the LOE, commenced a right turn to the north to traverse the LOE. About 1 NM to the north of Parramatta, the pilot observed a Piper PA-28-161 tracking northbound from Bankstown, which passed overhead about 20 ft above. In response, the R44 pilot immediately lowered the collective and commenced a descending right turn. The instructor in the PA-28 later reported that he did not observe the R44 until they passed. After the aircraft passed, the pilot of the R44 reported that he attempted to contact the Piper on Sydney Centre on two occasions, but no response was received. Soon after, the pilot of the PA-28 changed his radio settings from the Bankstown Tower to Sydney Centre frequency. A review of Airservices Australia radar surveillance data indicated that the distance between the two aircraft reduced to 0.2 NM (370 m) laterally, with both aircraft at the same altitude of 1,400 ft. The aircraft were operating in uncontrolled airspace and were not being separated by air traffic control. The ATSB investigated this serious incident, and the pilot of the R44 reported that he had Sydney Centre selected on his COMM 1 radio and Bankstown Tower selected on COMM 2; however, the volume on COMM 2 was turned down to a low ‘murmur’. He stated that his normal practice was to turn the volume up when operating to the south of Parramatta, so that he could listen for traffic departing Bankstown for the LOE. But when operating to the north of Parramatta, he turned the volume down as he had no need to monitor Bankstown Tower when operating in the LOE. The pilot reported that he did not hear any broadcasts from the PA-28. This serious incident highlighted the advantages of utilising two communication systems, if fitted, to enhance traffic awareness. It was also a reminder of the

benefits of notifying air traffic control if intending to conduct aerial work within a known area of high traffic, such as the Bankstown LOE (ATSB investigation AO-2012-014).



Aircraft separation event between a Robinson R44 Raven II helicopter (VH-HYC) and a Piper PA-28-161 (VH-TAK), 1 NM N of Parramatta, New South Wales (ATSB investigation AO-2012-014)

- A Boeing 737-800 was on an required navigation performance approach (ARBEY STAR) for runway 27 at Melbourne Airport, while a GAF N22 Nomad was conducting bushfire management survey work 15 NM to the north east of the airport. Melbourne Approach ATC advised the Nomad flight crew, who were operating under VFR and tracking westbound, to remain clear of the 737 on approach, but the controller did not correctly assign a visual separation standard. Shortly afterwards, the 737 flight crew received a TCAS traffic advisory with an aircraft 600 ft below and 3 NM away, followed by a resolution advisory to adjust vertical speed. The autopilot disconnected, and the flight crew reduced their vertical speed until the aircraft had passed.The ATSB is investigating this serious incident (ATSB investigation AO-2012-029)
- A Piper PA-34T conducting IFR flying training was involved in a near collision with a Cessna R182, which was on a pipeline survey under VFR near Avalon, Vic. The aircraft passed within 0.1 NM and 100 ft of each other in Class D airspace. The air traffic controller had provided traffic information to both aircraft, but the pilot of the Piper stated that the information was not sufficient for him to understand the intended track of the Cessna. The ATSB investigated this serious incident, which was a timely reminder that traffic information provided by air traffic controllers must be concise yet include enough relevant reference information to enable the pilot to determine if any avoidance action is required. Amendments have recently been made

to documents used by air traffic controllers to provide them with more detail on the provision of safety alerts in all classes of airspace, and on when to issue avoiding action within surveillance coverage (ATSB investigation AO-2012-071).

- A Beech 1900 was on final approach to Jabiru, NT, while an Airparts FU-24 was taking off from the reciprocal runway. The Beech 1900 flight crew made appropriate broadcasts on the CTAF during the approach to announce their intentions, but did not hear any other broadcasts. During the approach, the Beech 1900 flight crew observed a 'glint' on the runway. At the time, the captain believed it may have been from a car operating on a road near the runway or an aerodrome officer completing a runway inspection, so the approach was continued. Due to haze and sun glare, the Beech 1900 crew did not see the FU-24 until reaching 500 ft on final approach, at which point the FU-24 was at the point of takeoff on the reciprocal runway. The pilot of the FU-24 had been broadcasting, but had not checked his radio, which was not correctly set and was therefore was not transmitting. Both aircraft turned right for evasive action, and separation reduced to about 300 ft vertically and less than 250 m horizontally. The ATSB investigated this serious incident, and as a result, the operator of the FU-24 arranged for all pilots to re-visit company standard operating procedures on radio transmissions and low-level survey flying. This serious incident demonstrated the importance of checking the serviceability of radio equipment prior to flight. In particular, the use of available resources such as an AFRU to ensure the radio is transmitting (ATSB investigation AO-2012-134).

There was also a serious incident involving an engine failure in a Bell 206B JetRanger helicopter while on initial climb, resulting in a forced landing.

Flying training

In 2012 there were 16 accidents involving flying training, one of which resulted in fatalities and another resulted in serious injuries. There were also 44 flying training aircraft involved in serious incidents (Table 17). This was the highest number of serious incidents of any year since 2003, and was more than double the 10 year annual average (21 serious incidents per year in flying training operations). The number of flying training aircraft involved more broadly in accidents and incidents in 2012 (16 and 239 respectively) was similar to the number reported in the last couple of years.

Table 17: Flying training (VH- registered) aircraft occurrences, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	277	294	366	353	338	247	261	238	236	239
Serious incidents	13	11	12	22	18	18	24	30	22	44
Serious injury accidents	1	1	0	1	0	0	1	2	0	1
Fatal accidents	5	1	1	0	0	3	1	0	1	1
Total accidents	19	14	23	12	19	22	21	16	13	16
Number of people involved										
Serious injuries	2	2	0	1	0	0	1	3	1	1
Fatalities	7	2	1	0	0	4	1	0	2	2
Rate of aircraft involved										
Accidents per million hours	44.7	39.2	54.7	28	41.2	44.9	42	36.4	33.3	N/A
Fatal accidents per million hours	11.8	2.8	2.4	0	0	6.1	2	0	2.6	N/A

The single fatal accident involving flying training in 2012 is outlined below:

- On 9 November 2012, a student pilot and instructor departed Gold Coast Airport, Qld, for a training flight in a SOCATA TB-20 Trinidad. The student pilot had recently purchased the

TB-20, and was under the supervision of an instructor while undertaking transition training. The pilots had conducted a number of circuits at Lismore Airport, NSW, when several witnesses travelling along the Bruxner Highway observed the aircraft make an abrupt steep bank to the left, before pitching nose down and rapidly descending. Some of these witnesses then saw the aircraft's nose raise and the descent rate to reduce, before crossing the highway at a very low height and colliding with the ground in a paddock adjacent to the highway. The aircraft skidded along the ground, colliding with a fence, rupturing the fuel tanks before the aircraft flipped over. Both occupants on board the aircraft were fatally injured and a fuel-fed fire destroyed a substantial amount of the aircraft structure. At the time of writing, this accident was under investigation by the ATSB. This investigation is considering whether the operation of the engine and propeller, the aircraft's handling qualities, or the experience of the student or instructor contributed to the accident (ATSB investigation AO-2012-149).

Collision with terrain, SOCATA TB-20 Trinidad (VH-HBB), 3 km S of Lismore, New South Wales (ATSB investigation AO-2012-149)

The non-fatal flying training accidents and serious incidents in 2012 involved a number of common themes, which were also seen in other types of GA operations:

- aircraft separation with aircraft approaching the same reporting points
- aircraft separation in circuits at non-towered aerodromes, particularly on the turn to final. In most of these cases, one pilot was not broadcasting on the CTAF, or a pilot was not monitoring the CTAF (on another frequency)
- aircraft separation in circuits at Class D towered airports, where aircraft did not comply with sequencing instructions, sighted the incorrect aircraft, or entered the circuit below the correct altitude
- aircraft making unusual approaches without informing other pilots of their intentions, or overshooting the runway centreline on the turn to final
- engine failures in single-engine aircraft associated with a successful forced landing
- in helicopter training, a loss of control during practice autorotations (due to inappropriate or untimely control inputs or power setting changes) leading to a hard landing or tail rotor strike.

Some notable occurrences that were investigated by the ATSB in 2012 are discussed below:

- The pilot of a Cessna 172S aircraft received an ATC clearance to land on runway 35R at Moorabbin Airport, Vic. Several seconds later, the pilot reported observing another Cessna 172S aircraft pass overhead from his right, about 10 to 20 metres in front. In response, he reduced engine power and raised the nose of the aircraft slightly to slow the aircraft and

increase separation. The pilot then advised ATC, who immediately instructed the pilot of the intruder Cessna to conduct a go-around. The flight instructor in the intruder aircraft reported that he was not aware of the reporting pilot's Cessna operating in the circuit until after the incident occurred. The ATSB investigation into this serious incident found that the pilot of the reporting Cessna did not make a broadcast when joining downwind, as was required in the Civil Aviation Safety Authority (CASA) Visual Pilot Guide for the Melbourne Basin. Other issues identified by the pilots involved in this near miss included conversation in the cockpit being a distraction from radio traffic awareness, lookout vigilance and confirming the aircraft you are following is actually the aircraft you see in front, the effect of wind on separation between aircraft in different circuit legs, and being aware that traffic might be located outside of a pilot's normal traffic scanning area if it conducting a wide circuit (ATSB investigation AO-2012-099).

- The flight instructor and student pilot of a Schweizer 269C-1 helicopter were conducting a return training flight from Parafield Airport, SA, via the Dam Wall VFR approach point. When approaching Dam Wall, the flight instructor was advised by air traffic control of an aircraft above and to the left at 2,500 ft inbound, and two other aircraft 3 NM behind the Schweizer. The instructor became concerned with the aircraft behind as he could not sight them, and instructed the student to descend to 1,400 ft. Shortly after, the instructor received a traffic warning for an aircraft 1 NM behind at the same altitude, and a little later, both the instructor and the student observed a Cessna 172 pass overhead with less than 50 ft vertical separation. In the ATSB investigation into this near collision, the pilot of the Cessna reported that he had sighted the Schweizer in his 1 o'clock position at about 3 to 4 NM from Dam Wall and made a precautionary left turn and descent to avoid a separation issue. The Cessna pilot then temporarily lost sight of the helicopter as he became preoccupied with sighting the Dam Wall and preparing an inbound broadcast to Parafield Tower. This serious incident was a timely reminder to pilots operating in and around high traffic density areas (such as VFR approach points) that it is crucial to maintain a heightened level of situation awareness. As a result of this occurrence, a new VFR approach point has been proposed for helicopter operations into Parafield Airport (ATSB investigation AO-2012-115).
- During cruise on a night flight between Alice Springs and Tennant Creek, NT, the crew of the Gippsland GA-8 Airvan noted that the engine oil pressure indication was dropping. They intended to conduct a precautionary landing onto a nearby airstrip at Ti Tree, however, they were unable to activate the runway lights. A short time later, the engine began to run rough and subsequently failed. They decided to abandon the landing at the unlit airstrip, and using vehicle lights as a guide, successfully completed a forced landing on the Stuart Highway. The ATSB investigation into this serious incident found that the pilot activated lighting at the Ti Tree airstrip was known to be unreliable and had not recently been tested by the airstrip operator, but that this information had not been communicated to pilots. The lighting at this airstrip has since been upgraded. One of the greatest concerns for pilots operating single-engine aircraft is the prospect of a total power loss at night. Should such an event occur, it is crucial that pilots are mentally prepared to act immediately. This incident demonstrated how responding to an adverse situation promptly can result in a positive outcome (ATSB investigation AO-2012-092).
- A Hélicoptères Guimbal Cabri G2 helicopter travelled to the western grass helicopter training area at Bankstown Airport to demonstrate to a student the recovery from low main rotor RPM in the hover. During the demonstration, the helicopter began to rotate to the left. The instructor opposed the rotation with full right pedal, however, the rotation could not be stopped, and the helicopter drifted towards the airport boundary fence. The instructor elected to put the helicopter down to prevent a further loss of control or a collision with the fence, and the helicopter landed heavily. The ATSB investigation into this serious incident found that the Cabri G2 has a high main rotor inertia compared to other helicopters of similar weight and performance. The helicopter manufacurer advised the ATSB that, combined with the design of the electronic RPM governor, the high main rotor inertia makes recovery from low rotor RPM in the hover difficult. As a result of this serious incident, the helicopter manufacturer is preparing a

service letter to help prevent training sequences being performed that are inappropriate for the helicopter type (ATSB investigation AO-2012-140).

Near collision between two Cessna 172S Skyhawk aircraft (VH-EWE and VH-EOP), Moorabbin Airport, Victoria (ATSB investigation AO-2012-099)

Private/business/sports aviation

Private/business and sports aviation generally describes aircraft that are being operated for pleasure or recreation, or are being used for a business or professional need, including private aerial stock mustering. It is difficult to distinguish between business and private operations, so they are aggregated for the purposes of this report.

It is important to note that only aircraft conducting these operations that are registered on the Australian civil aircraft (VH-) register are included in this section. Sports and recreational aircraft that are registered under other schemes (such as by Recreational Aviation Australia (RA-Aus)) are considered separately in the *Recreational* section of this report on page 63.

As the number of hours flown in sports aviation is not comprehensively known, rate data is not available for the combined private/business/sports aviation operation type. In 2012, there were 287 private/business/sports aviation aircraft that were involved in an occurrence reported to the ATSB, including 17 that were in a fatal accident, the highest number of fatal accidents for 10 years (Table 18).

Table 18: Private/business/sports aviation (VH-registered) aircraft occurrences, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	222	215	240	289	319	277	287	196	221	196
Serious incidents	3	22	13	14	24	17	21	21	34	36
Serious injury accidents	6	7	2	5	5	9	6	8	6	3
Fatal accidents	5	7	13	15	9	13	9	5	9	17
Total accidents	63	83	64	56	66	65	66	64	56	58
Number of people involved										
Serious injuries	8	10	3	10	7	14	7	10	11	6
Fatalities	13	16	18	25	18	23	9	7	17	25

Private/business

There were 2,855 aircraft being used for private or business flying involved in incidents, serious incidents, and accidents that were reported to the ATSB in the last 10 years (Table 19). Incidents reported to the ATSB increased between 2004 and 2007, and again in 2011, but have generally decreased since 2007.

Table 19: Occurrences involving general aviation aircraft conducting private and business operations, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	178	171	208	275	293	236	259	157	192	172
Serious incidents	2	19	12	13	19	14	17	14	27	30
Serious injury accidents	2	3	0	4	4	7	3	5	4	1
Fatal accidents	3	6	9	12	7	11	6	5	8	15
Total accidents	52	72	53	49	58	58	57	57	42	50
Number of people involved										
Serious injuries	2	6	1	9	6	12	3	6	9	3
Fatalities	11	15	14	21	15	20	6	7	16	22
Rate of aircraft involved										
Accidents per million hours	134.9	183.4	135.6	131.1	153	151.6	146.2	148.5	111.9	N/A
Fatal accidents per million hours	7.8	15.3	23	32.1	18.5	28.8	15.4	13	20.8	N/A

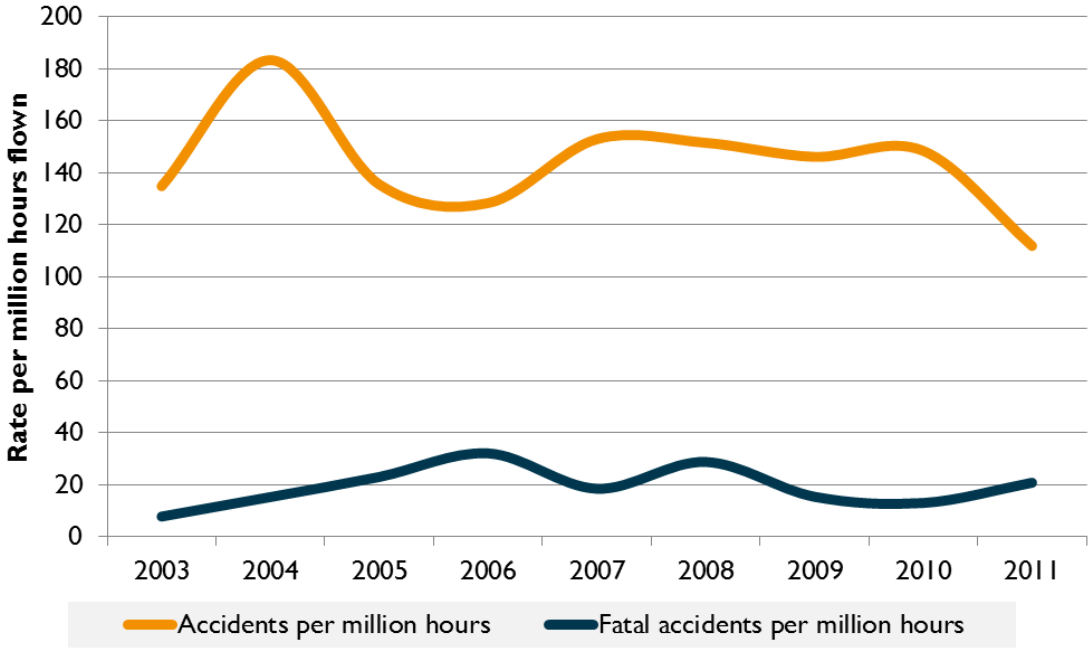
As the amount of flying activity has been relatively constant in private and business aviation over the last decade at about 370,000 to 400,000 hours flown per annum, the decrease in reporting suggests a level of underreporting of occurrences to the ATSB. The ATSB conservatively estimates that 25 to 30 per cent of all aviation safety incidents in Australia each year are not reported. A major challenge for the ATSB in its charter to improve transport safety is that there is a lower level of awareness in the GA community of the need to report safety incidents, and what constitutes a reportable transport safety matter. Future amendments to the *Transport Safety Investigation Act* 2003 (TSI Act) and Regulations will clarify what industry needs to report, in order to make reporting clearer and less onerous for pilots and operators alike. It is hoped that these changes, along with improved engagement with the GA community by the ATSB (through

programs such as *SafetyWatch* and the popular *Avoidable Accidents* series) will help to reduce underreporting of incidents.

While the number of incidents reported in 2012 (172) was the second lowest out of any year in this period, the number of serious incidents was at its highest in 10 years[9], and the number of accidents and fatal accidents was higher than in 2011. The number of fatal accidents in 2012 was the highest for the past 10 years. Similar types of accidents involving GA aircraft happen time and time again, and most GA accidents are avoidable. These include mismanagement of fuel, poor situational awareness when operating around non-towered aerodromes, collision with wires and other obstacles when flying too low, flying VFR into instrument meteorological conditions (IMC), and a loss of control following a partial power loss after take-off.

Private/business operations recorded one of the highest annual accident rates of any Australian aviation operation type (second only to aerial agriculture). In 2011, there were about 112 accidents per million hours flown; however, this represented the lowest accident rate in private/business operations in the last 10 years (Figure 16). Unfortunately, the fatal accident rate in private/business operations increased in 2011 compared to previous years to almost 21 per million hours flown. This is higher than other types of GA that are normally associated with a higher level of operation risk, such as aerial agriculture and mustering.

Figure 16: Accident rate for aircraft (VH- registered) involved in private flying & business operations (per million hours flown), 2003 to 2011



There were 15 fatal accidents in private and business operations in 2012 involving VH- registered aircraft, which was the highest number in the last 10 years:

- On 27 January 2012, a de Havilland DH-82A Tiger Moth took off from Maryborough Airport, Vic. with two people on board. Witnesses reported that immediately after takeoff the aircraft had a partial, intermittent power loss, and continued to fly at low altitude towards the departure end of the runway. At the departure end of the runway, where open terrain changed into woods, witnesses saw the aircraft make a climbing left turn at low speed, before stalling and descending. The aircraft impacted the ground and both occupants were fatally injured. The

[9] Due to ATSB data coding and reporting policy changes (serious incidents were categorised differently prior to 2003, when the *Transport Safety Investigation Act* 2003 and Regulations were introduced), the number of serious incidents presented for 2003 cannot be compared with more recent years.

ATSB investigation into this accident found that the partial engine power loss was probably a result of a partial blockage within the aircraft's fuel cock. Although sufficient runway remained ahead to allow a safe landing at the time the partial power loss first occurred, the pilot continued the flight under limited power without gaining sufficient height to clear trees beyond the runway. The ATSB *Avoidable Accidents* publication *Managing partial power loss after takeoff in single-engine aircraft* reminds pilots that the risk associated with a partial power loss during or immediately after takeoff in a single-engine aircraft is reduced if the pilot makes an immediate commitment to land (ATSB investigation AO-2012-017).

- On 4 February 2012, a Robinson R44 helicopter lifted off from Jaspers Brush Aerodrome, NSW for aerial photography of the launching of a deep sea submarine in nearby Jervis Bay. On board were the pilot and a camera operator. Soon after lifting off, the pilot's door opened and the pilot reached out to close the door. Simultaneously the helicopter abruptly pitched nose-up then steeply nose-down, rolling to the right before the right landing gear skid and main rotor blades struck the ground. A fuel-fed fire started in the vicinity of the fuel tanks and lower mast area prior to the helicopter coming to a stop. Both occupants were fatally injured, and the helicopter was destroyed. The ATSB investigation into this accident found that the pilot's door was not properly latched prior to lift off and opened during the turn to depart. In attempting to shut the door the pilot probably let go of the cyclic control from the normal (right) control hand, allowing for an unintended, abrupt nose-up pitch and the helicopter tail hitting the ground. The helicopter then nosed over and impacted the ground. A fire began when one of the fuel tanks was breached. An important aspect of this investigation was post-accident survivability, and the ATSB identified that the fatal injuries in this and several other accidents involving R44 helicopters were due to the post-impact fire. In this and the other accidents, the R44's had not (and were not yet required to have been) modified in accordance with a manufacturer service bulletin that specified replacement of aluminium fuel tanks with more impact-resistant bladder-type fuel tanks, which decrease the risk of a post-accident fire. Both the ATSB and CASA have separately highlighted the benefits of the upgraded bladder-type fuel tank and related modifications to operational and maintenance personnel, and as of 30 April 2013, all R44 helicopters operating in Australia are now required by CASA to be fitted with bladder-type fuel tanks. This accident highlighted the importance of ensuring all doors are secured prior to takeoff. That said, the opening of a door in flight will not normally affect the operation of an R44, but the instinctive reaction to immediately deal with such an event can be quite strong. Pilots need to be aware that this reaction may be hard to overcome and in the event of an unexpected situation occurring such as the opening of the door, it is vital that pilots should continue to 'fly the aircraft'. This includes choosing to land to close the door if necessary (ATSB investigation AO-2012-021).

Loss of control, Robinson R44 helicopter (VH-COK), Jaspers Brush Aerodrome, New South Wales (ATSB investigation AO-2012-021)

- On 11 April 2012, an Ayres S2R-G10 Thrush departed from St George, Qld on a ferry flight to Moree, NSW. The owner-pilot was the sole occupant, and was flying the aircraft to Moree for scheduled maintenance. The aircraft impacted terrain to the north-west of Moree. The pilot was fatally injured in the accident, and the aircraft was destroyed by the impact and by an intense fuel-fed fire. A number of witnesses reported observing the aircraft in a steep spiralling descent that was consistent with a spin prior to impact. While this accident was still under active investigation by the ATSB at the time of writing, examination of the wreckage by the ATSB indicated that the aircraft impacted terrain while rotating in a clockwise direction. All of the major aircraft components were accounted for with no evidence of pre-impact damage. Continuity of the flight control system to the cockpit area was established, and a substantial amount of fuel was located in the wreckage (ATSB investigation AO-2012-049).
- On the morning of 29 April 2012, the owner-pilot of a Cessna 150M was conducting private aerial stock mustering on a cattle station north east of Bourke, NSW. Some early patches of fog had cleared, and the weather was fine and calm. After about an hour and a half in the air, the pilot radioed stockmen on the ground to direct them to an area where cattle were not moving. The aircraft was observed circling over the area, then entered a steep descent which was followed by the sound of an impact. The aircraft was destroyed, and the pilot fatally injured. The ATSB investigation into this accident found that while manoeuvring at low level, the pilot inadvertently allowed the aircraft to aerodynamically stall, resulting in a high rate of descent and a collision with terrain. There was insufficient information about the pilot's control inputs for the investigation to establish what factors precipitated the stall. The pilot did not hold a valid medical certificate at the time of the accident, and had not completed a flight review for a number of years. This increased the risks of operating an aircraft, especially during aerial stock mustering. This accident was a good reminder to private GA pilots that pilot proficiency can decline without regular practice of non-routine procedures under supervision. Pilots should take every opportunity to refresh their knowledge and skills, at a minimum during a flight review every two years with a flight instructor or an approved training/check pilot (ATSB investigation AO-2012-059).
- On 28 May 2012, a Cessna 172 Skyhawk collided with terrain near Wentworth, NSW while on a solo private flight in the local area. No details of the flight were submitted to ATC, or left with any other person. After a two day search and rescue operation, the aircraft wreckage was found 10 km west south west of Wentworth Airport. The pilot had been fatally injured, and the

aircraft destroyed by the impact and a post-impact fire. Examination of the wreckage by the ATSB identified that the aircraft collided steeply with the terrain at high speed. All of the major aircraft components were accounted for in the vicinity of the accident site, with the exception of the left cabin door. There was no evidence of any pre-impact damage or fire. Continuity of the flight control system to the cockpit area was established. A number of cockpit instruments were retained for further technical examination. On-site examination of the aircraft's propeller and engine revealed no pre-impact abnormalities, and damage to the propeller and engine crankshaft was consistent with their failure while under power. Fuel and other aircraft records indicated that the aircraft was fully refuelled at the aerodrome on 10 May 2012 and had likely not flown since that date. Weather at the time of the accident was calm, with no significant low cloud and good visibility. At the time of writing, this accident was still under investigation by the ATSB, with a focus on the pilot's flying experience, licence, endorsements and medical history, the recovered cockpit instruments, and the aircraft's weight, balance, performance, and maintenance records (ATSB investigation AO-2012-072).

Collision with terrain, Cessna 172 Skyhawk (VH-WLF), 10 km W of Wentworth, New South Wales (ATSB investigation AO-2012-072)

- On 4 June 2012, the pilot of a Cessna 182Q took off from Walgett, NSW in good weather conditions for a flight to Mudgee, initially climbing to 5,500 ft. During the flight, the cloud base lowered. About 25 minutes after the pilot departed, he rang a friend who lived near Mudgee, and asked for an appraisal of the weather there. The friend reported weather conditions suggesting that it might not be suitable to fly to Mudgee in VFR conditions. The friend recalled that the pilot said that if the weather conditions deteriorated too much, he would turn around and return to Walgett. For the next 10 minutes, the pilot continued to descend until the aircraft was flying about 1,000 ft above flat terrain, either close to or in the base of the cloud. The terrain ahead and to the left of this track continued to rise to an altitude significantly above that at which the aircraft was flying. About 13 minutes later, the aircraft impacted a rock face in the Warrumbungles near Tooraweenah, NSW, destroying the aircraft and fatally injuring the pilot. The ATSB investigation into this accident found that the risk to flight was increased by

deteriorating weather conditions, and the pilot was probably flying with forward visibility sufficiently obscured by cloud to not be able to see and avoid the rising terrain. In addition, the pilot did not select a flight track to avoid the rising terrain, or conduct a diversion to a suitable aerodrome, which would have been an effective measure to manage the deteriorating weather. The ATSB *Avoidable Accidents* publication *Accidents involving Visual Flight Rules (VFR) pilots in Instrument Meteorological Conditions* is a good reminder to pilots of the insidious risks associated with reduced forward visibility when flying in or near the cloud base (ATSB investigation AO-2012-076).

- On 1 October 2012, a de Havilland DH-84 Dragon took off from Monto, Qld on a private VFR flight to Caboolture with the pilot and five passengers on board. About two hours into the flight, the pilot requested air traffic control assistance and reported that the aircraft was in 'full cloud'. For most of the remainder of the flight, the pilot and ATC exchanged communications, at times relayed through a commercial flight and a rescue flight in the area due to the limited ATC radio coverage in the area at low altitude. Air traffic control was unable to direct the pilot to an area of known visual conditions because of the extent of the cloud cover and uncertainty over the aircraft's position. Communication with the aircraft was subsequently lost. A two day search and rescue effort found the wreckage of the aircraft in a remote area to the south-west of Gympie. The accident was not survivable, and the six occupants were fatally injured. At the time of writing, this accident was still under active investigation by the ATSB. Several items and components that were retrieved from the accident site have already been examined, including a GPS unit and some aircraft instruments, and no indications of an aircraft malfunction have been found. The investigation will continue to examine air traffic radar and radio recordings, the aircraft wreckage, instruments and maintenance records, the emergency response, weather information, and witness reports (ATSB investigation AO-2012-130).

Collision with terrain, de Havilland DH.84 Dragon (VH-UXG), 36 km SW of Gympie, Queensland (ATSB investigation AO-2012-130)

- On 3 October 2012, the pilots of two Robinson R22 helicopters, each with a passenger on board, landed in a relatively open part of a gorge that had been spotted while on a sightseeing flight about 130 km west of Halls Creek, WA. With the others on the ground, one of the pilots lifted off to have a look at the gorge from the air. The pilot descended into a narrow part of the

gorge where the remaining pilot and a passenger were swimming, and maintained a hover. While the swimmers returned to the other helicopter, they saw the R22 climbing, and the helicopter tail contact a rock overhang about 30 m above the gorge pool. The tail boom separated, and the helicopter rolled into the surrounding rocks out of view. The swimmers went to the site of the accident, where they found the helicopter submerged and the pilot trapped inside, unable to be freed. The pilot of the remaining R22 ferried the two passengers, in turn, out of the gorge area. The ATSB investigation determined that the pilot who descended into the confined gorge through a relatively narrow opening did so without prior knowledge of the gorge characteristics, and without communicating his intentions to anyone else. That created a situation where there was sufficient space inside the gorge to hover and reverse direction, but with nowhere to land and no other exit path, the pilot was committed to climb out through the narrow opening. This required the pilot to look up through the rotor disc to judge terrain clearance, and combined with fading daylight, the lack of a horizon, and uneven gorge walls, there was the potential for the pilot to become disoriented. After the accident, the pilot of the remaining R22 was able to ferry the passengers out of the gorge area. This was carried out with higher risk than was absolutely necessary, as the helicopter was operated in darkness without the appropriate equipment or pilot qualifications, and without any search and rescue alerting being active (ATSB investigation AO-2012-133).

- On 29 October 2012, a Cessna 172N was being operated on a maintenance positioning flight from Coldstream, Vic. to a private airstrip at Bagshot, Vic. with a pilot and two passengers on board. The aircraft arrived in the circuit at Bagshot as another aircraft was on final approach to land from the south. A passenger in the aircraft reported that both the pilot and passengers were focussing on the aircraft that had just landed as they completed their circuit and commenced final approach. A witness at the airfield saw the Cessna contact a powerline while on short final approach, rotated over the powerline, and impacted the runway in an almost inverted attitude. A post-impact, fuel-fed fire destroyed the aircraft, and all occupants of the aircraft were injured, one fatally. The ATSB investigation into this accident was still underway at the time of writing, but found that the nose landing gear contacted the powerline. The powerline had no markers fitted, and was was not required to under the current Australian Standards for private landing strips. The owner of the landing strip advised he routinely advised pilots using the airstrip of the location of the powerlines, and that there was a need to land a significant distance down the airstrip if approaching from the south to avoid the powerlines (ATSB investigation AO-2012-142).

Wirestrike, Cessna 172N Skyhawk (VH-TKI), 9 km NE of Bendigo, Victoria (ATSB investigation AO-2012-142)

- On 3 November 2012, an amateur-bulit P-51 Scale Mustang collided with terrain just after becoming airborne for a private flight near Toowoomba, Qld. The aircraft was destroyed by a post-impact fire and the pilot was fatally injured. While the ATSB did not investigate this accident, a witness heard the engine running rough, and saw the pilot turn the aircraft to the right and then back to the left to avoid buildings before impacting a creek bed (ATSB occurrence 201210466).
- On 17 December 2012, a Cessna 182A took off on a private flight from the pilot's own airstrip near Gympie, Qld. The pilot was flying in to a Christmas function at a parachute drop zone at Burrum Heads, about 100 km away, and was intending to land in a paddock about 1,500 m to the north of the drop zone. Several witnesses gathered at the drop zone saw the Cessna fly almost overhead at low altitude, and sever two powerlines at a height of about 9 m above the ground. The aircraft was then seen to climb, still trailing the cables, before turning slightly right and disappearing from sight behind trees. The ATSB investigation, which was still underway at the time of writing, found that the aircraft impacted the ground in a nose down attitude of almost 90° with little forward airspeed, and that the right wing had separated from the aircraft prior to impact. A post-impact, fuel-fed fire had consumed most of the wreckage and the pilot was fatally injured (ATSB investigation AO-2012-170).

Collision with terrain, Cessna 182A Skylane (VH-SGB), Burrum Heads, Queensland (ATSB investigation AO-2012-170)

There were also four fatal accidents reported to the ATSB in 2012 involving VH- registered amateur-built aircraft. All of these accidents were collisions with terrain, and were generally reported by another aircraft (or wreckage was found by passers-by some time after the accident). While they were not investigated by the ATSB at the time, all future VH- registered amateur-built aircraft accidents resulting in a fatality will be investigated.

One of these fatal accidents involved an unregistered experimental helicopter, which was a one-seater with a two-stroke engine. While there was very little information reported to the ATSB about this accident, the helicopter collided with terrain in a remote area of a station near Eromanga, Qld, 36 km from the station house.

In another, which involved an amateur-built SeaRey amphibious aircraft that crashed north of Weipa, Qld, the ATSB provided assistance to an investigation by the Queensland Police Service by attempting to recover flight data from a GPS unit that was fitted to the accident aircraft.

There were also 35 non-fatal accidents and 30 serious incidents (one involved two GA aircraft) reported to the ATSB in 2012, which involved GA aircraft conducting private or business flying. Serious incidents are situations in which an accident almost happened. The non-fatal accidents and serious incidents in 2012 involved a number of common themes, which were also seen in other types of GA operations:

- loss of aircraft control on landing (eight occurrences, often associated with runway excursions and landing gear damage)
- runway excursions (eight occurrences, some in which the aircraft was damaged in a collision with an obstacle off the runway)
- total power loss due to fuel mismanagement or inadequate pre-flight preparation (seven occurrences)
- engine malfunction during takeoff or climb, leading to a forced landing (six occurrences)

- near collision between an aircraft on final approach, and an aircraft turning from base to final or taking off from the reciprocal runway (five occurrences)
- wirestrike on final approach, or for helicopters, during the transition from hover to forward flight (four occurrences)
- runway incursion leading to a loss of separation or near collision on the ground (two occurrences).

Sports aviation

Sports aviation includes gliding, parachute operations, private balloon operations and aerobatics in VH-registered aircraft. In 2012, there were 25 incidents involving general aviation aircraft conducting sports aviation, the lowest number since 2006 (Table 20). The number of sports aviation accidents also decreased in 2012 after a spike in 2011, with the eight reported accidents more reflective of the average number of sports aviation accidents over the last 5 years.

Among the accidents reported to the ATSB in 2012 involving VH-registered sports aviation aircraft were two fatal gilder accidents, and two serious injury accidents:

- During the initial climb from Ararat Airport, Vic, the tow line broke and the PZL–Bielsko 50-3 Puchacz glider collided with terrain. The two pilots were fatally injured (ATSB occurrence 201202629).
- During the approach to Narromine Airport, NSW, the Rolladen-Scheneider Flugzeugbau GmbH LS8-A glider collided with a tree on short final. The aircraft lost control and collided with terrain, and the pilot was fatally injured (ATSB occurrence 201212199).
- The Cameron Rugby 90 hot air balloon landed heavily at Ballarat, Vic., dragging along the ground for 20 m before becoming airborne and then landing heavily again. The pilot suffered serious injuries, including a broken leg (ATSB occurrence 201203583).
- During approach to Benalla Airport, Vic., the ICA Brasov IS-28B2 glider lost lift. The pilot attempted to land in a paddock, but the aircraft collided with a fence. The two pilots sustained serious injuries and the glider was substantially damaged (ATSB occurrence 201200152).

The remaining four accidents and four serious incidents in 2012 involved four gliders, four balloons, and one powered aeroplane. Of these occurrences involving gliders, there was a hard landing, a ground loop, a near collision between two gliders, and a loss of glider control after encountering a strong thermal which resulted in a collision with trees. All of the accidents involving balloons involved a wirestrike while descending to land. The single powered aircraft accident was a wheels-up landing after the nose landing gear did not extend.

Table 20: Occurrences involving general aviation aircraft conducting sports aviation, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	44	44	32	14	26	41	28	39	29	24
Serious incidents	1	3	1	1	5	3	4	7	7	5
Serious injury accidents	4	4	2	1	1	2	3	3	2	2
Fatal accidents	1	1	4	3	2	2	3	0	1	2
Total accidents	10	11	11	7	8	7	9	7	13	8
Number of people involved										
Serious injuries	6	4	2	1	1	2	4	4	2	3
Fatalities	1	1	4	4	3	3	3	0	1	3

Foreign general aviation

There were eight accidents involving foreign-registered GA aircraft in Australia in the last 10 years. Two of these occurred in 2012, resulting in one fatality and one serious injury (Table 21):

- The British-registered Schempp-Hirth Ventus-2CT glider rapidly lost height during a final glide back to Benalla, Vic. due to a large area of sink. The pilot attempted to use the glider's sustainer engine to arrest the sink rate, but the aircraft continued to sink below the altitude of the hills ahead of the aircraft. The pilot attempted to make a forced landing in a paddock on rising terrain. While making a low turn to avoid a house, the starboard wingtip struck the ground, the glider collided with terrain, and then ground looped. The pilot suffered serious injuries, including a punctured lung and broken ribs, and the glider was substantially damaged (ATSB occurrence 201200046).
- The New Zealand-registered Schleicher ASW 20C glider collided with terrain while attempting to land in a paddock near Tocumwal, NSW. The pilot was seriously injured (broken legs and internal injuries) and the glider was substantially damaged. The Gliding Federation of Australia conducted an investigation into this accident, and reported that the glider flew too far downwind in the circuit as the pilot was preoccupied with maintaining separation with the tow aircraft ahead of the glider. On final approach, the pilot attempted to lose speed using airbrakes, but encountered heavy sink. The pilot retracted the airbrakes and conducted a dive in order to regain speed and clear a stand of trees on the approach path, but the right wing of the glider collided with a tree in the middle of the landing paddock during the dive (ATSB occurrence 201212479).

Most of the 54 incidents reported to the ATSB in 2012 involving foreign-registered GA aircraft involved airspace issues, or non-compliance with ATC instructions. Twenty-three incidents were reported where a pilot diverted off track or did not maintain their assigned altitude, 12 involved a runway incursion or an aircraft entering restricted or controlled airspace without a clearance, and five incidents involved incorrect coordination details being provided between air traffic services when the aircraft entered Australian airspace.

Table 21: Foreign registered general aviation aircraft occurrences, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	19	12	31	43	47	60	50	66	57	54
Serious incidents	0	1	1	0	1	0	0	1	0	0
Serious injury accidents	0	0	0	0	0	0	0	0	0	2
Fatal accidents	0	1	0	0	0	0	0	1	0	0
Total accidents	0	1	0	1	1	1	0	2	0	2
Number of people involved										
Serious injuries	0	0	0	0	0	0	0	0	0	2
Fatalities	0	2	0	0	0	0	0	1	0	0

Other general aviation

Between 2003 and 2012, over 19,000 aviation safety occurrences were reported to the ATSB that involved an Australian-registered GA aircraft, but no information was provided on the type of flying operation. The number of occurrences involving 'unknown' GA aircraft from 1,453 in 2003 to a peak of 2,253 in 2010, but has decreased since then (there were 1,641 such occurrences in 2012). The large number of unknown GA aircraft involved in reportable occurrences has been, in part, related to the abolition of mandatory flight plans for all aircraft since the mid 1990's. In many occurrences involving a GA aircraft where the type of flying operation was not known, the ATSB was notified by someone other than the pilot of the aircraft involved (such as ATC, the public,

pilots of nearby aircraft, or aerodrome-based staff). A review of the occurrences reported in 2012 found that most were associated with:

- airspace-related occurrences (airspace incursion, aircraft separation, operational non-compliance, and regulations and standard operating procedures)
- ground operation-related occurrences
- bird and animal strikes.

Recreational

Over the last 10 years, reporting of safety incidents to the ATSB by recreational aviation pilots and organisations has increased tenfold (Table 22). In 2012, there were 147 incidents, 42 serious incidents, and 85 accidents reported involving aircraft registered by an RAAO (Australian non-VH-registrations). This covers a very diverse range of aircraft types, including factory and amateur-built fixed-wing aircraft, paragliders, gyrocopters, weight-shift hang gliders, trikes, powered parachutes, and microlights.

The increase in reporting over the last 10 years is primarily reflective of a significant change in private flying and sports aviation in Australia, where more pilots are taking up the opportunities offered by recreational aviation flying as opposed to using VH- registered aircraft. These include factors of aircraft purchase and operating cost, maintenance, access to training, and licensing requirements. Despite this growth, the ATSB conservatively estimates that 25 to 30 per cent of safety incidents do not get reported to the ATSB in recreational aviation, and across GA more broadly. This is especially the case with respect to situations where an accident did not happen, but there was the potential for one to occur. Reducing underreporting remains a key focus for the ATSB, and programs such as *SafetyWatch* and the popular *Avoidable Accidents* series aim to increase the awareness among recreational aviation pilots of their reporting requirements, and why it is important to report.

A normalised occurrence rate by the total flying activity in Australian recreational aviation is not yet available due to the way in which individual associations report activity data to the BITRE in different formats. The ATSB is working towards collating the information from different recreational aviation associations to produce an estimate for total flying activity across recreational aviation, and in future, reporting occurrences by their respective RAAO.

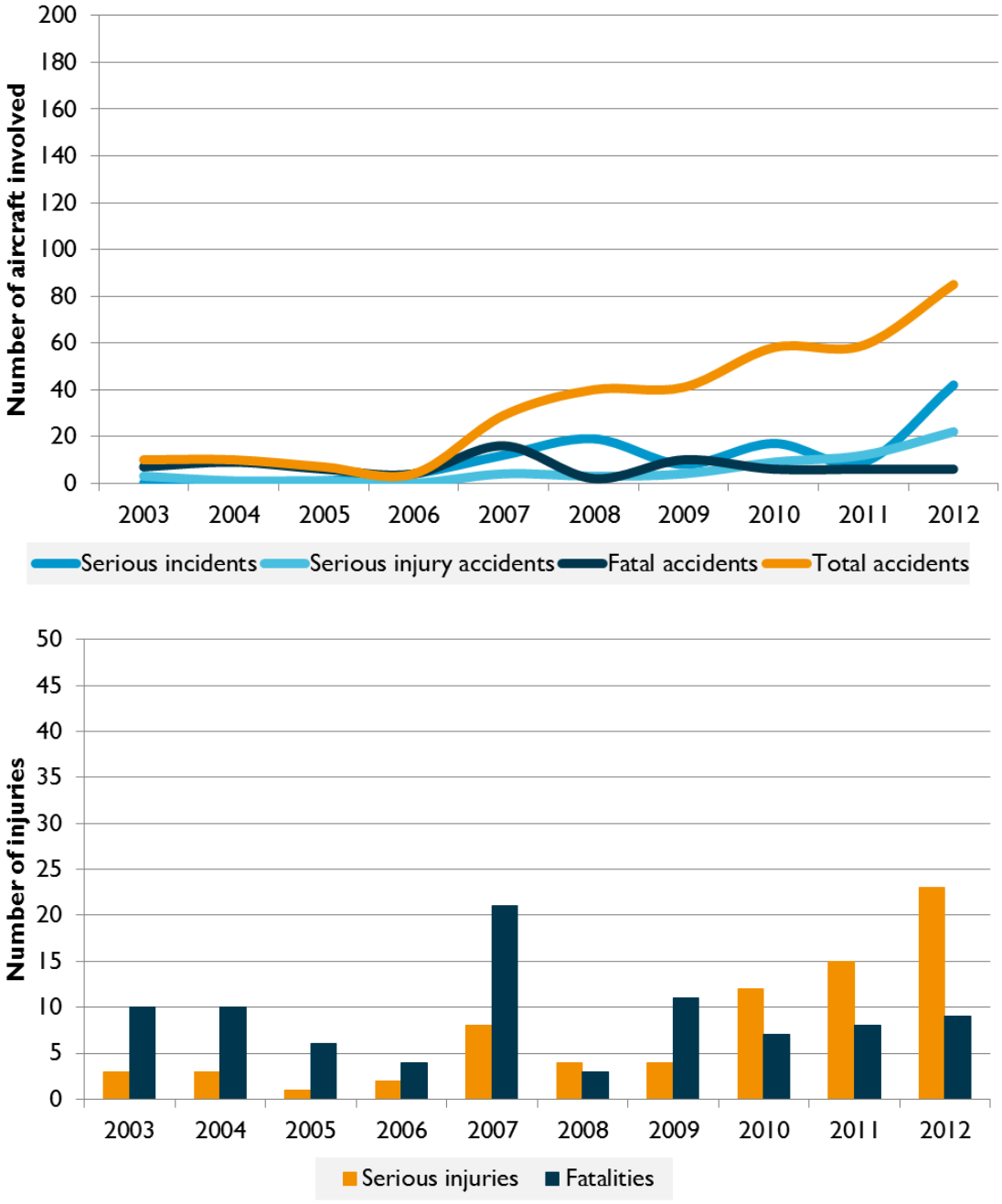
Table 22: Recreational aviation aircraft occurrences, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of aircraft involved										
Incidents	15	24	21	25	59	88	79	119	130	147
Serious incidents	0	0	1	4	12	19	8	17	9	42
Serious injury accidents	3	1	1	0	4	3	4	9	12	22
Fatal accidents	7	9	6	4	16	2	10	6	6	6
Total accidents	10	10	7	4	29	40	41	58	59	85
Number of people involved										
Serious injuries	3	3	1	2	8	4	4	12	15	23
Fatalities	10	10	6	4	21	3	11	7	8	9

There were six fatal accidents in recreational aviation in 2012, and a further 22 aircraft were involved in an accident where occupants were seriously injured (Figure 17). A comparison with the GA occurrence and injury trends over the last 10 years (as was shown in Figure 13) would suggest that while an increase in the number of recreational aviation accidents reported to the

ATSB is reflective of growth in this sector, there is likely to be a significant level of underreporting from recreational pilots of serious safety incidents and serious injuries.

Figure 17: Recreational aviation occurrences and injuries, 2003 to 2012



The fatal accidents involving recreational aircraft in 2012 are described below:

- On 14 January 2012, a GT Kruza gyrocopter was being operated on a private flight with the pilot and one passenger on-board. The aircraft had departed Mangalore Airport, Vic. that morning for a one hour training flight. Later that morning, a passer-by identified the wreckage of the gyrocopter, which had impacted into terrain a short distance from the airport. Both the pilot and passenger had been fatally injured. There were no witnesses to the accident. Investigators from the Australian Sports Rotorcraft Association (ASRA) were deployed to the accident site to assist the Victorian Police with the accident investigation. An assessment of the site indicated that the gyrocopter had impacted into terrain at high speed with a near-vertical nose attitude. A preliminary inspection of the gyrocopter's flight controls by ASRA investigators

revealed that the torque tube, a component integral to the rotor head of the gyroplane, had fractured in-half into two even lengths. The torque tube was normally clamped and bolted through the torque bar of the rotor head. Integrity of the torque tube was critical to ensure controllability of the gyroplane. The ATSB assisted the ASRA investigation by identifying the mode of fracture of the gyroplane's torque tube. The ATSB technical examination of the torque tube confirmed that the torque tube had failed under the influence of fatigue crack growth that had initiated from a manufacturing feature in the tube. Controllability of the gyroplane was compromised once the torque tube had fractured. In addition, the ATSB attempted to recover data from a GPS unit and a mobile telephone found at the accident site, however, no data was able to be recovered from either electronic device (ATSB occurrence 201200150).

- On a training flight near Bundaberg, Qld, the Czech Sportcruiser collided with terrain and the two occupants sustained fatal injuries. The instructor and student were practicing stall training during the accident flight, though it is not known whether an aerodynamic stall and loss of control led to the collision with terrain. No other details were provided to the ATSB regarding the circumstances of this accident (ATSB occurrence 201202356).
- On 7 April 2012, the pilot of the Airborne Edge XT-912 microlight departed Temora, NSW at 1804 local time, on a flight to Cootamundra. The pilot made an inbound call at 10 NM from Cootamundra. At 1830 local time, witnesses at Cootamundra Airport saw a light tumble as the aircraft clipped a tree on approach, then saw the aircraft burst into flames as it collided with a windmill. Both occupants were fatally injured. Investigators from RA-Aus were deployed to the accident site to investigate the accident, and to assist the NSW Police and NSW Coroner with their investigations. No other details were provided to the ATSB regarding the circumstances of this accident (ATSB occurrence 201202825).
- On 6 May 2012, a Gyroscopic Rotorcraft gyrocopter collided with terrain at a cattle station near Bollon, Qld while conducting aerial mustering. The pilot, who was the sole occupant, was fatally injured, and the gyrocopter was destroyed by the impact and a post-impact fire. An investigation was conducted by ASRA into this accident. The ground party involved in the muster observed the gyrocopter ‘swooping’ down to attempt to move stubborn cattle, a manoeuvre that was considered as normal practice when using a gyrocopter for aerial mustering. The ground parties were generally able to keep the gyrocopter in sight, except during the swooping manoeuvres when they lost sight of it below the tree line. One witness observed the gyrocopter swoop down until obscured from view by the tree line, and then heard a ‘crack’ and observed smoke from where he had last seen the gyrocopter. The ASRA investigation identified that the pilot did not hold a current ASRA pilot licence, and that the gyrocopter’s logbook was not up to date. An ELT was identified at the accident site, however, it was an older model of ELT that required manual activation, and was not activated in the accident. Investigators from ASRA determined from damage to the pilot’s helmet and the propeller that during flight at or below tree top level, the helmet became dislodged due to a worn press stud used to fasten the helmet’s chin strap, and passed through the arc of the propeller. The helmet was destroyed, and the propeller blade dislodged from its hub. It is likely that the pilot lost control of the gyrocopter at this point, and at low altitude, the gyrocopter rolled to the right and struck trees and terrain. The ATSB assisted ASRA by providing an assessment of a GPS unit that was located at the accident site, however, the unit was badly fire damaged and was unlikely to still contain useful data (ATSB occurrence 201203961).

Collision with terrain, Gyroscopic Rotorcraft gyrocopter, near Bollon, Queensland (ATSB occurrence 201203961). Photo source: Australian Sports Rotorcraft Association

- On 8 June 2012, while in company with another microlight on a flight from Newcastle to Temora, NSW, an Airborne Edge XT-912 microlight collided with terrain on approach to Temora Airport and was destroyed. The pilot, who was the sole occupant, was fatally injured. No other details were provided to the ATSB regarding the circumstances of this accident (ATSB occurrence 201205318).
- On 24 August 2012, a RAF gyrocopter collided with terrain 100 km east of Pormpuraaw, Qld and was destroyed by a post-impact fire. The pilot, who was the sole occupant, sustained fatal injuries. The gyrocopter was not registered with ASRA at the time of the accident. No other details were provided to the ATSB regarding the circumstances of this accident (ATSB occurrence 201208409).

The 22 accidents reported to the ATSB in 2012 where the pilot or passengers were seriously injured largely involved paragliders and hang gliders. In these accidents, heavy landings due to changing wind direction or a loss of lift, or a loss of control from an aerodynamic stall after a tow line broke. Serious injury accidents involving powered aircraft reported in 2012 included three engine failures on approach to land, two wirestrikes, and two occurrences where a ground handler or pilot touched a propeller during engine start or ground preparations. There was also an accident where an aircraft stalled in the downwind leg of a circuit shortly after takeoff, and entered a spin before colliding with terrain. Following the accident, the pilot reported that he had departed with an unserviceable airspeed indicator.

There were a further 57 recreational aircraft involved in non-fatal, non-serious injury accidents, and 42 aircraft involved in serious incidents reported to the ATSB in 2012. Almost all of these occurrences involved fixed-wing, single-engine aircraft. Many involved common themes, which were also seen in other types of GA operations:

- engine malfunction (43 occurrences), especially:
  - power loss or engine failure during initial climb, leading to a forced landing
  - engine failure on approach, due to mechanical failure or fuel mismanagement
- hard landing (13 occurrences), often due to windshear and resulting in landing gear damage or a loss of directional control during the landing roll
- loss of control or collision with an obstacle on final approach to land, usually due to windshear (four occurrences)
- loss of directional control on takeoff resulting in a runway veer-off (four occurrences).

Non-fatal and non-serious injury accidents and serious incidents involving other aircraft types included a mid-air collision between a paraglider and a hang glider in South Australia, and hang glider pilots losing directional control during take-off and initial climb due to turbulence or changing wind direction. There was also a serious incident reported to the ATSB involving an unmanned air vehicle, in which an ignition system failure on initial climb led to an engine failure, and a forced landing in grass away from the launch site.

Occurrences by aircraft type

This section explores trends in occurrences by the type of aircraft involved, and the type of operation being conducted. It looks primarily at the rate of accidents within each type of operation, in relation to the number of hours flown by the type of aircraft within that category.

Of the 15,107 aircraft on the Australian civil aircraft (VH-) register at the time of writing, fixed-wing aeroplanes accounted for 84 per cent of all aircraft (11,679 powered fixed-wing aeroplanes and 987 unpowered gliders). Rotary-wing aircraft accounted for 14 per cent (2,067 aircraft). The remaining 2 per cent were balloons.

In this section:

- *aeroplanes* refers to all VH- registered fixed-wing aircraft
- *helicopters* refers to all similarly registered rotary-wing aircraft
- *recreational* refer to aeroplanes and gyrocopters registered with a recreational aviation administration organisation (RAAO), including fixed-wing ultralights and trikes
- *other* aircraft types include paragliders, hot air balloons, hang gliders, unmanned air systems, and dirigibles.

Differences in accidents between operation groups and aircraft type

Table 23 shows that, over the 10 years ending 2012, there were considerably more accidents in Australia involving aeroplanes than helicopters.

When flying activity is considered, however, the accident rate involving helicopters in almost all types of operations is higher than for aeroplanes conducting the same type of operation (Table 25). In 2012, there were about two helicopter accidents for every five aeroplane accidents in general aviation (GA). There have been no charter helicopter accidents[10] since 2008.

When GA aeroplanes and helicopters were compared using pooled data between 2003 and 2011[5], GA helicopters had an accident rate of about 108 per million hours flown (271 accidents for about 2.5 million hours flown) and GA aeroplanes had about 81 accidents per million hours flown (717 accidents for about 8.9 million hours flown). This represents an accident rate involving GA helicopters that is about a third higher than for GA aeroplanes. This accident rate combines single and multi-engine aircraft. There is also variation in accident rates across different operation types, which are discussed further on in this section.

As very few helicopters were involved in air transport operations (all were involved in charter work) in the last 10 years, a comparison of accident rates with fixed-wing air transport aircraft is not provided here.

Also of note in Table 23 is the growing number of recreational aircraft accidents reported to the ATSB. In 2012, there were more accidents involving recreational aircraft in Australia than accidents involving VH- registered aeroplanes in GA. Flying activity data is not yet available for recreational aviation operations in Australia, so it not possible to compare the rate of accidents involving recreational aircraft with other aircraft types.

[10] There were no regular public transport (RPT) helicopter aircraft operations in Australia during the period 2003 to 2012. All air transport operations involving helicopters were charter operations.

Table 23: Number of accidents, by aircraft type, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Aeroplanes										
Air transport	27	12	12	10	17	23	9	20	16	8
General aviation	81	98	78	59	83	84	79	84	72	61
Helicopters										
Air transport	3	4	0	1	5	6	1	3	5	4
General aviation	27	34	31	25	25	34	34	36	25	26
Recreational										
Recreational aviation	8	7	5	3	24	37	32	52	53	64
Other										
General aviation	9	10	9	7	7	7	6	5	11	6

Helicopters were involved in about 28 per cent of all GA accidents in the last 10 years, and 31 per cent of all fatal accidents, even though they accounted for only 14 per cent of the Australian VH-registered fleet at the time of writing and flew far less hours than aeroplanes. Three helicopters involved in charter air transport operations were involved in fatal accidents between 2003 and 2012, which was 21 per cent of all fatal accidents in Australian air transport during this period (Table 24).

In 2012, there was a marked increase in fatal accidents involving aeroplanes conducting GA operations when compared to the last few years, while there were only a third as many fatal accidents involving GA helicopters compared to 2011. The number of accidents in air transport remained low, irrespective of aircraft type. Despite the increase in recreational aviation accidents over the last few years, the number of fatal accidents involving recreational aircraft was lower in most years than accidents involving GA aircraft.

Table 24: Number of fatal accidents, by aircraft type, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Aeroplanes										
Air transport	1	0	2	1	1	2	0	1	2	1
General aviation	8	6	10	12	9	18	7	8	6	14
Helicopters										
Air transport	1	0	0	0	1	1	0	0	0	0
General aviation	5	4	3	4	2	2	8	4	9	4
Recreational										
Recreational aviation	6	6	5	3	11	2	6	4	5	6
Other										
General aviation	0	1	3	3	1	2	1	0	1	2

Visual flight rules in instrument meteorological conditions and controlled flight into terrain, Cessna 182Q Skylane (VH-CWQ), 15 km N of Tooraweenah, New South Wales (ATSB investigation AO-2012-076)

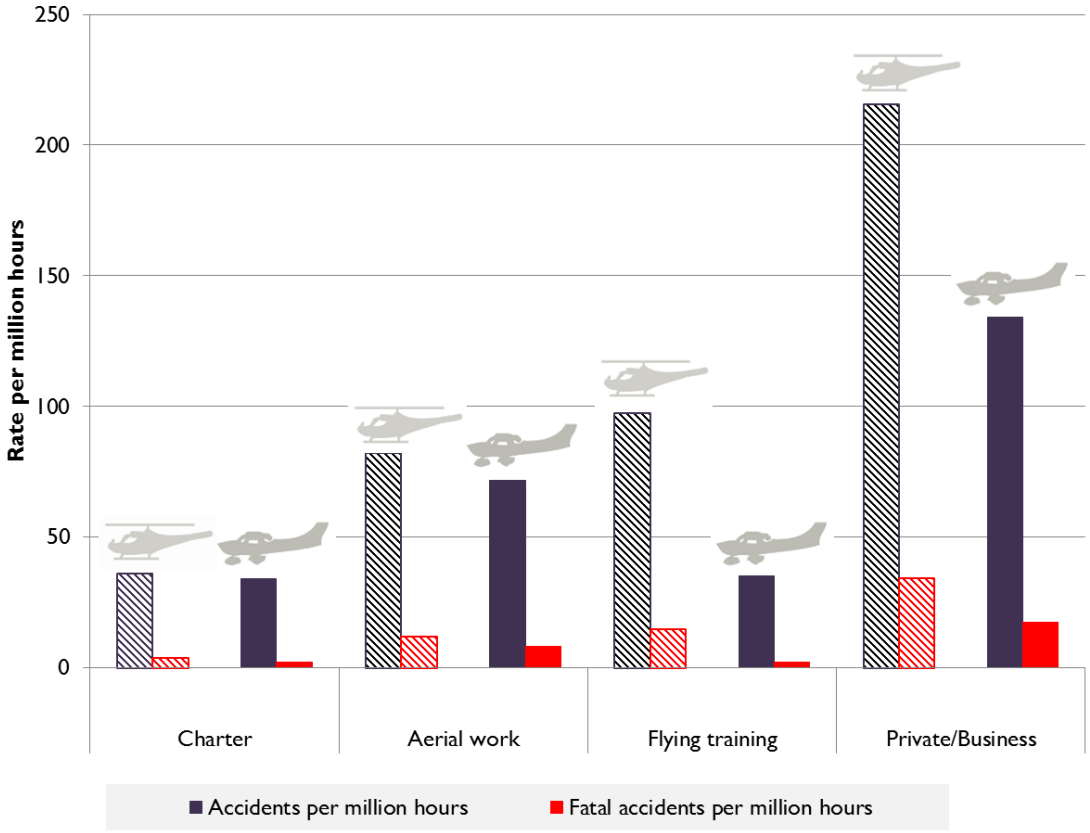
Differences in accidents between specific operation types and aircraft types

When comparing the accident rate of aeroplanes and helicopters by operation type, there is significant difference between some types of GA operations (Table 25 and Figure 18). Flying activity data is not yet available for recreational aviation in Australia.

Table 25: Accidents, fatal accidents, and number of fatalities by operation type and aircraft type, 2003 to 2011

Operation	Aircraft type	Accidents per million hours	Fatal accidents per million hours	Number of fatalities
Charter[10]	Helicopters	36.1	3.9	9
	Aeroplanes	34.1	2.2	15
Aerial work	Helicopters	82.4	12.1	34
	Aeroplanes	71.8	8.3	23
Flying training	Helicopters	97.7	14.8	7
	Aeroplanes	35.3	2.0	12
Private/Business	Helicopters	215.6	34.4	22
	Aeroplanes	134.1	17.3	122

Figure 18: Rate of accidents and fatal accidents by operation and aircraft type, 2003 to 2011



Charter

Aeroplanes and helicopters involved in charter air transport operations had similar accident rates (34 versus 36 accidents per million hours flown over the last 10 years).

The rate of fatal accidents over the last 10 years involving charter helicopter operations was lower than for aeroplanes (2.2 versus 3.9 per million hours flown). Correspondingly, there were fewer fatalities in charter helicopter accidents (nine) than in charter aeroplane accidents (15).

Aerial work

Aeroplanes involved in all types of aerial work had only a slightly lower accident rate than for helicopters conducting aerial work (72 versus 82 per million hours flown over the last 10 years). There are, however, significant differences in the types of aerial work that are performed by aeroplanes as opposed to helicopters. For example, about 75 per cent of agricultural hours are flown by fixed-wing aircraft. As a result, aerial agriculture (as a sub category of aerial work) to some extent skews the accident rate for aeroplanes. Conversely, a large proportion of aerial mustering utilises helicopters.

The fatal accident rate in aerial work for helicopters over the last 10 years (about 12 per million hours flown) was similar to the aeroplane fatal accident rate (about 8 per million hours flown), but there were a greater number of fatalities involving helicopters (34, compared to 23 for aeroplanes). Aeroplanes and helicopters perform a similar number of hours in aerial work – in 2011, about 287,000 hours were flown by aeroplanes, and about 222,000 hours by helicopters.

Flying training

Helicopters used for flying training were involved in a lot more accidents than. The helicopter accident rate from 2003 to 2011 was 97.7 per million hours flown, which was more than double that for aeroplanes conducting flying training (35.3 accidents per million hours flown). Most flying

training is done in aeroplanes – in 2011, 346,000 hours (compared to 45,000 for helicopters), however, the gap has been shrinking since 2009. This was due to slight growth in helicopter flying training activity, but mostly to a significant fall in fixed-wing flying training (110,000 less training hours flown in 2011 when compared to 2009).

The fatal accident rate over the last 10 years for helicopter flying training was more than seven times higher than that for aeroplanes being used for training (about 15 fatal accidents per million hours flown, compared to 2 fatal accidents per million hours flown for aeroplanes), although the number of fatalities was lower for helicopter fatal accidents. A review of the fatal accidents involving helicopters involved in flying training since 2003 found that most involved a loss of control from a hover, or a catastrophic failure in-flight (such as the loss of rotor blade). In both of these situations, an irrecoverable loss of control and collision with terrain was likely, even if the pilot was experienced. In comparison, fatal flying training accidents involving aeroplanes often involved collisions with other aircraft, or objects on the ground during a forced landing or runway excursion.

Private/business

Helicopters performing private or business flying had an accident rate over the last 10 years that was about 50 per cent higher than that for aeroplanes (about 216 accidents per million hours for helicopters, compared to 134 per million hours flown for aeroplanes).

Helicopters also had a higher fatal accident rate, with about twice as many fatal accidents involving helicopters than aeroplanes when corrected for flying activity (34 versus 17 fatal accidents per million hours flown). There were, however, significantly more fatalities in those fatal accidents involving aeroplanes than in helicopter accidents. The difference in the number of accidents between helicopters and aeroplanes is reflective of the difference in their use in private and business flying – in 2011, aeroplanes in Australia were utilised for about 327,000 hours of private and business flying, whereas helicopters flew less than 56,000 hours in this type of operation.

Wirestrike, Robinson R44 Raven I helicopter (VH-HIE), 21 km E of Maryborough Airport, Victoria (ATSB investigation AO-2012-079)

Occurrence types: what happened

Accidents and incidents are often the result of a complex set of circumstances, involving a chain (or sequence) of events. The ATSB categorises each reported accident and incident into one or more occurrence types to identify what happened, and how the sequence of events played out to lead to an accident or incident. Classifying occurrences in this way helps to understand what types of occurrences have taken place, and identify potential areas for safety improvement and communication.

There are five broad occurrence type categories currently used by the ATSB to classify occurrences:

- airspace-related
- aerodrome and airways facility-related
- environment-related
- mechanical-related
- operational-related.

These categories are further broken down into different occurrence types, which are detailed in Appendix B. The ATSB records one or more occurrence types for all aircraft involved in each occurrence. Accidents and serious incidents generally have more occurrence types coded than incidents, as they are more likely to be investigated, and their severity usually means that there is a greater amount of information to draw upon for analysis and coding. In occurrences involving multiple aircraft, aircraft with the same operation type are recorded twice, whereas aircraft with different operation types are recorded against the corresponding operation type.

The tables in this section show that one of the most common occurrence types in both air transport and general aviation (GA) is a consequential event. Consequential events happen as the result of an occurrence, such as a rejected take-off after a warning device activates in the cockpit, or a precautionary disembarkation as a result of fumes in the cabin. In other words, a preceding event (the warning device activating, or the fume event) has led to the consequential event.

Occurrence types do not explain why an accident or incident happened, but generally are a description of what occurred. This report does not delve into the safety factors (individual actions, local conditions, risk controls, or organisational influences) that explain what led to an occurrence. An analysis of safety factors is more valuable when considering a cluster of occurrences that have a similar occurrence type (such as in the ATSB's *Avoidable Accidents* series), or through detailed ATSB investigations of particular accidents or serious incidents.

The frequency of a particular occurrence type does not necessarily reflect its importance or safety risk. For example, fuel-related events may be relatively rare (when compared with fumes events), but fuel starvation is always a very serious incident. Many fuel starvation events result in an attempt at an emergency landing, and potential aircraft damage and injury to people on board or outside the aircraft. In comparison, most fumes-related events are minor in nature, do not affect the safety of flight, and do not result in any injury.

Commercial air transport

Accidents and serious incidents

In 2012, most accidents and serious incidents in air transport operations were related to aircraft separation, aircraft control, powerplant and propulsion, weather, and a combination of terrain collisions, runway events and ground operations events (Table 26).

Table 26: Accidents and serious incidents in air transport operations, by occurrence type, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Aerodrome and airways facility											
Aerodrome related	0	1	1	0	0	0	0	0	0	0	2
Airspace											
Aircraft separation	10	11	6	4	16	8	6	13	5	13	92
Operational non-compliance	1	2	3	0	5	4	3	2	1	0	21
ATC procedural error	1	1	2	1	2	1	1	0	2	1	12
Airspace incursion	0	0	0	0	1	1	1	0	0	0	3
Breakdown of co-ordination	0	0	0	0	0	0	0	1	0	0	1
Other	0	0	0	0	1	0	0	0	0	0	1
Environment											
Weather	2	3	1	0	5	5	1	2	0	7	26
Wildlife	0	1	0	0	2	0	0	1	0	1	5
Mechanical											
Powerplant / propulsion	6	6	5	5	9	15	6	10	12	7	81
Airframe	8	7	7	2	9	6	7	4	5	3	58
Systems	1	4	6	3	5	9	5	1	4	2	40
Operational											
Aircraft control	9	7	6	6	15	17	11	13	5	10	99
Miscellaneous	2	9	6	5	8	25	8	6	5	4	78
Terrain collisions	3	4	5	4	5	8	2	4	10	5	50
Runway events	6	1	2	5	8	8	1	5	7	5	48
Ground operations	5	2	0	1	5	5	1	5	6	5	35
Fuel related	4	5	2	0	4	6	3	0	2	2	28
Communications	3	3	1	2	2	4	1	3	3	3	25
Fumes, smoke, fire	2	4	4	1	1	6	3	1	1	0	23
Flight preparation / navigation	0	1	4	0	4	0	1	3	0	1	14
Cabin safety	0	0	3	0	3	2	0	2	0	0	10
GPWS / TAWS	0	1	1	0	2	0	1	0	0	2	7
Regulations and SOPs	1	0	1	1	0	1	0	0	0	0	4
Aircraft loading	1	1	0	0	0	0	0	1	0	0	3
Consequential events	13	13	15	10	17	28	15	17	15	11	154

Aircraft separation

There were13 serious incidents in air transport in 2012 involving separation standards between aircraft, and aircraft separation issues were the second most common type of serious incident in commercial air transport over the last 10 years.

These aircraft separation serious incidents were mostly loss of separation situations and traffic collision and avoidance system (TCAS) resolution advisory alerts, with a few near collisions. By their nature, these types of serious incidents indicate a reduced safety margin between two aircraft, and an increased risk of a mid-air collision.

In October 2013, the ATSB published a research investigation that reviewed all loss of separation occurrences since 2008 (ATSB investigation AR-2012-034).

In 2012, seven loss of separation serious incidents occurred that involved a commercial air transport aircraft. Three of these occurrences involved a foreign-registered aircraft. In four loss of

separation occurrences, the ATSB assessed the collision risk between the aircraft as high. This assessment was based on factors such as the relative tracks of the aircraft, the awareness of the developing situation by both air traffic control (ATC) and flight crews, and the effectiveness of aircraft separation defences (such as ATC alert systems, separation recovery procedures, and traffic collision and avoidance systems fitted to aircraft):

- The separation standard of 15 minutes was infringed between a south-bound Airbus A320 and a west-bound Airbus A340 over the Indian Ocean. The aircraft were crossing at the same IFR point at the same altitude, with separation reducing to 2 minutes. The ATSB investigated this serious incident (ATSB investigation AO-2012-012).
- A Boeing 737-800 and an Airbus A330 were on tracks that crossed near Tindal, NT. As the aircraft approached Tindal, the distance between the aircraft reduced to about 3.5 NM before vertical separation was established. The incident occurred about 16 minutes after a handover between two air traffic controllers. The ATSB investigated this serious incident (ATSB investigation AO-2012-048).
- A loss of separation occurred near Narrogin, WA between a westbound Airbus A330 at FL380 and an eastbound A330 climbing to FL410 on the same track. Separation between the aircraft reduced to 800 ft vertically and 3.5 NM horizontally. This serious incident was investigated by the ATSB (ATSB investigation AO-2012-161).
- A loss of separation occurred near Thangool, Qld between a Bombardier DHC-8 and an opposite direction Cessna Citation at the same level. When the aircraft were 4 NM apart, the controller issued turn instructions to both flight crews to re-establish separation. This serious incident was not investigated by the ATSB (ATSB occurrence 201211284).

There were also five serious incidents in 2012 involving a GA aircraft getting too close to an air transport aircraft. In most, the aircraft passed within 100 m of each other. Almost all of these serious incidents involved a charter operation, and involved one of the flight crews having difficulties with radio communication (due to frequency congestion on a common traffic advisory frequency (CTAF), or due to the radio being tuned to an incorrect frequency). One occurrence involved a low capacity regular public transport aircraft:

- Shortly after departure from Moree, New South Wales, a Cessna 404 flight crew were advised of an inbound Fairchild SA227 Metro, however, the crews were unable to communicate due to CTAF frequency congestion. In anticipation of a possible conflict, both crews adjusted their vertical profiles. Communication was established just prior to the aircraft passing in close proximity (1 NM apart horizontally, and 300 ft apart vertically). The ATSB did not investigate this serious incident (ATSB occurrence 201201301).

The remaining aircraft separation serious incidents in 2012 in air transport occurred during the take-off run of a GA aircraft at Taree Airport, NSW. The pilot of a Van's RV-10 reported a Saab 340 entering the runway, and shortly after becoming airborne passed above the Saab at about 300 ft. The pilots of both aircraft reported making all required broadcasts, but did not hear each other. The ATSB conducted a short investigation into this serious incident (ATSB investigation AO-2012-043).

Aircraft control

Five accidents and five serious incidents related to aircraft control problems on air transport aircraft in 2012. The majority of these occurrences were hard landings due to the aircraft being affected by windshear on final approach, or were temporary control issues that were rectified in-flight by the crew. In one case, a loss of aircraft control occurred.

Most of these aircraft control issues involved charter aircraft. Two occurrences resulted in minor injuries to passengers, including the following accident:

- A Cessna 172N aircraft was taking off from Happy Valley airstrip, Qld to conduct a visual flight rules charter flight with the pilot and three passengers on board. After takeoff at about 25 to 30 ft above ground level, the aircraft descended and impacted the ground. The ATSB investigated

this accident, and found that the circumstances of the aircraft's descent were consistent with an aerodynamic stall as it climbed out of ground effect while flying at an airspeed and configuration where the airspeed would not normally remain constant (ATSB investigation AO-2012-007).

Collision with terrain, Cessna 172N Skyhawk (VH-ZWR), The Oaks, 6 km S of Happy Valley, Fraser Island, Queensland (ATSB investigation AO-2012-007)

There were two serious aircraft control incidents in 2012 involving scheduled RPT services:

- During the approach into Alice Springs, NT, the pilot of the Cessna 210 did not lower the landing gear and subsequently landed wheels up. The aircraft sustained minor damage. The ATSB did not investigate this serious incident (ATSB occurrence 201209394).
- On a service from Denpasar, Indonesia to Brisbane, Qld, the Boeing 737 became established in the cruise and the seat belt sign was turned off. Shortly after, the flight crew observed opposite direction traffic on the aircraft's TCAS, about 1,000 ft above and slightly to the left. The crew saw the other aircraft pass to the left. Soon after, the first officer reported that they felt 'cobblestone'-like turbulence. The aircraft then experienced a wake induced roll, initially to the right to a maximum angle of 6.5° and then left to 40.4°, with a 40 ft loss in altitude. The ATSB conducted an investigation into this serious incident. Surveillance data from ATC indicated that there was about 2.1 NM lateral and 1,400 ft vertical separation and the correct air traffic control separation standards were being applied at the time. No crew or passengers were injured (ATSB investigation AO-2012-121).

Powerplant and propulsion

There were seven powerplant issues on commercial air transport aircraft in 2012 that were associated with a serious incident or accident. All of these involved single-engine aircraft conducting charter work, and none resulted in injuries.

In almost all cases, the powerplant issue led to a power loss, and a subsequent forced or precautionary landing that resulted in aircraft damage. Causes of power loss in these occurrences were engine fuel pump failures, fouled spark plugs, fuel starvation, and runaway engine rotor speed. Three occurrences involved helicopters.

In many cases, a potentially deadly outcome (such as a loss of control, or collision with terrain) was prevented due to emergency training or quick thinking by the pilot:

- Shortly after departing on a charter flight from Broome, WA for a pearl farm, the pilot of a Robinson R44 helicopter reported that the engine and rotor tachometer were indicating that the engine and rotor revolutions per minute were at the upper limit of the operating range. The pilot switched the governor off and was able to reduce the engine and rotor revolutions per minute (RPM), however the low RPM light and horn activated. At about 200 ft above ground level and a speed of 60-70 kts, the pilot was unable to re-establish control of the engine RPM and he elected to perform a precautionary landing on a road. The ATSB conducted an investigation into this accident, but could not conclusively identify the reason for the power loss. A malfunction within the governor assembly itself, or the righ magneto were considered likely (ATSB investigation AO-2012-117).

Weather

There were five accidents and two serious incidents reported to the ATSB in 2012 that were associated with severe weather, and involved air transport aircraft. Most of these occurrences occurred during charter operations, where the aircraft was affected by windshear on final approach to land. Four of these occurrences resulted in injuries, two of which included serious injuries:

- A gust of wind caused a Cessna 210 Centurion to yaw significantly to the left as the aircraft attempted to land at the Nyirripi airstrip, NT. The aircraft was seriously damaged, the supervisory pilot was seriously injured, and the pilot in command under supervision sustained minor injuries. The ATSB conducted an investigation into this accident, and the aircraft operator issued guidance notes to all of its flight crews regarding windshear recognition and appropriate recovery actions (ATSB investigation AO-2012-056).
- During a manouvre to slow down the helicopter by initiating a descent and flare, the Robinson R44 was seriously damaged when it lost power and collided with terrain near Maryvale, NT. On board the helicopter were a pilot and three passengers, one of whom was seriously injured as a result of the accident. The ATSB investigated this accident, and while a definitive cause for the engine power loss could not be identified, a review of the carburettor icing chart for the R44 revealed that the temperature / dew point spread at the time of the accident put the flight in the ‘Serious Icing – Descent Power’ operating realm (ATSB investigation AO-2012-078).

Collision with terrain, Robinson R44 Raven I helicopter (VH-HOU), near Maryvale, Northern Territory (ATSB investigation AO-2012-078)

Two serious incidents involving severe weather affected aircraft on scheduled regular public transport (RPT) services. One of these was the turbulence event on a flight from Indonesia to Brisbane that resulted in a temporary aircraft control issue (discussed earlier). The second involved a Boeing 737-800 approaching the take-off reference speeds on departure from Perth Airport, when the airspeed stopped increasing and did not start increasing again for several seconds. Despite having observed a headwind via the windsock at the departure end of the runway, the captain noticed that the wind vector on the navigation display was showing a tailwind of about 20 to 25 kts. The captain disconnected the auto-throttle and fully advanced the thrust levers. During the initial climb, the first officer performed a windshear escape manoeuvre. The ATSB conducted an investigation into this serious incident, and found that there were no indications of an impending wind change before take-off. This serious incident was a reminder to pilots that significant wind changes can occur during takeoff, can be difficult to predict, and can occur in the absence of thunderstorm activity. The wind conditions at each end of a runway may differ significantly so that headwind conditions can exist at one end, and tailwind conditions at the other end (ATSB investigation AO-2012-168).

Terrain collisions

Five terrain collisions occurred in 2012 involving charter aircraft. All but one of these (a ground strike) were accidents, which involved injuries, including an accident where the pilot was fatally injured. In that accident (involving a Piper Seneca departing Broome, WA – discussed earlier in this report), the ATSB investigation found that damage to the wreckage was consistent with the aircraft descending steeply into terrain at relatively low forward speed and a high rate of descent, most likely after the engines had lost power (ATSB investigation AO-2012-093).

The remaining accidents were due largely to windshear affecting aircraft, and in one case, carburettor icing. These accidents were also associated with aircraft control and powerplant issues respectively, and are discussed earlier in this section.

Runway events

Three runway excursions in 2012 involved aircraft conducting charter work. In one case, during the landing, an aircraft overran the end of the runway after both main landing gear tyres deflated due to excessive brake application. In the remaining two occurrences, the aircraft was slightly damaged during the runway excursion, and in one case there were injuries reported:

- A Cessna 210 Centurion was about to land after a charter passenger flight to Urapunga, NT. The pilot reported sun glare restricted visibility during the landing. The aircraft overran the end of the runway and travelled through two fences before coming to a stop. The pilot and two passengers evacuated the aircraft. The pilot received minor injuries and the two passengers were uninjured. The ATSB investigation into this accident identified the restricted visibility as an approach and landing hazard, with this accident a good reminder to pilots of the importance of conducting a go-around if conditions are not as expected (ATSB investigation AO-2012-107).
- Another Cessna 210 was departing from Cape Leveque, WA on the return leg of a scenic charter. On board were the pilot and five passengers. Early in the take-off run, the aircraft veered to the left, and the pilot applied right rudder. The pilot elected to continue the takeoff. At about 45 kts, the aircraft again veered to the left. With the aircraft about one metre off the centreline of the runway, the pilot attempted to re-align the aircraft, but it did not respond. The aircraft main wheels were now in contact with washed-out areas of ground on the edge of the runway. The aircraft's left wing clipped trees and the Cessna swung almost 90°, striking the right wing on the ground. The ATSB conducted an investigation into this accident, and the airport operator closed the airstrip the day after the accident to grade the runway surface and repair the washouts (ATSB investigation AO-2013-001).

Two runway incursions (involving three air transport aircraft) were reported to the ATSB in 2012 and were determined to be serious incidents. One of these occurrences involved reduced aircraft separation at Taree, NSW between a Saab 340 conducting an RPT service and a GA aircraft (discussed earlier in this section). In the other runway incursion, a Cessna 210 was backtracking on runway 18 at Darwin Airport for the general aviation parking area. At the same time, a Cessna 310 was holding at taxiway E2 for an intersection departure from runway 29. The surface movement controller instructed the Cessna 210 to cross runway 29 at about the same time as the aerodrome controller cleared the Cessna 310 for takeoff on runway 29. It was estimated both visually and by radar that the departing aircraft overflew the taxiing aircraft crossing the runway by between 150 and 500 ft (ATSB investigation AO-2012-030).

Runway excursion, Cessna T210 Centurion (VH-DQI), Cape Leveque, Western Australia (ATSB investigation AO-2013-001)

Ground operations

There were three collisions, and two near collisions on ground reported to the ATSB in 2012 involving commercial air transport aircraft.

All of the collisions on ground involved charter aircraft, and two involved minor injuries to the pilots. These included the two runway excursions (at Cape Leveque and Urapunga) discussed earlier in this section. The third collision on ground occurred while an Aero Commander 500S was taxiing at Mornington Island Aerodrome, Qld, when the right wing outboard of the engine struck a pole. The pole cut more than 6 inches into the leading edge of the wing.

The two near collisions on the ground involved aircraft conducting scheduled RPT services. In one of these occurrences, a Boeing 737 being pushed back from its gate at Melbourne Airport came into close proximity with an arriving Boeing 737 (discussed earlier in this report). The second serious incident happened when a Piper Chieftain passed beneath the wing of a Bombardier DHC-8 while both aircraft were taxiing at Horn Island Airport, Qld. While the ATSB did not conduct an investigation, it was reported that communication between the flight crews could not be established after the aircraft had passed (ATSB occurrence 201207758).

Incidents

The top five most common incident types in 2012 were wildlife strikes, non-compliance with published information or ATC instructions, miscellaneous operational events, aircraft system issues, and weather (Table 27).

Table 27: Incidents in air transport operations, by occurrence type, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Aerodrome and airways facility											
Airways facility	29	25	49	16	11	12	11	21	11	14	199
Aerodrome related	17	20	16	20	20	24	28	17	13	23	198
Airspace											
Operational non-compliance	407	529	736	613	739	774	708	975	884	853	7,218
Aircraft separation	212	235	231	145	118	181	160	154	184	207	1,827
Breakdown of co-ordination	106	167	204	147	175	154	184	249	198	233	1,817
ATC procedural error	159	156	237	243	183	162	122	74	58	67	1,461
Airspace incursion	54	72	53	48	87	72	52	50	61	58	607
Other	19	7	15	17	4	7	7	3	3	10	92
Environment											
Wildlife	644	852	951	921	959	1,052	1,162	1,339	1,411	1,311	10,602
Weather	100	168	168	169	196	216	172	235	322	426	2,172
Mechanical											
Systems	204	273	311	317	319	380	318	412	476	497	3,507
Airframe	154	159	217	182	244	303	258	254	301	258	2,330
Powerplant / propulsion	154	152	160	159	194	195	197	162	197	230	1,800
Operational											
Miscellaneous	123	141	189	257	294	379	355	333	367	535	2,973
Fumes, smoke, fire	72	72	103	101	122	143	135	261	286	305	1,600
Communications	81	137	125	113	85	138	95	67	72	75	988
GPWS / TAWS	67	163	242	149	83	36	22	18	38	69	887
Aircraft loading	10	13	20	60	66	63	41	124	222	221	840
Ground operations	52	49	43	54	65	65	50	49	78	72	577
Flight preparation / navigation	42	65	73	59	72	56	26	39	47	47	526
Cabin safety	27	26	38	40	51	51	39	58	88	60	478
Runway events	45	46	34	39	40	53	40	47	59	61	464
Aircraft control	22	42	53	64	65	51	37	27	44	57	462
Fuel related	21	31	22	32	54	53	35	30	35	32	345
Loading related	6	23	21	19	63	45	30	0	0	0	207
Terrain collisions	8	9	11	10	6	13	8	8	6	5	84
Regulations and SOPs	3	7	7	10	28	21	5	0	0	0	81
Consequential events	339	398	431	593	589	667	659	596	674	768	5,714

Wildlife strikes

Most wildlife strikes involving air transport aircraft were birdstrikes, with a small number of animal strikes reported. The number of birdstrikes has doubled over the last decade, driven by the large increase in aircraft movements (departures and landings) in high capacity RPT operations over the same period. In recent years, the ATSB, airport and airline operators have worked together to improve reporting processes for confirmed and suspected birdstrikes. This has resulted in a modest increase in the rate of birdstrikes per aircraft movement.

In slightly under half of all birdstrikes reported, the type of bird cannot be identified. There were 11 bird and bat species that accounted for more than 20 strikes each:

- Plover (48 strikes)
- Bat (40 strikes)
- Galah (39 strikes)
- Kite (27 strikes)
- Kestrel (25 strikes)
- Hawk (24 strikes)
- Black kite (23 strikes)
- Swallow (23 strikes)
- Nankeen kestrel (22 strikes)
- Flying fox (21 strikes)
- Magpie (21 strikes)

There were only 15 animal strikes to commercial air transport aircraft reported to the ATSB in 2012. Rabbits, hares, foxes and kangaroos were the most common species struck.

Operational non-compliance

The number of reports of pilot non-compliance with either ATC instructions or published information has decreased over the last few years due to a combination of factors. These include lower levels of reporting by ATC of operational non-compliance, and fewer incidents being classified as transport safety matters by the ATSB. Operational non-compliance is still the second most common type of incident reported to the ATSB involving commercial air transport, and about 80 per cent of these incidents occurred during high capacity RPT services.

In 2012, about 72 per cent of operational non-compliance in commercial air transport was related to verbal instructions from ATC. About half happened in either taxiing or cruise, but a significant number also occurred in descent, approach, and climb (where flight crews are required to negotiate multiple changes in altitude level and track, and give way to other traffic).While in the air, cases of non-compliance with ATC instructions were most commonly related to aircraft route and altitude deviations without a clearance. On the ground, non-compliance with a taxi or pushback clearance were the most frequent types of incidents.

The remaining 28 per cent of operational non-compliance incidents in air transport in 2012 related to published information. About one-third related to standard instrument departures (SIDs) and standard arrival routes (STARs), and the remainder were related to non-compliance with other Aeronautical Information Service (AIS) publications. Common examples of AIS non-compliance included entering a holding pattern the wrong way, aircraft conducting flights under instrument flight rules (IFR) giving incorrect estimated arrival times at IFR waypoints when under procedural separation, or pilots not responding to ATC instructions because they were not monitoring the correct radio frequency.

ATSB occurrence 201202307

On 12 February 2012, the flight crew of a Boeing 737 was conducting a scheduled passenger service from Sydney to Canberra. Due to scheduled maintenance, the instrument landing system at Canberra was not available and the crew prepared for an alternate instrument approach. This approach provided for lateral, but not vertical, flight path information. The flight was at night with rain showers and scattered cloud in the Canberra area.

Shortly after becoming established on the final approach course with the aircraft's automatic flight system engaged, the flight crew descended below the minimum safe altitude for that stage of the approach. The crew identified the deviation and levelled the aircraft until the correct descent profile was intercepted, then continued the approach and landed. No enhanced ground proximity warning system alerts were generated, as the alerting thresholds were not exceeded.

Miscellaneous operational incidents

In the ATSB occurrence type taxonomy (see Appendix B), miscellaneous operational incidents include warning device activations, airframe overspeed, crew incapacitation, depressurisation, stall warnings, security and laser-related issues, along with a mixed group of other types of reportable matters.

General warnings were the most commonly reported by commercial air transport flight crews (about 70 per cent of miscellaneous operational incidents), followed by airframe overspeed, stall warnings, and crew incapacitation. The largest group of warnings covered generator issues, flaps and slats, anti-skid, bleed air and air conditioning, engine chip detector, and fire and smoke systems.

Airframe overspeed occurrences were almost always associated with windshear or severe turbulence. A momentary flap overspeed was the most common, reported in about 56 per cent of airframe overspeed incidents reported in 2012. The overspeed was detected by the pilot in about 50 per cent of cases, and via a cockpit indication in the remaining incidents. The largest magnitude overspeed reported involved a Saab 340 on approach affected by windshear, resulting in an airframe overspeed of 30 kts for 15 seconds. In cases where the overspeed was not momentary, the flight crew usually conducted a missed approach, or in some cases a diversion to another airport.

Stall warning incidents on commercial air transport aircraft in 2012 were all stick shaker activations, generally due to severe turbulence or gusts (and in one case, avoiding action to prevent a birdstrike). In four incidents, a stall warning system problem (such as an alpha vane signal error) caused a spurious stick shaker to occur. In another incident, the stick pusher activated momentarily on a Fairchild SA227 Metro during cruise in straight and level flight at night. The aircraft lost about 50 feet of altitude before the stick pusher stopped, and the flight crew conducted a memory checklist followed by the quick reference handbook checklist. On arrival, the aircraft's stall warning computer was found to be inoperative (ATSB occurrence 201208120).

Nine cases of crew incapacitation were reported in commercial air transport operations in 2012, mostly due to illness and temporary disorientation from a laser. In most cases, the affected crew member was able to resume their duties for the remainder of the flight, and in only incident was the aircraft diverted to another airport.

Aircraft system issues

The number of incidents reported in air transport operations related to aircraft systems has shown a marked increase over the last 10 years when compared to other occurrence types, with two and a half times as many incidents reported in 2012 than in 2003.

In 2012, aircraft systems issues most commonly reported to the ATSB were avionics and flight instrument-related, or affected air conditioning and pressurisation systems. Electrical, flight control, fuel, and hydraulic system issues all made up more than 10 per cent of incidents.

Avionics and flight instruments made up one-third of all aircraft systems issues reported. Flight management computer, radio transmitter, and multi-function display failures were most common. In very few cases (generally involving radio or flight director failures, or mismatched speed indications) was the flight affected, through a rejected take-off or a diversion to another airport.

Air and pressurisation occurrences were commonly associated with reports of fumes or smoke. Faulty bleed air control valves, failed air conditioning packs, seized recirculation fans, and dislodged/fractured air conditioning ducts were the most frequently reported problems with this system.

Electrical problems differed between different types of air transport. In high and low capacity air transport aircraft, generator failures were most common. In charter aircraft, alternator failures and wiring discontinuities were more frequent sources of electrical issues. Most electrical problems were associated with an air return, particularly in high capacity RPT operations.

Flight control problems reported in 2012 most commonly involved high capacity RPT aircraft. Flap asymmetry warnings were common, as were problems with the flap slat indicator module. In smaller air transport and charter aircraft, flap drive system and servo problems were the most reported flight control issue.

Fuel system problems were likely to be fuel leaks observed from the wing access panels, or in some cases the fuel/oil heat exchanger return line. Fuel quantity indication problems were also commonly reported, due to failed bulbs or faulty indication sensors.

Hydraulic system problems were most frequently due to leaks from worn hoses or fittings, or from pump failures. Very few of these occurrences were associated with reports of fumes, although in the majority of incidents, the flight crew chose to divert or make an air return after the hydraulic issue was identified.

Weather

Over 400 weather-related events which affected safe air transport operations were reported to the ATSB in 2012. Often, different types of weather events are associated with each other; so many occurrences had more than one weather event recorded. About two-thirds of weather-related incidents involved windshear or turbulence, with lightning strikes the next most commonly reported incident. Only six occurrences involved icing.

Windshear events (microburst rarely occurred over the last 10 years) usually occurred on approach, and in about 40 per cent of cases led to an overshoot. In most cases, the flight crew conducted a missed approach and made a successful landing on the second attempt. An airframe overspeed was associated with 35 of the 185 windshear incidents reported in 2012, often a momentary flap overspeed of less than 10 kts. The remaining windshear/microburst occurrences led to aircraft sink on approach, or an undershoot. A missed approach was usually the outcome of these occurrences.

Turbulence incidents affecting commercial air transport aircraft were reported across a mixture of cruise, descent, and approach phases of flight. Where the type of turbulence was reported, reports were split fairly evenly between clear air, wake, and in-cloud turbulence. Twenty-two of these incidents resulted in minor injuries to cabin crew or passengers.

In the 89 occurrences where an air transport aircraft was struck by lightning in 2012, most resulted in no reported damage or injury, and in only 17 of these occurrences did the flight crew make a diversion or air return. In only five incidents was damage reported, usually to aircraft electrical or avionics systems. There was one incident reported where a lightning strike during the climb caused the windscreen of an Embraer E-190 to crack, and the aircraft was returned to Sydney (ATSB occurrence 201200598).

General aviation

Accidents and serious incidents

In 2012, most accidents and serious incidents involving GA aircraft were associated with terrain collisions, aircraft separation, aircraft control, powerplant and propulsion, runway events, ground operations, and fuel management (Table 28).

Table 28: Accidents and serious incidents in GA operations, by occurrence type, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Aerodrome and airways facility											
Aerodrome related	1	0	0	1	0	0	1	0	0	1	4
Airspace											
Aircraft separation	21	24	15	21	22	36	28	34	38	54	293
Operational non-compliance	2	5	5	6	5	13	8	3	7	11	65
ATC procedural error	1	1	1	2	0	4	3	1	2	1	16
Airspace incursion	0	0	1	1	1	2	3	1	1	0	10
Environment											
Weather	0	1	1	4	14	3	12	9	4	5	53
Wildlife	2	2	5	0	2	2	3	3	4	1	24
Mechanical											
Powerplant / propulsion	17	45	27	35	64	39	50	42	35	37	391
Airframe	16	11	11	11	10	10	12	10	7	7	105
Systems	5	4	4	2	4	6	7	10	8	1	51
Operational											
Terrain collisions	63	74	77	67	77	100	67	117	85	78	805
Aircraft control	34	47	42	32	43	49	43	38	41	39	408
Runway events	19	15	9	10	21	20	22	21	16	20	173
Ground operations	8	7	7	4	21	16	22	19	14	16	134
Miscellaneous	8	15	13	7	9	16	18	6	7	6	105
Fuel related	5	4	7	4	6	9	8	14	16	15	88
Communications	5	8	2	2	1	10	4	6	11	13	62
Fumes, smoke, fire	4	4	3	4	3	5	4	4	3	4	38
Flight preparation / navigation	3	4	2	2	4	4	5	0	3	3	30
Cabin safety	4	1	1	2	1	1	0	1	1	0	12
Regulations and SOPs	1	1	3	1	1	1	0	0	0	0	8
Aircraft loading	2	0	0	0	1	1	1	0	0	0	5
Consequential events	33	60	44	41	61	49	61	70	53	59	531

Terrain collisions

Most terrain collisions in 2012 that involved a GA aircraft were collisions with terrain (44 accidents and one serious incidents). As has been the case in previous years, most other terrain collisions in 2012 were wirestrikes, with a small number of ground strikes also reported to the ATSB.

Collision with terrain accidents were associated with a number of precursor events, especially engine failures in single-engine aircraft. While some of these were associated with forced landings after the power loss, however, those accidents that resulted in fatalities and serious injuries tended to be those where the pilot continued a flight after a partial power loss, either by conducting a circuit or attempting a turnback. Several collisions with terrain were reported to the ATSB in 2012 where an aerodynamic stall occurred as the pilot made a turn with reduced or unreliable engine power, and lost control of the aircraft.

ATSB occurrence 201210994

On the morning of 23 November 2012, the pilot and two other owner-pilots took off in a Piper Cherokee Six from runway 24L at Jandakot Airport, WA. After turning onto the track to Beverley and at about 800ft above ground level, the engine lost power. The pilot immediately turned the aircraft towards runway 30 and focussed on flying the aircraft while the other front-row occupant conducted some of the troubleshooting checks. The engine did not regain power. With insufficient height and speed to reach the flight strip or runway, the pilot force landed the aircraft into wooded bushland within the airport precinct approximately 150 m short of the runway 30 flight strip. The aircraft was substantially damaged by impact with trees. The occupants exited the aircraft with only a minor injury to one passenger.

Compared to 2011 (where about half of collisions with terrain involving GA aircraft occurred during aerial work operations), most collisions with terrain in 2012 involved privately operated aircraft. Less than 30 per cent occurred during aerial work operations, mostly those that involved aircraft flying at low level such as agriculture and mustering. About 35 per cent of collision with terrain accidents in 2012 involved a helicopter. While half of these accidents occurred during aerial work operations, privately-operated helicopters were involved in almost a third of these accidents.

Ten of the 16 helicopters involved in collisions with terrain in 2012 involved a fatality or serious injury, which was a similar proportion to aeroplanes (17 of 24 accidents). There were also five gliders that collided with terrain.

General aviation aircraft striking a wire resulted in seven accidents and 27 serious incidents in 2012. Sixty per cent of these wirestrikes happened while the aircraft was manoeuvring, or conducting aerial work. More than half of the aircraft involved were being used for aerial agriculture or mustering, with four serious incidents involving a hot air balloon. It was generally not known whether the aircraft was fitted with wire protection devices, or whether the pilot was aware of the wire prior to contacting it. Two wirestrikes in 2012 involving GA aircraft resulted in a collision with terrain where the occupants were killed or seriously injured.

Ground strikes involving GA aircraft were small in number (four accidents and one serious incident), and all involved privately operated aircraft. Only one of these occurrences resulted in minor injuries to the aircraft occupants, but most resulted in substantial aircraft damage (helicopter tail boom, propellers, or the aircraft flipping onto its back).

Aircraft separation

Almost 90 per cent of aircraft separation serious incidents in 2012 that involved GA aircraft were near collisions in the air (there were no accidents). Unsurprisingly, many happened in the circuit, approach, or initial climb when aircraft have a greater potential to get too close. In about half (28)

of these serious incidents, at least one of the aircraft involved was being used for flying training. In 10 of these cases, a near collision occurred between two flying training aircraft.

In 16 of the 47 near collisions reported across GA in 2012, a pilot was alerted to the presence of the other aircraft before they almost collided, usually by ATC. In all but one of these cases, one or both pilots were able to visually sight the other aircraft prior to passing. The majority of near collisions occurred on converging tracks or, in the case of aircraft on approach, same or reciprocal headings.

Aircraft control

Loss of aircraft control (15), hard landings (14), and wheels-up landing (8) were the most common types of aircraft control-related accidents and serious incidents involving GA aircraft in 2012.

Situations where a pilot lost control of an aircraft were evenly split between operations in the air, and operations on the ground (during taxi, takeoff, or landing). Many were associated with a bouncy landing (due to a hard landing or a gust) that resulted in a loss of directional control and/or damage to the landing gear, and sometimes a runway excursion. Those loss of control accidents involving helicopters were more likely to result in substantial aircraft damage and occupant injury that those involving aeroplanes.

Hard landing accidents in 2012 mostly involved aeroplanes, with only three accidents each involving gliders or helicopters. Compared to the previous year, there were more hard landing accidents involving privately-operated GA aircraft, although flying training aircraft were still involved almost half of this type of accident. Two hard landing accidents (both involving sports aviation aircraft) resulted in serious injuries to the occupants.

Wheels-up landing accidents were usually unintentional, where the pilot forgot to lower the landing gear during approach. This was often associated with distraction while attempting to diagnose or remedy another aircraft problem, such as a door opening during flight or a power loss.

ATSB occurrence 201210621

On 12 November 2012, during the take-off run from Kumarina Roadhouse airstrip, WA, the forward cabin door of the Beechcraft Bonanza opened. The pilot elected to continue the takeoff, and return to land and secure the door. Distracted by the opened door, concern for his passenger, and attention directed at locating an obstacle in the lower than normal circuit, the pilot forgot to lower the landing gear. The aircraft landed wheels up and skidded to a halt on the runway. The pilot and passenger were not injured.

Powerplant and propulsion

The majority of engine-related accidents and serious incidents involving GA aircraft that were reported to the ATSB in 2012 were total power losses or engine failure (21 of 37). The remaining occurrences were mostly partial power losses/rough running.

Total power loss situations involved a range of primarily single-engine aircraft, usually conducting private operations. Six of these were accidents, and were associated with a power loss resulting in a forced landing where the aircraft was damaged, or a loss of aircraft control. The reason for the engine failure was only known in about two-thirds of cases, but common causes were fuel mismanagement (five cases) and cylinder / connecting rod failure (three cases).

Partial power loss situations are arguably more dangerous to the GA pilot than a total power loss. In 2012, there were 21 accidents and serious incidents in which a total power loss occurred, but there were no serious or fatal injuries. On the other hand, 14 partial power loss accidents and serious incidents occurred that resulted in three fatalities and two serious injuries. These partial power losses involved a range of aircraft types and engines, with the most common factors

contributing to the loss of power being fuel system blockages and ignition mistiming. In several of the accidents that resulted in injuries, the pilot continued the flight or attempted to conduct a diversion or air return after identifying the partial power loss, rather than conducting a forced landing.

ATSB occurrence 201209809

On 11 October 2012, a Robinson R44 Raven 1 helicopter departed a property near Mount Molloy for Georgetown, Qld on a private flight. Shortly after becoming airborne, the helicopter experienced a loss of power. The pilot performed a 180° turn to the left and autorotated to a suitable area within autorotative distance, which was a contour drain located downslope from the departure point. The helicopter was inspected and the left magneto was found to have a badly worn distributor block, which allowed the timing gear to move and alter the internal timing by approximately 40°.

Other types of engine-related accidents involved a loss of oil pressure leading to engine failure, and propeller issues (such as a propeller delaminating in flight).

Runway events

In 2012, most runway-related accidents and serious incidents in GA were runway excursions (15 of 20 cases). About half were veer-offs (the aircraft departed to the left or right of the runway strip). Wind gusts and bouncing on landing on one wheel were commonly reported reasons for veer-offs.

The remainder of runway excursions were overruns (where the aircraft continued beyond the end of the runway), and were split evenly between aircraft on the landing roll and the takeoff roll. All were the result of a rejected take-off or, in the case of overruns on landing, braking performance; rather than a long or fast landing.

Runway excursion, Piper PA-39 Twin Comanche (VH-MMN), Innamincka Township authorised landing area, South Australia (ATSB investigation AO-2012-146)

The remaining five runway accidents and serious incidents involved runway incursions, or aircraft approaching the wrong runway.

ATSB occurrence 201210958

On 17 November 2012, a Piper PA-28R departed Bairnsdale on a private flight to Geelong (Grovedale), Vic. After landing at Geelong, the pilot noticed that the office buildings were unoccupied and a fence had been placed across runway 09/27. The pilot and passenger exited the aircraft and were subsequently advised that the airstrip had been closed and was being redeveloped.

This incident highlights the importance of reviewing flight information in its entirety, ensuring that operational documents are current, and the benefits of contacting the airstrip operator to not only obtain landing permission, but to also receive information on the runway and its condition, any hazards and/or obstructions, and if there are any special procedures applicable to the airstrip.

Ground operations

Thirteen of the 16 accidents and serious incidents reported to the ATSB in 2012 that involved GA aircraft on the ground were collisions. These collisions were usually associated with a runway veer-off, the effect of a wind gust during takeoff, a forced landing, or the poor surface quality of a taxiway. One of these collisions resulted in two serious injuries, where a glider on approach to land lost lift, and collided with a fence as the pilot attempted to make a landing into a paddock.

The remaining three occurrences were near collisions on the ground, or foreign object interference. In one case where an aircraft overran the end of a runway during a crosswind landing, the pilot was unable to operate the rudder due a section of the carpet trim becoming jammed behind the pilot's rudder pedal.

Fuel management

Fifteen accidents and serious incidents in 2012 related to fuel management or fuel system maintenance involved GA aircraft. Six of these were cases of fuel starvation, and four related to fuel exhaustion. In another occurrence, a pilot experienced an engine failure on approach to land because the fuel mixture settings were incorrect. In this case, the pilot was able to restart the engine and land at the airfield, but the engine failed again after landing.

There were also three cases reported to the ATSB where fuel contamination with water was identified after an engine failure, and a serious incident where a pilot detected fumes in the cockpit and then an engine fire from fuel leaking from a loose carburettor bowl.

Incidents

The most common types of incidents involving GA aircraft in 2012 were airspace-related (particularly airspace incursions, pilots not complying with published information or ATC instructions, and reduced aircraft separation). Wildlife strikes, runway events, and communication issues between aircraft were also frequently reported to the ATSB (Table 29).

Table 29: Incidents in GA operations, by occurrence type, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Aerodrome and airways facility											
Aerodrome related	12	3	9	10	7	6	4	10	3	8	72
Airways facility	16	2	4	10	1	4	2	3	4	2	48
Airspace											
Airspace incursion	882	1,152	1,158	1,265	1,251	1,120	1,193	1,186	996	865	11,068
Operational non-compliance	234	145	304	607	775	1,039	848	948	736	646	6,282
Aircraft separation	109	122	127	137	131	180	186	153	202	194	1,541
Breakdown of co-ordination	61	48	45	51	61	57	42	65	68	81	579
ATC procedural error	50	48	56	77	64	71	54	30	30	42	522
Other	42	6	11	6	1	4	1	2	1	7	81
Environment											
Wildlife	257	296	387	385	382	361	404	407	363	335	3,577
Weather	11	9	10	12	18	18	11	20	19	14	142
Mechanical											
Powerplant / propulsion	17	45	27	35	64	39	50	42	35	37	391
Airframe	16	11	11	11	10	10	12	10	7	7	105
Systems	5	4	4	2	4	6	7	10	8	1	51
Operational											
Runway events	137	164	232	263	228	296	453	302	269	245	2,589
Communications	80	91	77	175	124	201	148	138	119	124	1,277
Flight preparation / navigation	97	68	103	112	114	66	69	63	51	37	780
Miscellaneous	32	45	49	49	46	48	54	48	45	59	475
Aircraft control	30	41	57	44	64	49	54	31	46	37	453
Fumes, smoke, fire	35	39	30	37	40	36	32	41	41	31	362
Ground operations	27	33	39	28	30	33	40	40	28	32	330
Terrain collisions	25	35	35	24	35	35	41	22	31	28	311
Fuel related	24	15	20	13	18	19	13	21	20	13	176
Regulations and SOPs	3	6	3	2	9	15	4	0	0	0	42
Cabin safety	2	2	5	5	7	2	1	1	2	1	28
Aircraft loading	0	0	0	1	3	4	1	3	1	2	15
GPWS / TAWS	0	1	4	0	0	0	1	2	1	0	9
Loading related	0	1	2	1	1	0	0	0	0	0	5
Consequential events	253	228	256	349	324	345	347	293	321	333	3,049

Airspace incursions

Airspace incursions are by far the most commonly reported type of incident involving GA aircraft, making up 31 per cent of all GA incidents reported to the ATSB in 2012. In about 65 per cent of all incursions, the pilot deviated from track in such a way that they entered the controlled airspace horizontally, and about 25 per cent inadvertently entered the controlled airspace while climbing or descending.

Most airspace incursion incidents involving GA aircraft related to incursions into controlled airspace (in 2012, 68 per cent of airspace incursions). About 74 per cent of these involved the aircraft going from uncontrolled (Class G) airspace to controlled general and terminal (Class C) airspace. Eight per cent were an incursion from uncontrolled Class G airspace to controlled

terminal (Class D) airspace. There were only 33 airspace incursions involving GA aircraft going from controlled airspace to another area of controlled airspace without a clearance (normally Class D control zone to Class C control area). In Class G to Class C/D airspace incursions, the incursion was more likely to be into a control area (lower limit level) rather than into a control zone (from the ground up).

The remaining 32 per cent of airspace incursions by GA pilots were into prohibited, restricted, or Defence (PRD) airspace[11]. In 2012, the most frequent locations where aircraft inadvertently entered PRD airspace were Defence areas - area R350 near Puckapunyal, Vic. (36 incursions), R564 areas near Singleton, NSW (30 incursions), R358 areas in East Gippsland, Vic. (19 incursions). All of these areas contain Australian Defence Force bases or ranges that are used for live firing exercises, though live firing may not have been taking place at the same time as all of these airspace incursions.

ATSB occurrence 201200723

On 10 January 2012, a Boeing 777 was conducting a scheduled passenger service from Sydney to Abu Dhabi in the United Arab Emirates. During the cruise in Indonesian Airspace, the crew requested and received a clearance to divert around weather. The clearance issued was directed through an active military restricted area, and the aircraft entered the restricted area without a clearance. The restricted airspace was not on the charts held by the flight crew. The crew subsequently observed an aircraft on the traffic collision avoidance system (TCAS) crossing their track on descent. The controller instructed the crew to turn immediately due to traffic.

Operational non-compliance

Over 70 per cent of operational non-compliance incidents involving GA aircraft were due to a pilot not following verbal instructions from air traffic control. These types of incidents are reported to the ATSB by Airservices Australia. In 2012,157 incidents involved a pilot not complying with an ATC altitude assignment, 88 were ATC assigned route changes, and 33 were directions to change heading. The remaining incidents involved pilots not following ATC taxiing or runway entry instructions, or taking off without a clearance.

The remaining compliance issues involving GA pilots were related to pilots not following published information, such as AIS publications and notices to airmen (NOTAMs) (156 incidents), and SIDs and STARs (28 incidents). Many non-compliance occurrences involved deviations from track, climbing above the published altitudes for a circuit or a standard departure, and failure to update waypoint arrival estimates.

Wildlife

Almost all wildlife strikes involving GA aircraft in 2012 were birdstrikes (316 of 335 incidents), with only a small number of animal strikes reported. Compared to wildlife strike reporting by air transport operators and aerodrome operators (which has doubled over the last 10 years), strikes to GA aircraft that were reported to the ATSB have remained static.

[11] PRD areas are defined dimensions above areas of land or water within which flight is restricted permanently, or at specified times. They are designed to separate civil aircraft from areas of risk, such as military operations, sensitive environmental areas, or industrial activities. These areas can also be established to separate aircraft from specific aviation activities such as aerobatics or parachuting activities.

Only about a quarter of GA birdstrike reports have identified the type of bird. There were 11 bird and bat species that accounted for more than 20 strikes each:

- Galah (23 strikes)
- Magpie (17 strikes)
- Plover (17 strikes)
- Kestrel (16 strikes)
- Nankeen kestrel (14 strikes)
- Bat / fruit bat (13 strikes)
- Hawk (11 strikes)

One incident was reported in 2012 where a Socata TBM 700 struck more than 10 galahs on the approach to land, damaging the aircraft's lights.

There were only 15 animal strikes to GA aircraft that were reported to the ATSB in 2012. Kangaroo and rabbit strikes were most common. Minor damage to the aircraft was only reported in two of these incidents.

Runway events

Runway incursions accounted for about 75 per cent of all runway events involving GA aircraft that were reported to the ATSB in 2012.

Almost all of these runway incursions were by aircraft (rather than people or vehicles) and involved the actions of the pilot. Air traffic control actions were involved in nine cases. About 15 per cent led to go-around by another aircraft on final approach to the runway.

Other runway events that were incidents were mostly involved landing or taking off from the wrong runway or runway excursions.

ATSB occurrence 201208331

On 20 July 2012, a Bell 230 helicopter was conducting a night time inter hospital transfer between the Gold Coast and Cherborg, Qld. On arrival overhead Cherborg Hospital, the pilot visually identified the helipad and a police beacon light, and conducted an orbit to reduce speed and set up an approach to land. Due to the prevailing winds, this involved making a teardrop-shaped turn to position the helicopter about 3 NM from the hospital before descending.

On completion of the turn, the pilot reported that the lights of the town were clearly visible, and begun the descent. Approaching the edge of the township, the pilot was unable to see the police beacon, but assumed it had been switched off. When the helipad lights and hospital surrounds came into sight, the pilot realised that the helicopter was approaching Murgon Hospital, about 3 NM away from Cherborg.

As the helicopter was now below circling height, and the pilot was familiar with the approach into Murgon, he made a decision to continue the approach and landed safely.

Aircraft separation

Most aircraft separation incidents involving GA aircraft in happened in the circuit area, or involved a conflict between an aircraft entering the runway, and another aircraft occupying or on approach to the same runway. They often occurred at aerodromes outside of controlled airspace, where air

traffic services do not provide separation between aircraft, and where specific separation standards do not exist. As a result, it is difficult for the ATSB to determine the proximity of the aircraft involved in many of these incidents. These accounted for over half of all reported aircraft separation incidents involving GA aircraft in 2012.

In the majority of these cases, the conflicting aircraft were visually separated, and about half of the time one or both of the pilots manoeuvred their aircraft to reduce the risk of a collision.

About 30 per cent of aircraft separation incidents involving GA aircraft were related to a loss of separation in controlled airspace, where separation standards applied. About a third of these occurred on the ground, usually when an aircraft entered a runway or took off when another aircraft was taking off, landing, or departing the runway strip. Air traffic services were using radar separation standards in about half of the reported loss of separation incidents involving GA aircraft in 2012, procedural standards in about 20 per cent, and runway standards in 30 per cent.

Cases in which a near collision was confirmed are categorised by the ATSB as serious incidents, and are discussed earlier in this section.

Communication issues

Communication issues between a GA pilot and other nearby traffic, or between the pilot and ATC accounted for 114 of the 124 communication-related incidents reported to the ATSB in 2012. Almost three-quarters of these communication issues were due to non-communication by one of the pilots involved. There were also 23 incidents where a GA pilot had selected the incorrect frequency, and six cases where the pilot gave ATC the wrong information with respect to their operational intentions. There was only one reported incident in GA in 2012 where an over-transmission prevented two pilots from communicating, which led to one aircraft entering the runway while another aircraft was on final approach to land. In about 10 per cent of incidents, a radio equipment failure prevented normal communication between a pilot and ATC. In most of these situations, an alternative means of communication (such as a mobile phone, or a radio relay via another aircraft) was available to the pilot.

ATSB occurrence 20124294

On 13 May 2012, a Cessna 208 Caravan was conducting parachute operations at Bells Beach near Redcliffe, Qld. At about the same time, an amateur built Van's RV-8 aircraft was on a scenic flight around the Brisbane area.

At about midday, the Caravan departed Redcliffe Airport and proceeded to drop nine parachutes from FL140 at Bells Beach. The pilot made all necessary radio broadcasts prior to and immediately after the parachute drop. About three minutes later, as the RV-8 flew along Bells Beach, the pilot saw four parachutes and made a slight right turn away from a parachutist. The location of the RV-8 when the parachute-related broadcasts were made by the Caravan pilot meant that the pilot could not have heard the radio broadcasts.

Recreational

Accidents and serious incidents

Accident and serious incident reporting in the recreational aviation community has improved in recent years, as shown by the difference in the number of occurrences reported to the ATSB in 2003 as compared to 2012 (Table 30). Significant growth in recreational flying has driven this increase, as has greater awareness among pilots and recreational aviation administration organisations (RAAOs) of the need to report accidents and serious incidents to the ATSB.

In 2012, the most common types of accidents and serious incidents in recreational aviation were similar to those in general aviation more widely. The most common types of accidents and serious incidents were terrain collisions, engine issues, aircraft control problems, ground operations, runway events, and those associated with severe weather.

Table 30: Accidents and serious incidents in recreational aviation, by occurrence type, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Aerodrome and airways facility	0	0	0	0	0	0	0	0	0	0	0
Airspace											
Aircraft separation	0	0	1	2	3	6	2	3	1	3	21
Operational non-compliance	0	0	0	0	0	0	1	0	0	1	2
ATC procedural error	0	0	0	1	0	0	0	0	0	0	1
Environment											
Weather	0	0	0	0	0	1	0	5	0	10	16
Wildlife	0	0	0	0	0	1	0	1	0	0	2
Mechanical											
Powerplant / propulsion	1	2	0	0	14	17	10	24	16	42	126
Airframe	0	2	0	0	0	6	3	3	1	7	22
Systems	0	0	0	0	0	2	2	0	0	5	9
Operational											
Terrain collisions	8	8	7	6	21	17	28	29	37	47	208
Aircraft control	0	1	1	0	10	12	8	20	17	41	110
Ground operations	1	0	0	0	4	8	8	7	9	13	50
Runway events	0	0	0	0	2	6	6	4	10	11	39
Fuel related	0	0	0	0	1	4	1	0	1	6	13
Miscellaneous	0	0	0	0	0	10	1	1	0	0	12
Communications	0	0	1	0	1	3	2	0	1	1	9
Fumes, smoke, fire	0	0	0	0	1	1	1	3	0	0	6
Flight preparation / navigation	0	0	0	0	0	0	1	0	0	1	2
Consequential events	0	1	0	0	11	22	9	27	16	40	126

Terrain collisions

There were 47 terrain collisions involving recreational aircraft that were reported to the ATSB in 2012, and were classified as an accident or a serious incident. The majority of these (38) were collision with terrain accidents, with a further three serious incidents.

Most collision with terrain accidents in recreational aviation did not involve fixed-wing aeroplanes. Eight paragliders were involved in reported collision with terrain accidents in 2012, and one in a serious incident. A sudden change in wind direction contributing to an aerodynamic stall was the most common reported reason for these collisions with terrain. There was one accident which occurred during a paraglider tow launch, in which the tow weak link broke and the paraglider stalled before falling to the ground and seriously injuring the pilot. All of these collisions with terrain resulted in serious injuries, but no fatalities.

Hang gliders were involved in eight collisions with terrain in 2012, and as was the case with paragliding accidents, these accidents were usually due to a loss of lift from turbulence and an aerodynamic stall resulting in a loss of control. Other reasons for a loss of control resulting in a collision with terrain were a large bank by the pilot while the hang glider was under tow, and a loss of lift due to preceding hang gliders. Half of these accidents resulted in a serious injury, but none resulted in a fatality.

Five collision with terrain accidents reported to the ATSB in 2012 involved gyrocopters. Three of these accidents were fatal, and are discussed in detail in the *Recreational* section of this report on page 64.

Those involving fixed-wing aeroplanes (13 accidents and two serious incidents) were most often the result of a loss of directional control during landing or takeoff, due to windshear or a crosswind. Engine malfunctions contributed to three collision with terrain accidents.

ATSB occurrence 201200533

On 26 January 2012, a pilot and his passenger were planning a local flight in a recreational Jabiru 170 around George Town, Tasmania. During the initial climb, a propeller blade detached from the aircraft and the pilot conducted a forced landing on the remaining runway. The aircraft rolled through the runway and became airborne to clear a road. The aircraft collided with a fence in the adjoining paddock and overturned in a ditch. The pilot and passenger suffered minor injuries and the aircraft was seriously damaged.

Other types of terrain collisions reported to the ATSB that involved recreational aviation aircraft were wirestrikes (three accidents and two serious incidents in 2012) and ground strikes (three accidents). In three of the wirestrikes, most of which happened on approach to landing, the aircraft was seriously damaged or the occupants suffered serious injuries. All of the ground strikes reported were associated with a runway veer-off or a forced landing following an engine malfunction.

Powerplant / propulsion

Of the 42 powerplant issues involving recreational aircraft reported to the ATSB in 2012 that resulted in accidents or serious incidents, 34 were a total power loss in a single-engine aircraft. Almost all of these occurrences happened on approach to landing, or on initial climb, and in most cases, the accident was a result of a collision on ground during a forced landing.

Common reasons for engine malfunctions were major failures to engine internal components and connecting shafts (damaged pistons, shattered cam drive gear, broken gearbox drive shaft, fractured cylinder through-bolt, sheared rear flywheel bolts). Carburettor icing and fuel pump failures contributed to a few engine malfunction accidents.

The eight remaining powerplant / propulsion-related accidents and serious incidents included two cases where a broken exhaust valve led to rough running of the engine, and one serious incident where an aircraft's engine lost power on final approach due to fuel contamination.

Aircraft control

Most of the 41 aircraft control issues that were associated with an accident or serious incident in 2012 were a loss of control. Less than half (8 of 18) involved fixed-wing aeroplanes, and most were associated with either a hang glider or paraglider pilot losing control in turbulence.

All but one of those accidents and serious incidents involving aeroplanes involved a loss of control during takeoff or landing. Where a contributing factor to the loss of control was reported to the ATSB, crosswinds and gusts were a common theme in these accidents. In most cases, aircraft damage or injuries to the occupants were due the aircraft colliding with an obstacle off the side of the runway, such as a fence or tree.

Other aircraft control-related accidents and serious incidents involving recreational aviation aircraft in 2012 were associated with aircraft damage during a hard landing or runway veer-off. Many of these were associated with an engine malfunction or power loss during final approach,

distractions during landing (avoiding animals on the runway, securing the cockpit canopy), or a gust during final approach.

Ground operations

There were 11 collisions on ground, one near collision, and one ground handling issue that resulted in a reported accident or a serious incident involving a recreational aircraft in 2012.

Most of the collision on ground accidents and serious incidents resulted in substantial damage to the aircraft, but in only three cases was the pilot injured (one serious injury). Two of the injury accidents involved a pilot losing control of a paraglider.

The single ground handling accident involved a ground handler's hand contacting a propeller. In the near collision on ground, the pilot of a recreational aircraft lost directional control during take-off and veered off the runway; the aircraft coming into close proximity with another GA aircraft.

Runway events

Ten of the 11 runway events involving recreational aviation aircraft that resulted in an accident or a serious incident were runway excursions (primarily veer-offs).Many of these accidents were associated with a collision with an obstacle to the side of the runway, as discussed earlier in this section.

Most of the runway excursions were due to a loss of directional control after mechanical failure (brake lock, wheel support failure, rudder control loss, nosewheel collapse as a result of a hard landing).

The remaining serious incident was a runway incursion, where the crew of a Jabiru 160 did not taxi in accordance with ATC instructions and entered the runway without a clearance. This resulted in a loss of separation with an American Champion 7 that was landing at the same time.

Weather

Weather-related accidents and serious incidents involving recreational aircraft in 2012 most often involved windshear or turbulence affecting aircraft control during approach and landing. The result in most cases was a hard landing, or a loss of directional control resulting in a collision with an obstacle in the approach path. Two cases of carburettor icing were also reported that resulted in an engine failure and a forced landing.

Incidents

The most commonly reported types of incidents to the ATSB in 2012 that involved recreational aviation operations were airspace incursions, aircraft control issues, engine malfunctions, runway events, airframe issues, and terrain collisions (Table 31).

Table 31: Incidents in recreational aviation operations, by occurrence type, 2003 to 2012

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Aerodrome and airways facility											
Aerodrome related	0	0	0	0	2	2	0	0	0	0	4
Airspace											
Airspace incursion	7	16	3	11	9	17	34	39	33	35	204
Operational non-compliance	2	5	2	2	5	7	7	12	9	11	62
Aircraft separation	6	3	4	2	3	3	8	4	6	4	43
ATC procedural error	1	2	2	2	0	0	0	0	0	0	7
Breakdown of co-ordination	1	0	0	0	0	0	0	0	0	0	1
Environment											
Weather	0	0	0	0	2	3	0	3	4	4	16
Wildlife	0	0	0	0	2	2	2	3	5	0	14
Mechanical											
Powerplant / propulsion	1	0	0	0	11	14	4	24	19	20	93
Airframe	0	0	0	0	7	10	9	10	19	17	72
Systems	0	0	1	1	3	1	2	4	7	9	28
Operational											
Aircraft control	0	0	0	0	10	12	9	11	19	24	85
Runway events	3	0	8	3	7	10	9	11	12	20	83
Terrain collisions	0	0	0	0	9	11	6	11	17	15	69
Communications	1	1	1	6	0	6	5	5	4	4	33
Ground operations	0	0	2	0	6	8	1	1	5	7	30
Flight preparation / navigation	1	0	0	0	1	2	1	1	3	4	13
Fuel related	0	0	0	0	2	3	0	1	2	4	12
Fumes, smoke, fire	0	0	0	0	1	3	1	2	2	3	12
Miscellaneous	0	0	0	0	4	3	0	0	0	2	9
Aircraft loading	0	0	0	0	0	0	0	0	0	2	2
Regulations and SOPs	0	0	0	1	1	0	0	0	0	0	2
Cabin safety	0	0	0	0	0	1	0	0	0	0	1
Consequential events	1	1	1	1	8	17	9	27	21	27	113

Airspace incursions

Airspace incursions were the most commonly reported type of incident reported to the ATSB involving recreational aircraft. Most of these incidents are reported by Airservices Australia, and over 60 per cent (22 of 35 incidents) were controlled airspace incursions.

Most of the controlled airspace incursions happened while the aircraft was in cruise or climb. As was the case with GA aircraft incursions more generally, most involved a Class G to Class C incursion. Horizontal incursions were the most common type.

The remaining 13 airspace incursions were into PRD airspace. A wide range of PRD areas were involved in these incidents, notably R146A (near Lancelin, WA), R265B (near Edinburgh, South Australia), and R620C (near Amberley, Qld).

Most airspace incursions involving recreational aircraft were by aeroplanes, but there was one incident reported in 2012 involving a powered paraglider.

Aircraft control

Hard landings and loss of aircraft control made up the majority of aircraft control incidents involving recreational aircraft reported to the ATSB in 2012.

Most of the 11 hard landings reported involved aeroplanes, where the aircraft ballooned or bounced during landing. Only two of these incidents resulted in more than minor damage to the aircraft (propeller damage, detached nosewheel). Only two hard landings resulted in minor injuries, and these incidents involved a hang glider or a paraglider.

Four of the five loss of control incidents reported happened on the ground, during taxiing, landing, or takeoff. Three involved aeroplanes, and included a ground loop, a loss of control while turning the aircraft around on the runway to backtrack, and a runway veer-off.

Other aircraft control incidents involving recreational aircraft included three wheels-up landings, a pilot inadvertently retracting the landing gear during taxi, and an aft centre of gravity affecting takeoff performance due to the placement of the pilot's flight bag.

Powerplant / propulsion

Partial power loss, or rough running, accounted for 14 of the 20 incidents reported to the ATSB in 2012 regarding recreational aircraft engines. Faulty spark plugs, fuel pump failures, cylinder cracks, and crankshaft failures were some of the varied causes for rough running in these incidents. In most cases, the rough running occurred during climb or cruise, and the pilot was able to conduct a precautionary landing or make a diversion to a nearby airport.

Other engine issues reported by recreational pilots in 2012 included engine failures (four incidents, three of which occurred on the ground), abnormal engine indications, and smoke entering the cockpit due to a section of the aircraft's exhaust system detaching during flight.

Runway events

Half of the 20 runway-related incidents involving recreational aircraft in 2012 were runway excursions. Most of these happened on landing, were veer-offs, and in many cases the reason for the loss of directional control was not reported to the ATSB. When reported, mechanical failures with the aircraft (bent nosewheel strut, detached nosewheel, deflated tyre) were generally the reason for the loss of directional control.

Eight runway incursion incidents involved recreational aircraft in 2012, and in all but one case, the recreational aircraft entered the runway without a clearance from air traffic control. There were no reported incidents where a runway incursion led to a loss of separation with another aircraft, although in one incident, an aircraft rejected an approach for a touch and go landing after seeing a tractor enter the runway.

A runway undershoot incident was also reported to the ATSB, where the aircraft landed short of the threshold after encountering severe turbulence on final approach. There was also a report of a recreational aircraft landing on a closed runway.

Airframe issues

Landing gear problems were the most common airframe issue resulting in recreational aircraft incidents in 2012, accounting for 13 of 17 incidents. These incidents mostly happened during standing or during the landing roll. Landing gear failures (nose gear collapse, main landing gear leg crack, damage to nose wheel strut) and brake issues were the main problem areas.

ATSB occurrence 201203062

On 4 March 2012, the pilot of a Flight Design MC recreational aircraft had just completed a private flight to Childers, Qld.

As the aircraft was being pushed back to park, two bolts in the nose wheel assembly detached. An inspection revealed that no locktite had been used when the bolts had been assembled.

Other airframe issues affecting recreational aircraft that were reported to the ATSB included a cockpit canopy separating in flight, and a passenger door opening during climb after take-off.

Terrain collisions

Ground strikes were the most common type of incident involving a terrain collision. Of the 12 incidents involving recreational aircraft in 2012, most were associated with a hard landing (propeller or wing tip struck the ground when the aircraft bounced), or the nose gear collapsing during the landing roll. In one incident, the nose landing gear suspension on a Jabiru SP collapsed during engine run-ups, resulting in a prop strike.

There were also three collision with terrain incidents reported to the ATSB in 2012, involving a paraglider that collided with a tree in flight, a two incidents where a hang glider struck the ground shortly after takeoff when the right wing stalled.

Data sources and submissions

Sources of information

The sources of information during the investigation included:

- the ATSB occurrence database
- ATSB investigation reports
- aircraft and operator activity data from the Bureau of Infrastructure, Transport and Regional Economics (BITRE).

Appendices

Appendix A – Explanatory notes

Occurrence data represent a picture of aviation derived from information available at the time these statistics were prepared.

This appendix explains what data was included or excluded to produce these statistics, how operation types are defined, and other important points to consider when interpreting these statistics.

Inclusions

Specifically, occurrence data includes:

- the number of aircraft involved in incidents, serious incidents, serious injury accidents, fatal accidents and total accidents
- the number of serious injuries and fatalities
- accident and fatal accident rates per million departures and million hours flown.

Exclusions

Fatalities do not include those resulting from:

- parachuting operations where aircraft safety was not a factor
- suicides
- criminal acts.

Important points to consider

A number of procedures are used in different sections of this report to distinguish occurrences from aircraft and injuries.

- An occurrence may involve one or more aircraft.
- Where occurrence data is presented by operation type or occurrence type (as in the Occurrences by operation type and Occurrence types: what happened sections of this report), tabulated figures refer to the number of aircraft involved in occurrences. Occurrences involving more than one aircraft are recorded once for each aircraft involved.
- Aircraft involved in fatal accidents are counted based on what happens to the aircraft occupants. This means that each aircraft with an onboard fatality is counted separately as being involved in a fatal accident within the operation type of the aircraft. If two aircraft collide in mid-air and fatalities occur onboard both aircraft, two aircraft involved in fatal accidents are counted. Using the same example, if two aircraft collide in mid-air and a fatality occurs on one aircraft only, one aircraft is recorded as being involved in a fatal accident, but in total, two aircraft are recorded as being involved in accidents.
- Injuries and fatalities are recorded against only the operation type of the aircraft in which the injury or fatality occurred.
- Tables in this report record aircraft where the registration or flight number is known and/or where the operation type can be reasonably ascertained. For example, aircraft operating in Class G airspace without a transponder or flight plan can be reasonably expected to belong to general aviation, even though the operation subtype is not known.
- Where an occurrence has more than one level of injury, the highest injury level is recorded. For example, an accident involving an aircraft with four occupants may have one person with no injury, one person with minor injury, one person with serious injury, and one person with fatal injuries; this aircraft will be recorded as being involved in a fatal accident only.

- The number of serious injuries are derived from both fatal accidents that involve some serious injuries, and from serious injury accidents (serious injury accidents represent occurrences where serious injury is the highest injury recorded.)
- It is important not confuse serious injury accidents and serious incidents. A serious incident is an incident where an accident nearly occurred. In contrast, a serious injury accident involves an occurrence resulting in the highest injury that requires, or would usually require, admission to hospital within 7 days after the day when the injury is suffered.
- The high-level categories of all air transport and all general aviation include occurrence data where the country of registration is not known, but the general type of operation is known. This means that the addition of sub-categories will be less than the total number at the higher level.

Operation types

This report provides data pertaining to a number of operational types, which are utilised across a wide range of ATSB statistical and research reports.

Commercial air transport refers to scheduled and non-scheduled commercial operations used for the purposes of transporting passengers and/or cargo for hire or reward. Specifically, this includes:

- *High capacity regular public transport (RPT)* - regular public transport operations[12] conducted in high capacity aircraft. A high capacity aircraft refers to an aircraft that is certified as having a maximum capacity exceeding 38 seats, or having a maximum payload capability that exceeds 4,200 kg.
- *Low capacity RPT* - regular public transport operations conducted in aircraft other than high capacity aircraft. That is, aircraft with a maximum capacity of 38 seats or less, or having a maximum payload capability of 4,200 kg or below.
- *Charter* - operations involving the carriage of passengers and/or cargo on non-scheduled flights by the aircraft operator, or by the operator's employees, for trade or commerce (excluding RPT operations[13]).

General aviation (GA) is considered to be all flying activities that do not involve scheduled (RPT) and non-scheduled (charter) passenger and freight operations. It may involve Australian civil (VH–) registered aircraft, or aircraft registered outside of Australia. General aviation includes:

- *Aerial work.* This includes ambulance, medivac, and other emergency medical service flights; and flying for the purposes of agriculture, mustering, search and rescue, fire control, or survey and photography.
- *Flying training*.
- *Private, business and sports aviation*. Sports aviation includes gliding, parachute operations, ballooning, warbird operations, and acrobatics.

In these statistics, GA does not include operations involving Australian non-VH registered aircraft (such as military aircraft, or aircraft registered by recreational aviation administrative organisations (RAAOs).

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12 RPT operations are conducted in accordance with fixed schedules to and from fixed terminals over specific routes.

13 In this report, charter operations (for both occurrences and departures/hours flown) mostly refer to charter operations in low capacity aircraft. High capacity charter operations by operators predominately engaged in high capacity RPT operations (e.g. commercial airlines) are not routinely differentiated from RPT operations in either occurrence reports (to the ATSB) or activity reports (to BITRE).

Recreational aviation refers to all flying conducted for pleasure involving aircraft registered in Australia by RAAOs. These organisations have been authorised by the Civil Aviation Safety Authority (CASA) to maintain registers of aircraft and conduct administration of recreational flying. Recreational aviation aircraft include those registered with:

- Australian Sports Rotorcraft Association (ASRA) (primarily gyrocopters with a G– registration)
- Hang Gliding Federation of Australia (HGFA) (primarily weight-shift hang gliders, paragliders, trikes, and microlights with a T1– or T2– registration)
- Recreational Aviation Australia (RA-Aus) (registrations in the 10-, 19-, 24-, 25-, 28-, 32-, and 55- series). These encompass a wide range of aircraft types, sizes, and performance levels, and may include ultralight or sport aircraft, amateur-built or experimental aircraft, weight-shift microlights, and powered parachutes.

Reports of safety incidents involving military aircraft that have been reported to the ATSB are excluded from these statistics, unless the military aircraft has affected the safety of a civil aircraft.

Appendix B – ATSB occurrence type taxonomy

Occurrence Type Level 1	Occurrence Type Level 2	Occurrence Type Level 3
Operational	Aircraft control	Hard landing
		Incorrect configuration
		Loss of control
		Unstable approach
		Wheels up landing
		Other
	Aircraft loading	Dangerous goods
		Loading related
		Other
	Cabin Safety	Cabin communications
		Cabin preparations
		Passenger related
		Unrestrained occupants / objects
		Other
	Communications	Air-ground-air
		Callsign confusion
		Transponder related
		Other
	Consequential events	Ditching
		Diversion / return
		Emergency / Precautionary descent
		Evacuation / disembarkation
		Fly-by inspection
		Forced / Precautionary landing
		Fuel dump / burn off
		Missed approach / go-around
		Overweight landing
		Rejected take-off
		Other
	Flight preparation / Navigation	Lost / unsure of position
		Pre-flight / Planning
		Unsecured door / panel
		VFR into IMC
		Other
	Fuel related	Contamination
		Exhaustion
		Leaking or venting
		Starvation
		Other
	Fumes, Smoke, Fire	Fire
		Fumes
		Smoke

Occurrence Type Level 1	Occurrence Type Level 2	Occurrence Type Level 3
	GPWS / TAWS	
	Ground operations	Collision on ground
		Foreign object damage / debris
		Ground handling
		Ground prox
		Jet blast / Prop / Rotor wash
		Other
	Miscellaneous	Airframe overspeed
		Crew incapacitation
		Depressurisation
		Missing aircraft
		Security related
		Stall warnings
		Unauthorised low flying
		Warning Device Other
		Laser Related
		Other
	Regulations and SOPs	
	Runway events	Depart / App / Land Wrong Runway
		Runway Excursion
		Runway Incursion
		Runway undershoot
		Other
	Terrain Collisions	Collision with terrain
		Controlled flight into terrain
		Ground strike
		Wirestrike
Mechanical	Airframe	In-flight break-up
		Doors / Exits
		Furnishings and fittings
		Fuselage / Wings / Empennage
		Landing gear / Indication
		Windows
		Other
	Powerplant / propulsion	Abnormal engine indications
		Partial power loss / rough running
		Propellers
		Total power loss / engine failure
		Transmission and gearboxes
		Other
	Systems	Air / Pressurisation
		Avionics / Flight Instruments
		Electrical

Occurrence Type Level 1	Occurrence Type Level 2	Occurrence Type Level 3
		Fire protection
		Flight controls
		Fuel
		Hydraulic
		Other
Airspace	Aircraft separation	Airprox
		Breakdown of separation
		Loss of separation assurance
		Mid-air collision
		TCAS / ACAS
		Other
	ATC Procedural Error	Information error
		Failure to pass traffic
	Breakdown of co-ordination	
	FTC (Operational Non-compliance)	Published information
		Verbal instruction
	VCA (Airspace incursion)	Controlled airspace
		PRD
	Other	
Aerodrome and airways facility	Aerodrome related	Lighting
		Markings and signs
		Other
	Airways facility	ATM
		Navaids
		Radar
		Other
Environment	Wildlife	Animal strike
		Birdstrike
		Other
	Weather	Icing
		Lightning strike
		Turbulence
		Windshear / microburst
		Other
	Other	

Australian Transport Safety Bureau

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.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept 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.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Glossary

Occurrence - an accident or incident.

Accident - an occurrence involving an aircraft where:

- a person dies or suffers serious injury
- the aircraft is destroyed, or is seriously damaged
- any property is destroyed or seriously damaged (*Transport Safety Investigation Act* 2003).

Incident - an occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation (ICAO Annex 13).

Serious incident - an incident involving circumstances indicating that an accident nearly occurred (ICAO Annex 13).

Serious injury - an injury that requires, or would usually require, admission to hospital within seven days after the day when the injury was suffered (Transport Safety Investigation Regulations 2003).

Australian Transport Safety Bureau

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Research

ATSB Transport Safety Report
Aviation Occurrence Statistics 2003 to 2012
AR-2013-067
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