Australian Government
Australian Transport Safety Bureau

Aviation Occurrence Statistics 2002 to 2011

Research

ATSB Transport Safety Report
Aviation Research Report
AR-2012-025
Final

Report No. AR-2012-025

Publication date 30 May 2012

ISBN 978-1-74251-268-8

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Publishing information

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

Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT

Aviation Research and Analysis Report
AR-2012-025
Final

Aviation Occurrence Statistics 2002 to 2011

SAFETY SUMMARY

Why we have 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

There were 130 accidents, 121 serious incidents, and 6,823 incidents in 2011 involving VH-registered aircraft. These included a first officer who was thrown off a set of portable stairs by jet blast from a Boeing 747 at Brisbane Airport, a freight flight that disappeared while trying to land in the Torres Strait Islands, a Boeing 777 that flew just 1,000 feet above suburban Melbourne while on approach to land, and an ABC helicopter that was tragically lost on a flight over Lake Eyre.

General aviation operations continue to have an accident rate higher than for commercial air transport operations: in 2011, about four times higher for accidents, and nine times higher for fatal accidents.

Most commercial air transport accidents and serious incidents were related to reduced aircraft separation, and engine issues. Charter operations accounted for most of the accidents, including two fatal accidents in 2011. Air transport incidents were more likely to involve birdstrikes or a failure to comply with air traffic control instructions or published information.

For general aviation aircraft, accidents and serious incidents often involved terrain collisions, aircraft separation issues, or aircraft control problems. Where general aviation aircraft were involved in an incident, airspace incursions, failure to comply with air traffic control, and wildlife strikes were common.

In most operation types, helicopters had a higher rate of accidents and fatal accidents than aeroplanes, except for in charter operations. Even though the fatal accident rate is generally higher, helicopter accidents are on the whole associated with fewer fatalities than fixed-wing aircraft.

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 growth of reporting to the ATSB that has been seen over the last 10 years has helped us to better understand why accidents and incidents happen, and what the major safety risks are in different types of aviation operations. This helps everyone in the aviation industry to better manage their safety risk.

CONTENTS

SAFETY SUMMARY ..... **iii**

THE AUSTRALIAN TRANSPORT SAFETY BUREAU ..... **vi**

TERMINOLOGY USED IN THIS REPORT ..... **vii**

ABBREVIATIONS ..... **viii**

OPERATION TYPES USED IN THIS REPORT ..... **ix**

1 INTRODUCTION **1**

1.1 Background to the report 1

1.2 Data sources 1

1.2.1 Occurrence data 1

1.2.2 Activity data 2

1.3 Disclaimer 2

2 ACTIVITY DATA **3**

2.1 Departures 3

2.2 Hours flown 6

3 EXPLANATORY NOTES **9**

4 OCCURRENCES BY OPERATION TYPE **11**

4.1 Commercial air transport 13

4.1.1 High capacity RPT (VH- registered) 15

4.1.2 Low capacity RPT (VH- registered) 20

4.1.3 Charter (VH- registered) 23

4.1.4 Foreign-registered air transport 27

4.2 General aviation 30

4.2.1 Aerial work 35

4.2.2 Flying training 48

4.2.3 Private/business/sports aviation 51

4.2.4 Foreign general aviation 59

5 OCCURRENCES BY AIRCRAFT TYPE **60**

5.1 Differences between operation groups and fixed/rotary-wing accidents 60

5.2 Differences between operation types and fixed/rotary-wing accidents 62

6 OCCURRENCE TYPES: WHAT HAPPENED 65

6.1 Commercial air transport 65

6.1.1 Accidents and serious incidents 66

6.1.2 Incidents 70

6.2 General Aviation 75

6.2.1 Accidents and serious incidents 75

6.2.2 Incidents 79

APPENDIX A: ATSB OCCURRENCE TYPE TAXONOMY 85

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

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

TERMINOLOGY USED IN THIS REPORT

Occurrence: an accident or incident.

Accident: an occurrence involving an aircraft where:

(a) a person dies or suffers serious injury; or

(b) the aircraft is destroyed, or is seriously damaged; or

(c) any property is destroyed or seriously damaged (TSI 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 (TSI Regulations, 2003).

ABBREVIATIONS

ABC	Australian Broadcasting Corporation
AIS	Aeronautical information service
ATS	Air traffic services
ATSB	Australian Transport Safety Bureau
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BOS	Breakdown of separation
CASA	Civil Aviation Safety Authority
CFIT	Controlled flight into terrain
EMS	Emergency medical services
FTC	Failure to comply
GA	General aviation
GPS	Global Positioning System
ICAO	International Civil Aviation Organization
IFR	Instrument flight rules
IMC	Instrument meteorological conditions
IRM	Immediately reportable matter
MTOW	Maximum take-off weight
NM	Nautical mile
PIC	Pilot-in-command
PRD	Prohibited, restricted, Defence
RA-Aus	Recreational Aviation Australia
RPT	Regular public transport
RRM	Routinely reportable matter
SID	Standard instrument departure
SIGMET	Significant Meteorological Information
SIIMS	Safety Investigation Information Management System
STAR	Standard arrival route
TCAS	Traffic Collision Avoidance System
TSI	*Transport Safety Investigation Act* 2003 (Cth)
VFR	Visual flight rules

OPERATION TYPES USED IN THIS REPORT

This report provides data relating to the following operational types:

- **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[1] 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[2]).
- **General aviation (GA):** general aviation is considered to be all flying activities that do not involve scheduled (RPT) and non-scheduled (charter) passenger and freight operations. General aviation includes:
  - ***Aerial work*** - including 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, and acrobatics.

In this report, general aviation does not include operations involving Australian non-VH registered aircraft (such as military aircraft, or aircraft registered by sport and recreational flying organisations such as Recreational Aviation Australia).

---

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

2 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).

1 INTRODUCTION

1.1 Background to the report

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. 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.

The *Aviation occurrence statistics* report will be updated and published annually.

1.2 Data sources

1.2.1 Occurrence data

The accident and incident data collected by the ATSB is recorded in its aviation safety database, the Safety Investigation Information Management System (SIIMS). The occurrence data provided herein was extracted from the SIIMS database for the period 1 January 2002 to 31 December 2011 for Australian civil registered aircraft operating both within and outside Australian territory[3], and foreign registered aircraft operating within Australian territory only.

Please note that this report does not include occurrences relating to recreational aviation where the aircraft are registered with Recreational Aviation Australia, the Australian Sport Rotorcraft Association or the Hang Gliding Federation of Australia.

[3] 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.

1.2.2 Activity data

The Bureau of Infrastructure, Transport and Regional Economics (BITRE) Aviation Statistics section routinely collects activity data for air transport and general aviation operations. This includes hours flown data and departures data collected through:

- The annual *General Aviation Activity Survey* (the Survey), which is distributed to operators or owners of aircraft listed on the Civil Aviation Safety Authority's civil aircraft register with the exception of aircraft operated by the major domestic airlines (Qantas, Virgin Australia, Jetstar, and Tiger Airways). The Survey estimates some data where there is less than a 100 per cent return rate (see the Survey explanatory notes for 2010).
- Monthly performance data provided to the BITRE by airline operators.

The above activity data, available up to and including 2010 at the time of publishing, was used to calculate accident and fatal accident rates per million departures and per million hours flown. Note that activity data recently revised by BITRE for high capacity aircraft has risen from 2004 onwards. This relates to additional freight only activity, not previously available, being added to the figures.

For more aviation activity statistics, please visit the BITRE website at www.bitre.gov.au.

1.3 Disclaimer

Occurrence data used in this report is provided to the ATSB by responsible persons as defined in the *Transport Safety Investigation Regulations* 2003 Part 2.5. The ATSB accepts no liability for any loss or damage suffered by any person or corporation resulting from the use of this data.

The data contained in SIIMS is dynamic and subject to change pending the provision of new information to the ATSB.

2 ACTIVITY DATA

The number of aviation occurrences alone does not represent a complete picture of safety within the industry. For meaningful comparisons to be made between different types of aircraft and operations they perform, data in this report is presented as a rate per million hours flown or 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 sports and recreational aviation is not tabled in this report. Specific activity data for movements of non-Australian (foreign) registered aircraft is limited, but is tabulated where available.

2.1 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[4] 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 up to the end of 2010.

Table 1 shows that general aviation departures have generally fallen over the last 10 years. In 2002, there were 15 per cent more general aviation departures than in 2010. Since 2006, there have been about 1.9 million general aviation departures per year. Comparing general aviation to air transport, there are about 1.4 general aviation departures for every commercial air transport aircraft departure. In comparison, general aviation had about two times the number of aircraft departures in Australia in 2002 when compared to commercial air transport. The departures in

[4] 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 data.

general aviation are dispersed across a much larger fleet of aircraft. In both 2009 and 2010, there was a difference of about 600,000 departures between the two.

Commercial air transport operations have shown a gradual increase in departures across the last 10 years (Figure 1). Within air transport, domestic high capacity departures have increased in most years since 2002 in a linear fashion, and continued to show a marked increase in 2010 (Figure 2). On the other hand, low capacity aircraft departures have decreased over the same time period. Charter departures have remained relatively static. A small, gradual increase in foreign registered aircraft departures has been observed over the reporting period.

Figure 1: Departures by operation type, 2002 to 2011

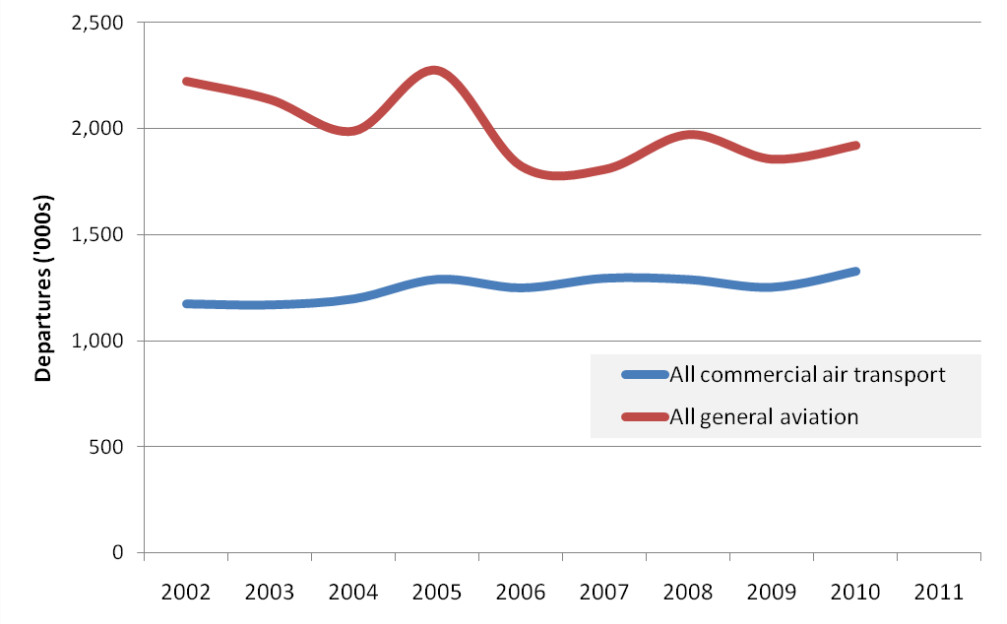


Figure 2: Departures in commercial air transport, 2002 to 2011

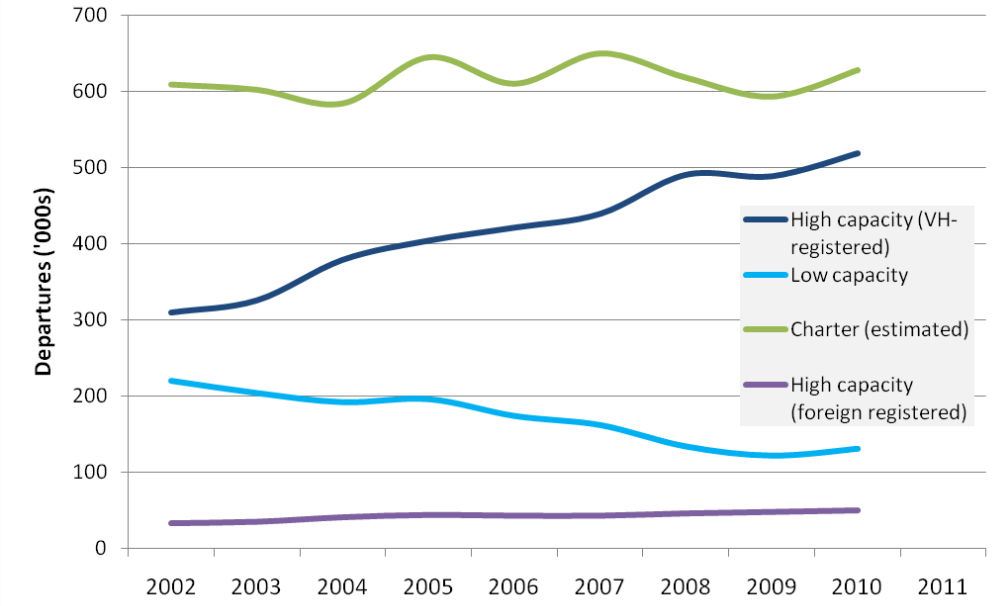


Table 1: Departures (thousands), 2002 to 2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010
All commercial air transport	1,172	1,167	1,196	1,289	1,248	1,294	1,288	1,251	1,327
High capacity (*VH- registered)*	310	326	379	404	421	439	490	488	518
Low capacity	220	204	192	196	174	162	134	122	131
Charter (estimated)[5]	609	602	584	645	610	650	618	593	628
High capacity (*Foreign)*	33	35	41	44	43	43	46	48	50
All general aviation	2,223	2,137	1,989	2,274	1,823	1,808	1,972	1,856	1,921

Total power loss and collision on ground, Cessna 177 Cardinal (VH-DSA), South Grafton Aerodrome, New South Wales (AO-2011-098)

[5] Charter balloon departures are not included in this figure.

2.2 Hours flown

Hours flown data (available up to the end of 2010) is used to calculate accident and fatal accident rates for different operation types. This data includes hours flown for both domestic/regional and international high capacity air transport operations for Australian airlines, and hours flown for general aviation. Note that information reported on hours flown by foreign registered aircraft is not reliable, and hence is not included in these figures. While departures are generally used as an exposure measure 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 takeoff phases of flight; for example some aircraft may be required to perform low flying.

Table 2 records thousands of hours flown by operation type[6] for Australian (VH-) registered aircraft. In 2002, general aviation and air transport hours flown were similar, but since this time, hours flown in air transport have continued to rise at a faster rate than those in general aviation. In 2010, there was a difference of about 480,000 hours flown between the two.

Hours flown in Australia increased steadily in air transport over the past nine years. For general aviation, hours flown increased from 2004 until 2008 but have remained static since 2008 (Figure 3). Low capacity air transport hours flown have generally declined over this period, however, they have increased slightly in 2010 (Figure 4). The reduction in low capacity air transport hours is in part due to an increase in the seating capacity of aircraft being used to service regional cities and mining communities, and the focus of low cost and leisure airlines on second-tier airports and major regional centres.

Figure 5 shows a comparison of flying activity between each subgroup of general aviation. Flying training hours flown increased since 2004, but showed a marked drop in 2010. Sources from the training industry have indicated that the 2010 drop was a result of lower numbers of overseas students due to the high Australian dollar. Private and business hours flown have been static for a number of years. Aerial work activity as a whole has increased slightly, though within aerial work Survey and Agricultural flying hours have displayed significant variability. This is most likely due to variability in business markets and drought conditions over the last decade. Other types of aerial work have displayed a relatively stable level trend in hours flown.[7]

---

[6] The *General Aviation Activity Survey* collects test and ferry hours as a separate category, but this data is not associated with the type of operation (e.g. aerial work, charter). 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.

[7] Hours flown by general aviation operation types are not recorded individually for all types of aerial work (e.g. check and training, fire control).

Figure 3: Hours flown by operation type, 2002 to 2011

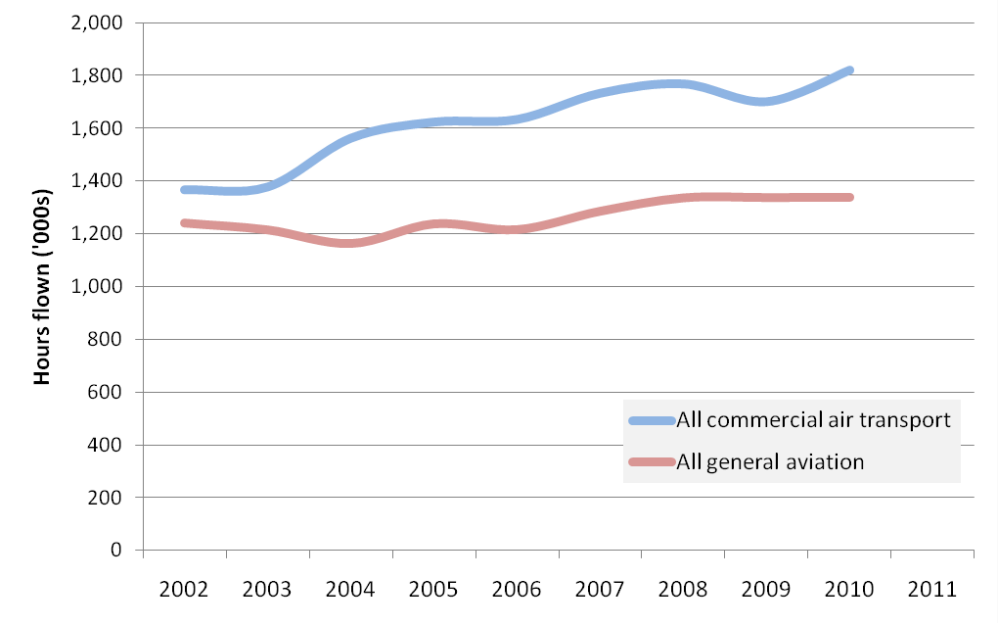


Figure 4: Hours flown in commercial air transport, 2002 to 2011

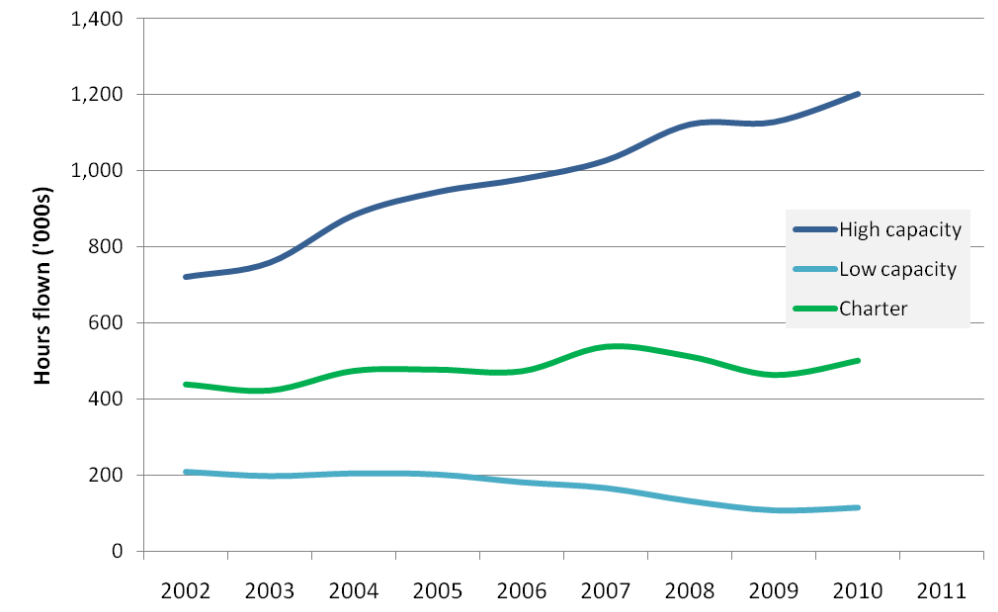


Figure 5: Hours flown in general aviation, 2002 to 2011

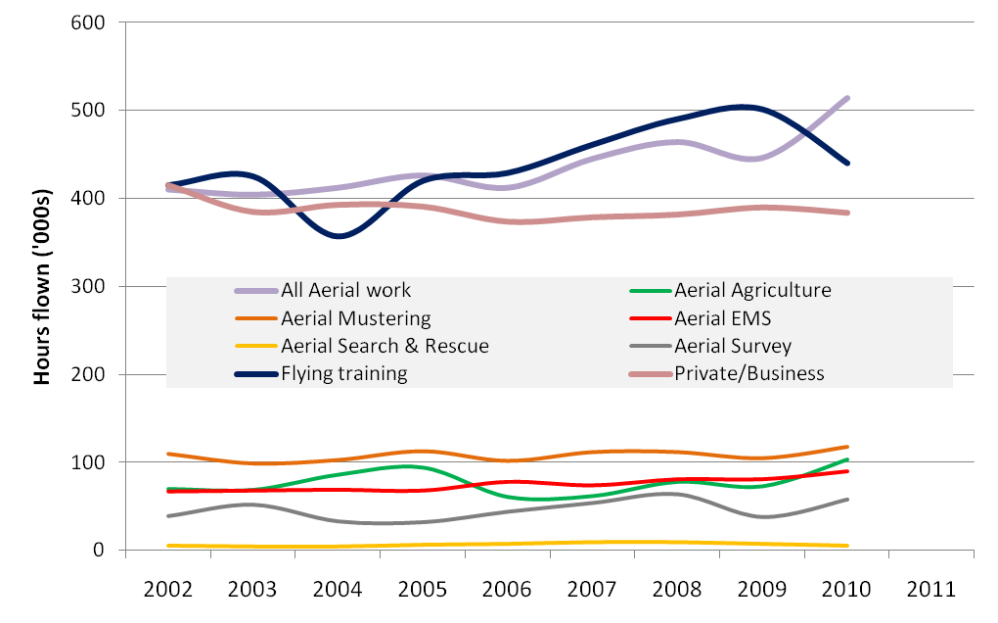


Table 2: Hours flown (thousands), 2002 to 2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010
All commercial air transport	1,367	1,378	1,562	1,623	1,633	1,732	1,767	1,700	1,819
High capacity	720	758	883	944	978	1,027	1,122	1,128	1,202
Low capacity	208	197	204	201	181	166	132	108	115
Charter	439	423	475	478	474	539	513	464	502
All general aviation	1,240	1,214	1,162	1,237	1,215	1,285	1,336	1,337	1,338
All Aerial work7	410	404	412	426	412	445	464	446	514
Aerial Agriculture	70	69	86	94	61	62	78	73	103
Aerial Mustering	110	99	103	113	102	112	112	105	118
Aerial EMS	67	68	69	68	78	74	81	81	90
Aerial Search & Rescue	5	4	4	6	7	9	9	7	5
Aerial Survey	39	52	33	32	44	54	64	38	58
Flying training	415	425	357	420	429	461	490	501	440
Private/Business	415	385	393	391	374	379	382	390	384

3 EXPLANATORY NOTES

Occurrence data represent a picture of aviation derived from information available at the time this report was prepared.

The following section contains a brief explanation of inclusions, exclusions, the structure of the report and other relevant factors to consider when reading this report.

Inclusions

Specifically, occurrence data in Chapters 4 to 6 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; and
- 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.

Structure of data in this report

In order to understand the structure of data in this report, a number of procedures are used in each chapter to distinguish occurrences from aircraft and injuries. An occurrence may involve one or more aircraft. The following points are of note:

- Occurrence data in Chapters 4 to 6 are presented based on 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.

Further definitions of terminology used in this report can be found on page viii.

Collision with terrain, Robinson R22 helicopter (VH-CME), 93km N of Julia Creek, Queensland (AO-2011-145)

4 OCCURRENCES BY OPERATION TYPE

This chapter provides data on occurrence numbers and rates relating to the following operational types:

- **Commercial air transport -** high capacity regular public transport (RPT) flights, low capacity RPT flights, and charter flights (involving both VH-registered and foreign-registered aircraft).
- **General aviation -** aerial work operations, flying training, and private, business and sports aviation (involving both VH-registered and foreign-registered aircraft).

Table 3 compares the number of fatal accidents and fatalities for commercial air transport and general aviation, and each of their operation subtypes (discussed in further detail in this chapter).

Compared to the previous edition of this report (2001-2010), there has been a slight decrease in almost all types of air transport and general aviation operations in 2002 to 2011 in both the number of fatal accidents and the number of associated fatalities. Despite this, the number of fatalities and serious injuries increased in 2011 when compared to 2010. Private/business aviation has by far the highest number of fatal accidents and associated fatalities.

Fatal accidents in some aircraft operations are more likely to have a greater number of associated fatalities than in other operation types. For example, there were 10 aircraft involved in fatal accidents while conducting survey and photography-related aerial work operations over the last 10 years (2002 to 2011), and 17 people were killed in these accidents. In comparison, there were 14 fatal accidents in aerial agriculture operations over the same period, which resulted in 14 fatalities. This is because aircraft used for agricultural operations usually have only the pilot on board, whereas survey/photography aircraft generally have a pilot, as well as camera operators or navigators, on board. This shows that the severity of an occurrence is a function of the number of aircraft involved, the type of flying operation, and the number of people on board these aircraft who may potentially be at risk of injury.

Collision with terrain, PZL Warszawa-Okecie M-18 Dromader aircraft (VH-FOZ), 22 km WSW of Dirranbandi, Queensland (AO-2011-082)

Table 3: Fatal accidents and fatalities by operation type, 2002 to 2011

Operation type	Number of aircraft associated with a fatality	Number of fatalities
Commercial air transport	**17**	**52**
High capacity RPT	0	0
Low capacity RPT	2	17
Charter	15	35
General Aviation	**145**	**233**
Aerial Work	41	56
Agriculture	*14*	*14*
Mustering	*7*	*8*
Emergency medical	*1*	*3*
Fire control	*2*	*2*
Survey and photography	*8*	*16*
Other/unknown	*9*	*13*
Flying training	13	18
Private/Business/sport	89	156
Private/Business	*71*	*135*
Sport aviation	*18*	*21*
Foreign registered general aviation	2	3

Runway overrun and collision with terrain, Cessna 172 Skyhawk (VH-SMY), 90 km WNW of Geraldton (East Wallabi Island), Western Australia (AO-2011-042)

4.1 Commercial air transport

There has been an increase in the number of incidents involving commercial air transport aircraft reported to the ATSB over the last 10 years (58 per cent increase between 2002 and 2011). This is greater than the increase in flying activity (departures) over this time, which rose by 13 per cent from about 1,172,000 departures in 2002 to about 1,327,000 departures in 2010.

This increase may be attributed to the introduction of the *Transport Safety Investigation Regulations* 2003 (TSI Regulations) during this period, which provides a prescriptive list of the types of occurrences that are required to be reported to the ATSB for both air transport and general aviation operations. This increase may also reflect an improved reporting culture by pilots, airline operators, and other air transport industry participants. More incidents were reported in 2011 than in any other year in the last decade.

Most occurrences were incidents - about 1 per cent of all air transport occurrences were serious incidents or accidents. On average, there were less than two fatal accidents every year involving commercial air transport aircraft, and they mainly involved aircraft engaged in charter operations. About one-in-twelve accidents involved a fatality. In 2011, the two fatal accidents involved charter aircraft – a Cessna 310 which collided with terrain soon after departure from Bathurst Island, Northern Territory, on a return flight, and an Aero Commander 500S conducting a cargo flight which lost radio contact on approach to Horn Island, Queensland, in bad weather.

The fatal accident rate for commercial air transport aircraft over the 2002 to 2011 period showed that there was an average of slightly over one fatal accident per million departures in any year, peaking in 2002 when there were four fatal accidents. There were no fatal accidents in 2004 and 2009 (Figure 6).

The overall accident rate varied over the last 10 years, reaching a low of about 9 to 10 accidents per million departures in 2005, 2006, and 2009 (Table 4). In 2010, the accident rate returned to the higher levels seen in 2007 of 17 accidents per million departures (there were 12 more accidents involving charter aircraft that year than in 2009). Charter aircraft account for the majority of accidents in commercial air transport, and have an accident rate per million departures that is about three and a half times higher than low capacity RPT operations, and seven times higher than high capacity RPT operations.

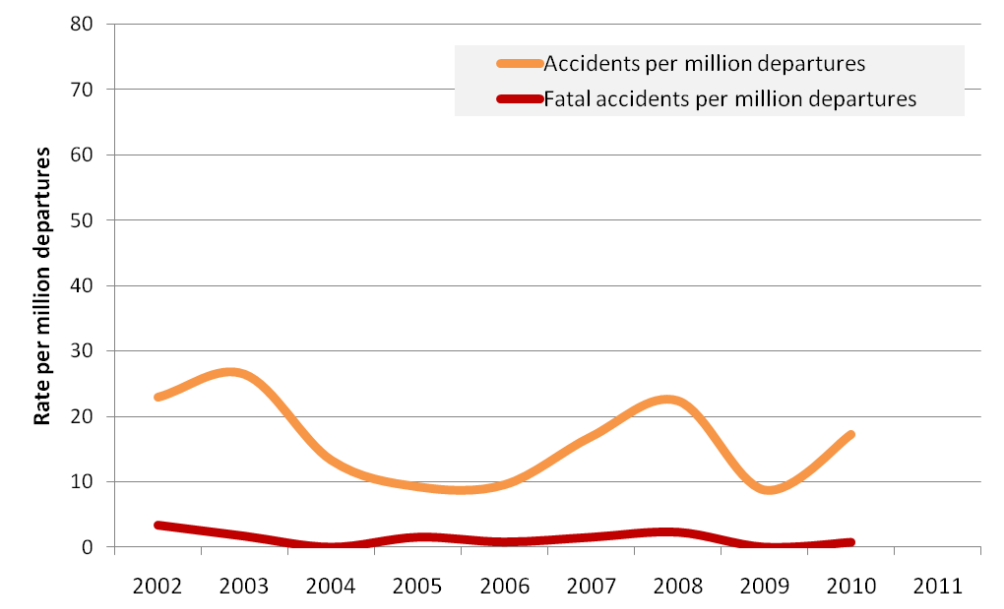
Table 4 shows a general increase in serious incidents from about 2003 onwards.[8] The number of serious incidents dropped from 47 (in 2008) to 24 in 2009 and 25 in 2011, after a slight rise in 2010. Serious incidents are indicators of events that almost led to accidents. As such, they represent occurrences which could have had more serious consequences.

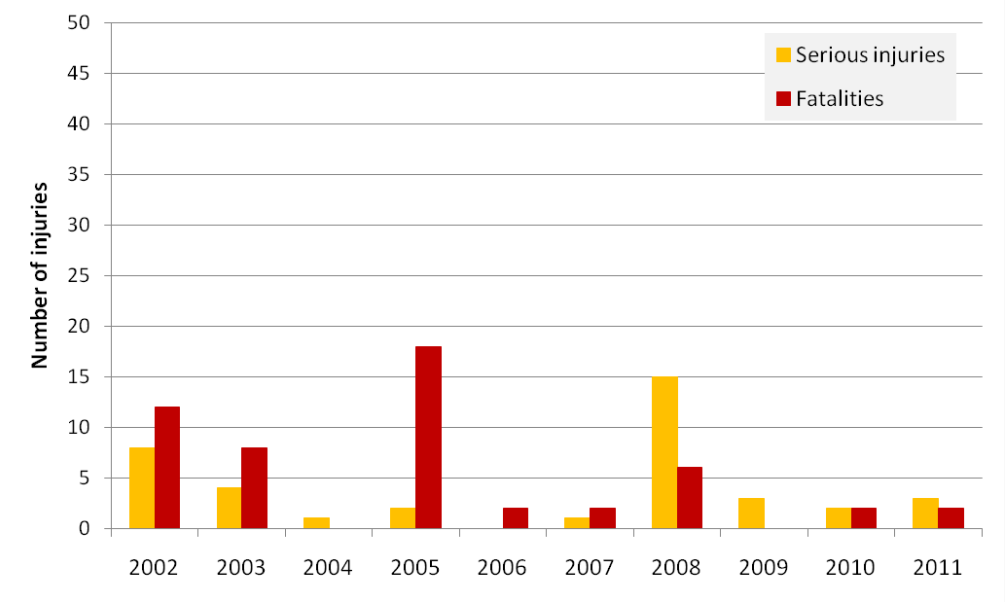
[8] This is likely an artefact of a database recoding exercise undertaken by the ATSB that reviewed serious incident classification dating back to a baseline coincident with the introduction of the *Transport Safety Investigation Act* 2003 and its associated Regulations.

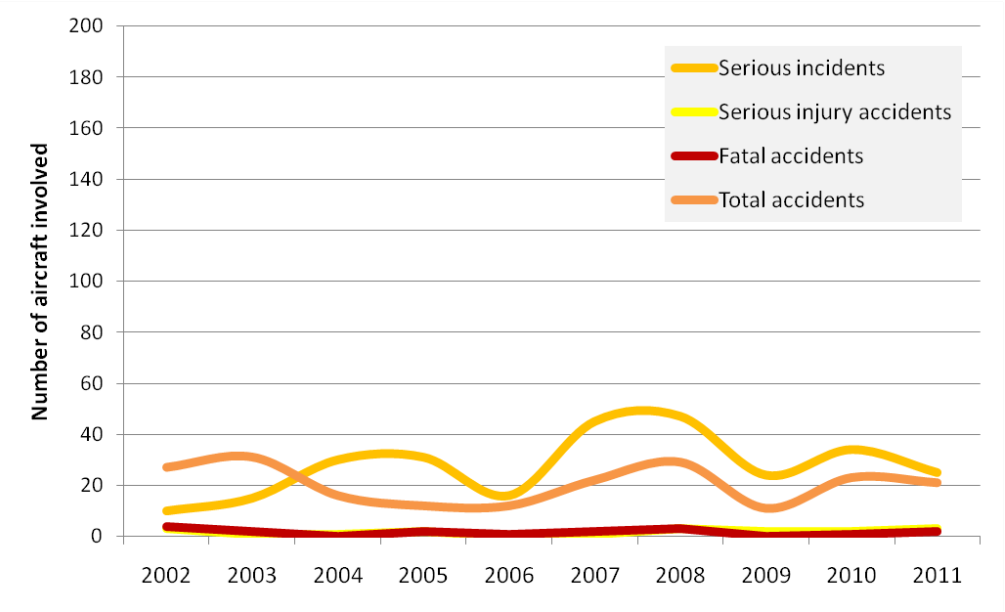
Table 4: All commercial air transport occurrences (VH- and foreign registered aircraft), 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	3,011	2,696	3,464	4,120	3,709	3,919	4,055	3,871	4,505	4,907
Serious incidents	10	15	30	31	16	45	47	24	34	25
Serious injury accidents	3	1	1	2	0	1	3	2	2	3
Fatal accidents	4	2	0	2	1	2	3	0	1	2
Total accidents	27	31	16	12	12	22	29	11	23	21
Number of people involved										
Serious injuries	8	4	1	2	0	1	15	3	2	3
Fatalities	12	8	0	18	2	2	6	0	2	2
Rate of aircraft involved										
Accidents per million departures	23	26.5	13.4	9.3	9.6	16.9	22.5	9.6	17.3	
Fatal accidents per million departures	3.4	1.7	0.0	1.5	0.8	1.5	2.3	0.0	0.8	

Figure 6: Commercial air transport occurrences and injuries, 2002 to 2011







4.1.1 High capacity RPT (VH- registered)

A general increase has been observed in the total number of incidents reported to the ATSB by Australian high capacity aircraft operators over the last 10 years (Table 5). Between 2002 and 2011, there was a 77 per cent increase in reported occurrences involving VH- registered high capacity air transport aircraft. When considering this increase, it is important to note that flying activity in high capacity commercial air transport has increased steadily since 2002 (in fact, departures have risen 67 per cent from 2002 to 2010).

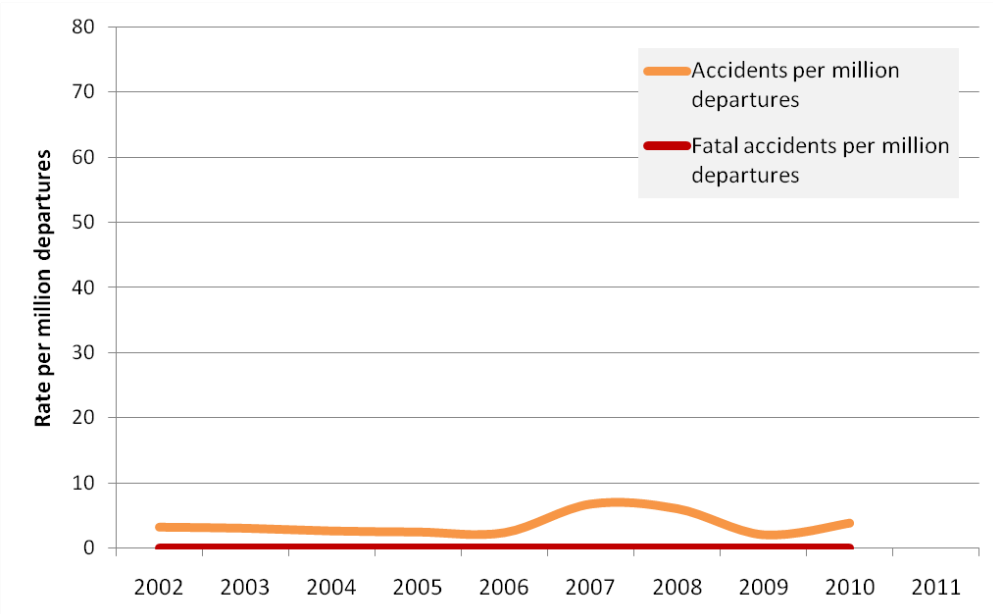
No fatalities were recorded among VH- registered high capacity RPT aircraft between 2001 and 2011. The last recorded fatal accident involving high capacity RPT in Australia was in 1975. This involved the collapse of a Boeing 707 nose gear during pushback. The nose of the aircraft fell onto the roof of the tug cabin crushing the driver.

The total number of accidents involving high capacity air transport aircraft has remained low, with about two accidents per year on average (Figure 7). The number of serious incidents increased from 2004 onwards. This, in part, was due to a review of the ATSB's classification of immediately reportable matters (IRMs), which took effect in July 2003. The number of serious incidents rose in 2010, but has declined in 2011.

Table 5: High capacity RPT (VH- registered aircraft) occurrences, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	1,776	1,478	1,976	2,392	2,184	2,244	2,457	2,408	2,853	3,243
Serious incidents	6	6	10	11	4	16	20	9	13	10
Serious injury accidents	1	1	0	1	0	1	1	1	2	2
Fatal accidents	0	0	0	0	0	0	0	0	0	0
Total accidents	1	1	1	1	1	3	3	1	2	3
Number of people involved										
Serious injuries	1	4	0	1	0	1	12	1	2	1
Fatalities	0	0	0	0	0	0	0	0	0	0
Rate of aircraft involved										
Accidents per million departures	3.2	3.1	2.6	2.5	2.4	6.8	6.1	2.0	3.9	
Fatal accidents per million departures	0	0	0	0	0	0	0	0	0	
Accidents per million hours	1.4	1.3	1.1	1.1	1.0	2.9	2.7	0.9	1.7	
Fatal accidents per million hours	0	0	0	0	0	0	0	0	0	

Figure 7: Accident rate for high capacity RPT aircraft (VH- registered) (per million departures), 2002 to 2011



The rise seen in the accident rate in 2007 and 2008 was due in part to:

- severe airframe vibration and an uncommanded roll of an Ozjet Airlines Boeing 737 aircraft on approach to Norfolk Island in December 2007;
- depressurisation of a Qantas Boeing 747 aircraft near Manila, Philippines in July 2008; and
- an uncommanded pitch down event involving a Qantas Airbus A330 aircraft near Learmonth, Western Australia, in October 2008.

In 2011, there were two accidents involving high capacity air transport aircraft and 10 serious incidents. The accidents were:

- On 1 September 2011, the crew of a Virgin Australia Boeing 737-800 aircraft (registered VH-BZG) was intending to conduct a ferry flight from Christchurch, New Zealand to Melbourne. While taxiing for takeoff, the aircraft's wingtip collided with the horizontal stabiliser of a parked Air New Zealand aircraft. There were no injuries. Approximately two-thirds of the winglet of VH-BZG was damaged.
- On 14 October 2011, a Qantas Boeing 747-400 aircraft, registered VH-OEH, was taxiing away from a gate at Brisbane Airport under its own power. The aircraft was asked by ground control to hold to wait for passing aircraft, positioning VH-OEH behind a Virgin Australia Boeing 737-800 aircraft which was parked at a gate (registered VH-VUM). At the time, the first officer of the VH-VUM was alighting from the rear door of the aircraft using push stairs to speak to the refueller. As the first officer was about to descend the stairs, VH-OEH was given a taxi clearance and considerably higher thrust was applied than what was recorded for taxiway movements on preceding days. The jet blast generated toppled the stairs (with the first officer still on them at the top) onto their side and pushed them several metres from the aircraft. A number of other ground staff took shelter behind buildings on the ramp to protect themselves from the jet blast. The first officer sustained serious injuries to his arms and legs, and was taken to Royal Brisbane Hospital. Neither aircraft was damaged (AO-2011-137).

Both of these accidents are under internal investigation by the operators involved. The jet blast incident was investigated by the ATSB (AO-2011-137).

The 10 serious incidents in 2011 involved:

- two cases of medical incapacitation of the first officer
- a faulty valve in the cabin pressurisation system
- a breakdown in separation between a business jet and a Boeing 737 (AO-2011-011)
- a runway incursion involving an Airbus A320 and a Cessna 404 aircraft conducting scheduled flights (AO-2011-010)
- a helicopter passing close to an Airbus A320 on final approach
- an in-flight fumes event due to a electrical fault and fire in a windscreen heater on an Airbus A330 aircraft (AO-2011-041)
- jet blast from an Airbus A320 that affected passengers and ground staff boarding another aircraft (AO-2011-137)
- a breakdown of separation where two Boeing 737 crossed tracks (AO-2011-144)

- an occurrence where the captain became incapacitated on approach and the first officer had to land the aircraft.

A number of these serious incidents involved separation issues (both in the air and on the ground) where there was a medium risk of collision. In addition to investigations into each of these occurrences, the ATSB has initiated a research investigation to review all breakdowns of separation and loss of separation assurance events involving air transport aircraft since 2008. The aim of this investigation is to look for patterns and common errors by pilots and air traffic controllers that lead to loss of separation between aircraft in controlled airspace.

The number of serious injuries in high capacity air transport operations remained small in 2011. There was one occurrence where a serious injury occurred, which involved the first officer who was thrown from the top of a set of portable pushstairs when they toppled due to jet blast from another aircraft. The first officer sustained a broken arm and leg.

In the last 10 years, two accidents in particular resulted in a large number of serious injuries:

- On 2 July 2003, a Boeing 747-438 aircraft, registered VH-OJU, operating from Singapore, arrived at Sydney during the airport's curfew period under a tailwind of around 12 kts. The pilot flying selected auto brake setting three and idle reverse thrust in accordance with the curfew requirement. However, during the landing roll, the reverse thrust was inadvertently de-selected. On arrival at the terminal, the pilot in command (PIC) observed a 'BRAKE TEMP' 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 the PIC 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 (200302980).
- On 7 October 2008, an Airbus A330-303 aircraft, registered VH-QPA, was operating from Singapore to Perth and cruising at an altitude of 37,000 ft when the autopilot disconnected. Following this, the crew received various aircraft system failure indications. While the crew were evaluating the situation, the aircraft abruptly pitched nose-down and descended 650 ft. After returning the aircraft to 37,000 ft, the crew commenced actions to deal with multiple 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 less serious injuries. Most of the injuries involved passengers who were standing, or who were seated without their seatbelts fastened (AO-2008-070).

Damage to overhead cabin panels after an in-flight upset, Airbus A330 (VH-QPA) Western Australia (AO-2008-070)

In addition to these occurrences, several other notable serious incidents and accidents involving high capacity RPT aircraft have occurred between 2002 and 2011:

- On 20 August 2005, smoke was detected in the forward cargo hold of a Qantas Airbus A330 (registered VH-QPE) during cruise. It diverted to Kansai, Japan for a precautionary landing and during evacuation, one passenger sustained serious injuries and eight others sustained minor injuries (200504074).
- On 21 July 2007, a Jetstar Airbus A320 aircraft (registered VH-VQT) was attempting to land at Melbourne airport in fog but abandoned the landing due to low visibility. During the go-around, the aircraft was not in the correct flight mode, and it did not initially climb as expected by the crew. The aircraft descended to within 38 ft of the ground and this triggered an Enhanced Ground Proximity Warning System alert. A second missed approach was conducted and the aircraft diverted to Avalon, Victoria. The investigation found that the thrust levers were not in the take-off/go-around position during the first missed approach. It also found that the aircraft operator had changed the standard operating procedure for go-around, and this reduced the possibility of the flight crew detecting the incorrect flight mode (AO-2007-044).
- On 7 February 2008, a Qantaslink Boeing 717 aircraft (registered VH-NXE) operating to Darwin when the crew conducted a visual approach and elected to follow the instrument landing system to the runway. The aircraft was above the glideslope for the majority of its approach and shortly before landing, it temporarily exceeded the operator's stabilised approach criteria.

The aircraft landed heavily on the left main landing gear, and this led to creasing of the fuselage and damage to airframe longitudinal structural components, landing gear, and tyres. No passengers were injured in this accident (AO-2008-007).

- On 25 July 2008, a Qantas Boeing 747 aircraft (registered VH-OJK) was operating between Hong Kong and Melbourne when an oxygen cylinder, installed in the forward cargo hold, ruptured and discharged its pressurised contents, propelling the cylinder upwards through the cabin floor. This led to an immediate and rapid depressurisation of the cabin. The cylinder penetrated the cabin, striking a door frame, door handle and overhead panelling before falling to the cabin floor and exiting the aircraft through the ruptured fuselage. The aircraft made an emergency landing at Manila and all passengers safely disembarked from the aircraft (AO-2008-053).
- On 7 April 2009, a Virgin Australia Boeing 737 was ready to depart from Townsville Airport. As the rear cabin door was closed, the portable stairs were removed from the aircraft. A ground crew member was closing the door at the time and fell through the gap between the portable stairs and the aircraft. The ground crew member fractured their pelvis and eye socket in the fall.
- On 4 March 2010, a Qantaslink Boeing 717 aircraft (registered VH-NXM) was being prepared to depart from Ayers Rock when the pilot in command instructed the cabin crew to close the aircraft doors. The cabin crew member allocated to the forward left door had difficulty unlatching the door, so the cabin crew member allocated to the opposite door came to assist. The assisting cabin crew member placed one foot outside the aircraft onto the portable stairs to assist with closing the door. At the same time, ground personnel has started to move the portable stairs and the assisting cabin crew member fell through the open door onto the apron. The cabin crew member sustained a fractured left arm, a sprained right wrist and other minor injuries (AO-2010-015).
- On 4 November 2010, a Qantas Airbus A380 aircraft (registered VH-OQA) was operating between Singapore and Sydney when the No. 2 engine sustained an uncontained engine failure. The aircraft returned to Singapore and landed safely. A subsequent examination of the aircraft indicated that sections of the liberated turbine disc penetrated the left wing and the left wing-to-fuselage fairing, resulting in serious structural and systems damage to the aircraft (AO-2010-089).

4.1.2 Low capacity RPT (VH- registered)

Over the last 6 years, there has been a decrease in the number of incidents reported to the ATSB involving low capacity RPT aircraft (Table 6). This was influenced by a decline in flying activity over this period (hours flown by low capacity RPT aircraft have almost halved since 2002, and the number of departures is 40 per cent lower in 2010 than in 2002).

Flying activity in low capacity scheduled air transport (which includes aircraft with less than 38 seats) has decreased for reasons such as the mining boom (larger aircraft are needed to move more people to regional cities and mining communities), regional airlines utilising 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.

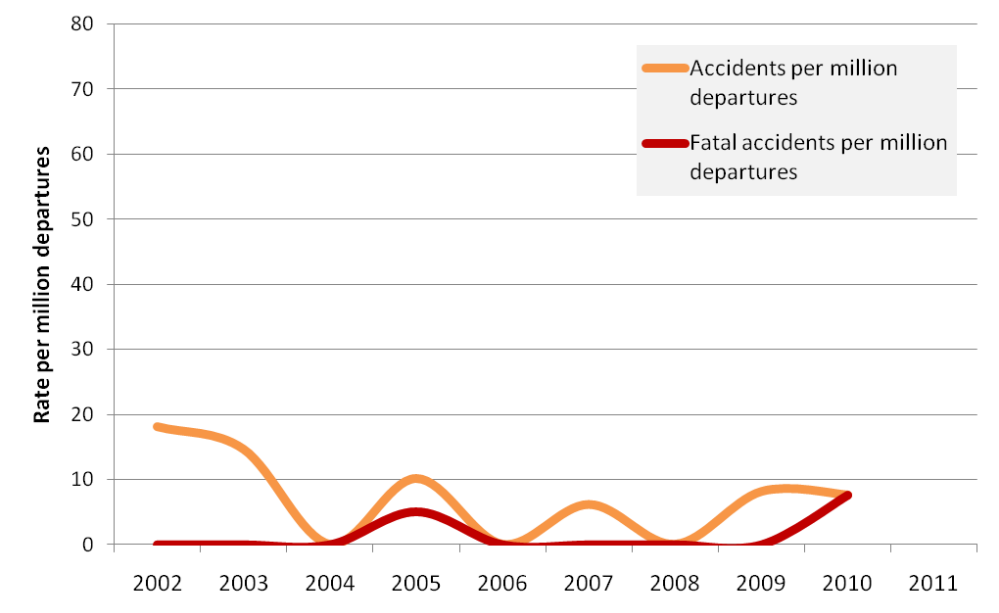
Despite the general reduction in incidents reported, due to the greater decline in low capacity RPT flying activity, the number of incidents per departure has steadily increased from 2003.

There were less incidents and serious incidents in 2011 involving low capacity RPT aircraft, after a spike in 2010. The accident rate per million hours flown and per million departures are very similar, at about 7 to 8 accidents per million hours/departures.

Table 6: Low capacity RPT (VH- registered aircraft) occurrences, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	561	579	636	691	540	606	493	470	535	527
Serious incidents	1	6	10	7	5	8	11	4	6	2
Serious injury accidents	0	0	0	0	0	0	0	0	0	0
Fatal accidents	0	0	0	1	0	0	0	0	1	0
Total accidents	4	3	0	2	0	1	0	1	1	0
Number of people involved										
Serious injuries	0	0	0	0	0	0	0	0	0	0
Fatalities	0	0	0	15	0	0	0	0	2	0
Rate of aircraft involved										
Accidents per million departures	18.2	14.7	0.0	10.2	0.0	6.2	0.0	8.2	7.6	
Fatal accidents per million departures	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	7.6	
Accidents per million hrs	19.2	15.2	0.0	9.9	0.0	6.0	0.0	9.2	8.6	
Fatal accidents per million hrs	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	8.6	

Figure 8: Accident rate for low capacity RPT aircraft (VH- registered) (per million departures), 2002 to 2011



There are generally very few accidents involving low capacity scheduled air transport aircraft in Australia (Figure 8). There were 12 accidents between 2002 and 2011, with a third of these occurring in 2002. There were no accidents involving low capacity RPT aircraft in 2011, however, one serious incident occurred. This involved a runway incursion at Darwin Airport between a Hardy Aviation Cessna 404 aircraft which was on a scheduled passenger service to Snake Bay, Northern Territory, and a Jetstar Airbus A320 which was operating a high capacity passenger service to Sydney. To access the main taxiway, the A320 crew was required to obtain a clearance to cross runway 11/29. On reaching the runway holding point, the A320 crew received a clearance from air traffic control to cross the runway. Prior to crossing, the crew checked the runway and approach paths for traffic. The pilot in command (PIC) stated that they were clear to the left, but the copilot noted that there was an aircraft lined up and stopped on runway 11. Soon after, the copilot observed the aircraft commence its take-off roll. He advised the PIC, who immediately stopped the aircraft. Investigation of this occurrence found that air traffic control had provided the instruction for the Airbus to cross the runway based on the expectation that the Cessna would have commenced the takeoff soon after receiving a take-off clearance (AO-2011-010).

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 resulted in a total of 17 fatalities:

- On 7 May 2005, Transair was operating a Fairchild SA227-DC Metro 23 aircraft (registered VH-TFU) with two pilots and 13 passengers, in far north Queensland 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 (200501977).
- On 22 March 2010, an Airnorth Embraer EMB-120ER Brasilia aircraft (registered VH-ANB) 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 (AO-2010-019).

Loss of control, Embraer EMB-120ER (VH-ANB), near Darwin Airport, Northern Territory (AO-2010-019)

4.1.3 Charter (VH- registered)

Prior to 2004, the number of aircraft involved in reported charter incidents was in the vicinity of 400 per year, but between 2004 and 2008, a significant rise in reported incidents was observed (Table 7). This trend was reversed in 2009 and 2010, but the number of reported incidents increased again in 2011.

Of all air transport operations, charter had the highest total number, and highest rate of accidents and fatal accidents per million hours and per million departures (Figure 9). The number of total accidents has varied significantly from year to year, and in 2011 was about average (17 accidents).

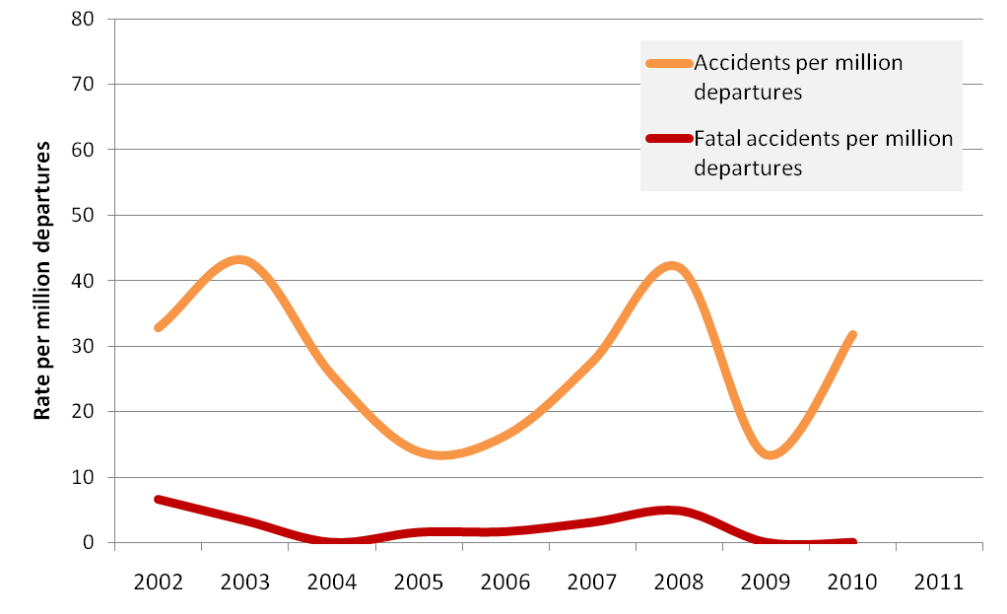
The accident rate per million departures declined after a peak in 2003, reaching just a third of the 2003 level in 2005. It then increased, by 2008 reaching levels similar to those found in 2003. In 2009, it then fell to a new low, before returning to the long term average in 2010. The accident and fatal accident rate per million hours is higher than for departures, 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 serious incidents also increased from 2003 onwards, but has declined slightly since reaching a peak in 2007.

Table 7: Charter (VH- registered aircraft) occurrences, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	411	374	445	522	578	690	713	600	499	553
Serious incidents	1	3	9	6	6	16	13	10	14	11
Serious injury accidents	2	0	1	1	0	0	2	1	0	1
Fatal accidents	4	2	0	1	1	2	3	0	0	2
Total accidents	20	26	15	9	10	18	26	8	20	18
Number of people involved										
Serious injuries	7	0	1	1	0	0	3	2	0	1
Fatalities	12	8	0	3	2	2	6	0	0	2
Rate of aircraft involved										
Accidents per million departures	32.8	43.1	25.6	13.9	16.4	27.7	42.1	13.5	31.8	
Fatal accidents per million departures	6.6	3.3	0.0	1.5	1.6	3.1	4.9	0.0	0.0	
Accidents per million hrs	45.6	61.5	31.6	18.8	21.1	33.4	50.7	17.2	39.8	
Fatal accidents per million hrs	9.1	4.7	0.0	2.1	2.1	3.7	5.8	0.0	0.0	

Figure 9: Accident rate for charter aircraft (VH- registered) (per million departures), 2002 to 2011



In 2011, there were 18 aircraft conducting charter work that were involved in 17 accidents. Two of these accidents involved fatalities, and one involved a serious injury; all three of those occurrences are under investigation by the ATSB:

- On 5 February 2011, the pilot of a Cessna 310R aircraft (registered VH-XGX) was conducting a return flight to Darwin following a charter flight to Bathurst Island, Northern Territory. The pilot, who was the sole occupant, departed

Bathurst Island Aerodrome and collided with terrain about 1 km upwind of the runway (AO-2011-017).

- On 24 February 2011, the pilot of an Aero Commander 500S (registered VH-WZU) was conducting a cargo charter flight from Cairns to Horn Island, Queensland. After an uneventful flight from Cairns, the aircraft arrived in the Horn Island area and the pilot contacted air traffic control, advising that he intended to hold position to the east of the airport until the weather improved and he could safely land. About half an hour later, radio contact was lost with VH-WZU, and a search was commenced for the aircraft. Several days later, items believed to be from the aircraft were located floating 85 km east of Horn Island. In mid-October 2011, the aircraft wreckage was located by a crayfish diver and was surveyed by police divers in November 2011. The dive team inspected the wreckage and found no evidence of the pilot. They also obtained video and photographs of the wreckage and provided copies of those records to the ATSB. The investigation was still on-going at the time of writing (AO-2011-033).
- On 2 April 2011, a Robinson R44 helicopter (registered VH-HUL) was conducting charter flights for a food and wine festival from a helicopter landing site at the Lorn Reserve on the east bank of the Hunter River, near Maitland, New South Wales. The helicopter had been positioned near three overhead high-voltage transmission lines that spanned the river next to the Belmore Bridge. On the second flight of the day, the pilot commenced hover checks at the landing site due to a gradual change in wind direction. After completing the checks, the pilot flew the helicopter forward and turned towards the river. About 50 ft above the ground, the helicopter was caught in a gust, and drifted towards the powerlines. One of the main rotor blades severed a power line. After hearing a loud noise and feeling a slight shudder, the pilot landed back at the Reserve. One end of the severed (but still energised) power line fell onto a safety railing on the western side of the Hunter River. The ensuing electrical discharge resulted in a full thickness burn to the leg of a three year old child who was touching the railing (AO-2011-046).

Engine power loss and forced landing, Cessna U206G Stationair (VH-LAN), near William Creek, Lake Eyre, South Australia (AO-2011-104)

The remaining accidents involved:

- An aircraft that collided with sand dunes in the approach path after being 50 ft below the approach height. On the approach, the pilot was distracted by maintaining separation with maritime channel markers, and inadvertently descended lower than expected. The aircraft landed safely with significant structural damage to the left wing (AO-2011-052).
- A heavy landing of a Cessna U206G Turbo Stationair aircraft, resulting in serious aircraft damage (no injuries to any occupants).
- An Aérospatiale EC225 Super Puma helicopter that collided with a light pole while taxiing, and the rolled onto its side. The crew, passengers, and a person on the ground sustained minor injuries. The helicopter and a nearby aircraft were extensively damaged (AO-2011-083).
- An autorotation of a Robinson R44 helicopter into terrain following severe vibration (AO-2011-088).
- Two accidents involved aircraft that were damaged when they landed short of the runway. None of the occupants were seriously injured in either of these incidents, however, the aircraft sustained serious damage (AO-2011-052, AO-2011-101).
- A forced landing of a Cessna U206 Stationair aircraft following an engine failure during a scenic flight over Lake Eyre. Neither the pilot nor any of the five passengers were injured (AO-2011-104).
- A Robinson R44 helicopter that had an engine fire and loss of oil pressure in flight, and made a precautionary landing. The occupants were not injured, but the fire caused serious damage to the helicopter (AO-2011-113).

- An aircraft that landed wheels up because the pilot had forgotten to extend the landing gear. In another occurrence involving a different aircraft, the nose landing gear did not extend fully on approach. During the landing, the nose gear collapsed due to a failed nose gear lock bar.
- A Cessna 210 aircraft that overran the end of the runway during the landing roll, and sustained serious damage to the propeller and nose gear. No-one was injured (AO-2011-153).

4.1.4 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 were, however, over 500 incidents reported to the ATSB in 2011 involving foreign-registered air transport aircraft (Table 8). These included a serious incident where a Thai Airways Boeing 777-300 aircraft (registered HS-TKD) descended to 1,000 ft while on an instrument approach into Melbourne Airport on 24 July 2011. This was almost 1,000 ft below the minimum altitude for this approach segment. The controller instructed the crew to go around and conduct a missed approach, after which the aircraft landed uneventfully (AO-2011-086).

Table 8: Occurrences involving foreign registered air transport aircraft in Australia, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	261	251	389	504	403	366	379	382	563	518
Serious incidents	2	0	1	7	1	5	3	1	1	1
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	2	1	0	0	1	0	0	1	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

From 2002 to 2010, 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 (registered A6-ERG). The Airbus commenced the take-off roll on runway 16 at Melbourne on a flight to Dubai, 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 tonnes below the actual take-off weight of the aircraft (AO-2009-012).

The other accidents involving foreign-registered high capacity aircraft were as follows:

- On 1 March 2002, a British Airways Boeing 747-400 aircraft (registered G-BLND) departed from Sydney on a flight to Bangkok. In the cruise, there was a sudden onset of airframe vibration, followed by alerts to the flight crew relating to operation of the No. 3 engine. The engine was shut down and the crew jettisoned fuel, then returned to Sydney and landed uneventfully. Technical investigation showed that a fan blade on the No. 3 engine had cracked due to fatigue originating from a manufacturing bond-line defect. Blade fragments which had escaped forward of the engine nacelle damaged the wing, control surfaces, fuselage and the No. 4 engine. The fan blade had accrued only 9,444 cycles of its 15,000-cycle design life before failing (200200646).
- On 8 December 2002, an Air New Zealand Boeing 767-200ER aircraft (registered ZK-NBC) sustained an uncontained engine failure from a fatigue crack in the first stage high pressure turbine disk of the No. 1 engine. The aircraft returned to Brisbane and landed safely. Parts ejected from the engine damaged wing leading edge flaps, disabling them during landing. Technical investigation found that the damaged turbine disk had sustained microstructural damage either during manufacturing, or during repair through a 'shot peening' process. The ATSB investigation also found that following the declaration of an emergency, there were emergency procedure-related misunderstandings between flight crew and cabin crew (200205780).
- On 22 August 2003, a Vincent Aviation Reims-Cessna F406 aircraft (registered ZK-VAF) was operating a passenger charter flight from Darwin to Tindal, Northern Territory. At approximately 85 to 90 kts during the take-off roll, the nose landing gear collapsed. The aircraft slid to a stop, the pilot shut down the engines, and all occupants evacuated the aircraft uninjured. The actuator rod-end was found to have an incorrect locking washer fitted, and was not that specified by the nose landing gear actuator manufacturer. The nose landing gear actuator microswitch was also found to be incorrectly adjusted (200303713).
- On 2 February 2006, a United States-registered United Airlines Boeing 747-400 aircraft was taxiing for departure at Melbourne for a flight to the United States via Sydney. At the same time, a Qantas Boeing 767 aircraft was stationary on taxiway Echo and waiting in line to depart from runway 16. The tail section of the 767 was protruding into taxiway Alpha while the aircraft was awaiting a clearance to enter the runway. The left wing tip of the 747 collided with the right horizontal stabiliser of the 767 as the 747 crew attempted to manoeuvre their aircraft behind the 767, but misjudged the distance between the two aircraft (200600524).

Ground strike, Airbus A340-500 (A6-ERG), Melbourne (AO-2009-012)

4.2 General aviation

General aviation is considered to be all flying activities outside of scheduled (RPT) and non-scheduled (charter) passenger and freight operations.

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. In this report, data for general aviation departures, hours flown, and occurrences do not include aircraft that are not registered on the Australian civil register (i.e. do not have a VH- registration). Such aircraft include hang gliders, ultralight trikes, powered parachutes, gyrocopters, as well as aircraft registered with Recreational Aviation Australia (RA-Aus).

Conservative estimates place at least 90 per cent of the Australian VH-registered aircraft fleet into the category of general aviation aircraft. General aviation also accounts for the majority of aircraft movements across Australia, as shown in Figure 1. In comparison, large air transport aircraft (those having a maximum take-off weight of 35,000 kg or more) operated by major airlines make up less than 3 per cent of Australian-registered aircraft. General aviation aircraft also make up more than half of the total hours flown by Australian-registered aircraft (Figure 3).

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. The reasons for this difference in reporting between air transport and general aviation are not clear, but may relate to the fact that a lot more airspace-related occurrences are reported by air transport and other instrument flight rules (IFR) aircraft operators (as these aircraft are required to submit flight plans, and commonly operate in controlled airspace supervised by Airservices Australia). Operational issues involving air transport aircraft are more likely to be noted and reported (due to resulting delays, service difficulty report requirements to the Civil Aviation Safety Authority (CASA), and due to the increased complexity of aircraft systems to alert crew to these issues). The use of safety management systems and internal reporting systems may also contribute to an increased number of reports from air transport operators. In uncontrolled airspace where general aviation aircraft usually fly, detection of airspace and operational errors and occurrences rely on self-reporting or on visual sighting and identification by other aircraft.

In addition, the number of prescribed reportable matters detailed in the *Transport Safety Investigation Regulations* 2003 (TSI Regulations) is smaller for general aviation when compared with air transport. The TSI Regulations are currently undergoing a major review to align reporting requirements for all commercial operations – notwithstanding if they are commercial air transport, or commercial general aviation.

In 2011, the ATSB received 3,384 occurrence reports relating to over 1,900 different general aviation aircraft. This represents about 13 per cent of all aircraft on the CASA VH- register. Only one occurrence report per aircraft registration was received in most circumstances, but over 550 aircraft were involved in multiple occurrences in 2011 (one aircraft was involved in 10 different occurrences). Aircraft conducting aerial work tended to report more occurrences, or were individually associated with more occurrence reports. This seems to suggest that either certain general aviation operations involve a greater level of risk, or that the

reporting culture within these operation types is stronger than in other areas of general aviation.

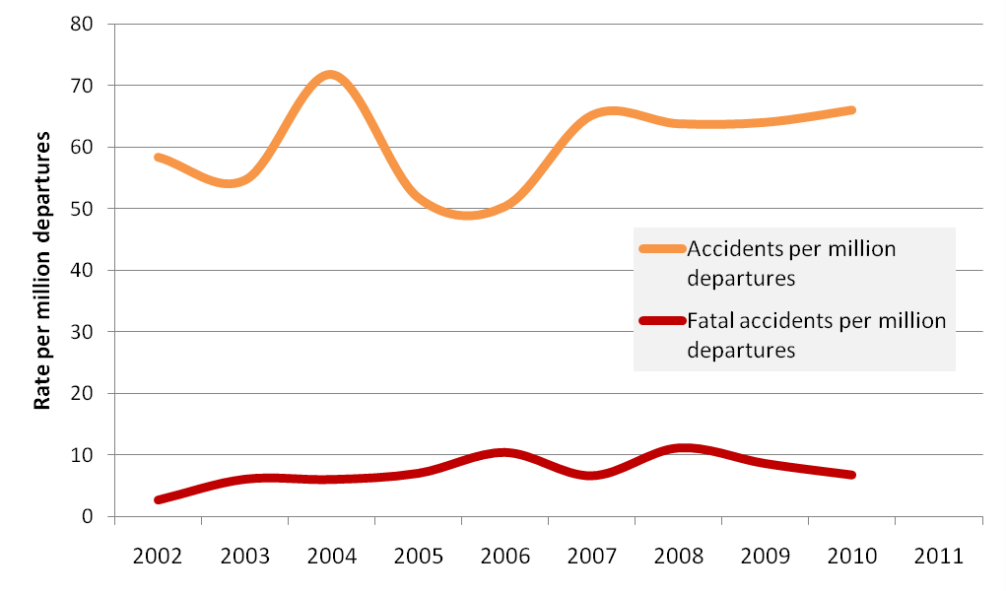
In 2009, the number of occurrences reported to the ATSB involving general aviation aircraft rose to about the same level as for air transport aircraft (Table 4 and Table 9). Since that time, the number of occurrences reported involving general aviation aircraft has decreased markedly (while those reported from air transport have continued to rise) - in 2011, there were almost 1,700 more occurrences reported in air transport than in general aviation. Moreover, there were over 100 less general aviation occurrences reported to the ATSB in 2010 compared with 2009, and more than 400 fewer occurrences reported in 2011 compared with 2010 (which is the least number of occurrences reported in 6 years). This is despite slight growth in general aviation flying activity in terms of the number of hours flown and the number of departures over the last few years. Unfortunately, there was an increase in the number of fatalities resulting from accidents in 2011, although2011 did see a reduction in the total number of general aviation accidents and serious incidents.

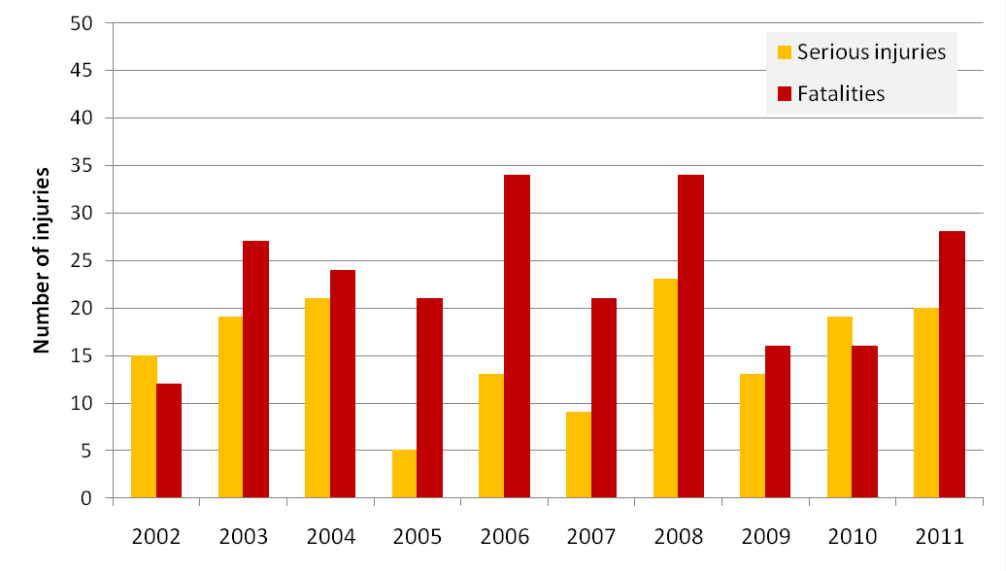
Table 9: All general aviation occurrences (VH- and foreign registered aircraft), 2002 to 2011

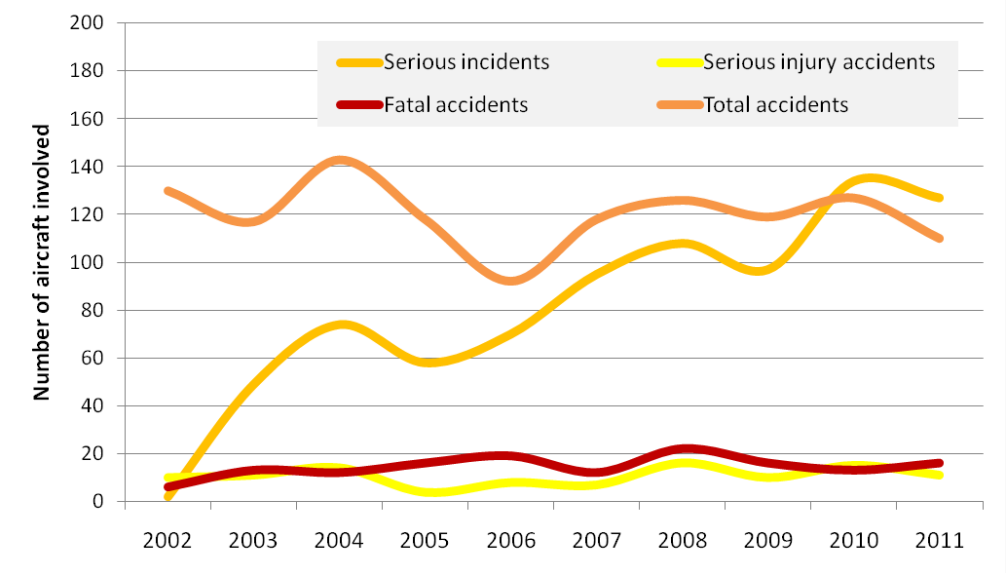
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	2,653	2,409	2,673	3,057	3,501	3,538	3,526	3,684	3,559	3,147
Serious incidents	2	49	74	58	70	95	108	97	134	127
Serious injury accidents	10	11	14	4	8	7	16	10	15	11
Fatal accidents	6	13	12	16	19	12	22	16	13	16
Total accidents	130	117	143	118	92	118	126	119	127	110
Number of people involved										
Serious injuries	15	19	21	5	13	9	23	13	19	20
Fatalities	12	27	24	21	34	21	34	16	16	28
Rate of aircraft involved[9]										
Accidents per million departures	58.5	54.7	71.9	51.9	50.5	65.8	63.9	64.1	66.1	
Fatal accidents per million departures	2.7	6.1	6.0	7.0	10.4	7.2	11.2	8.6	6.8	
Accidents per million hours	104.9	96.3	123.2	95.3	75.8	92.6	94.3	89.1	94.9	
Fatal accidents per million hours	4.8	10.7	10.3	12.9	15.6	10.1	16.5	12.0	9.7	

[9] 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 nine accidents, including two fatal accidents, over the period between 2002 and 2011, where aircraft hours are not known and not included in the denominator figures.

Figure 10: General aviation accident rates and injury occurrences (VH- and foreign registered aircraft), 2002 to 2011







For each fatal accident, 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 (in 2005 for example, there were two fatal accidents in commercial air transport resulting in 18 fatalities). For the 1,200 general aviation aircraft involved in accidents between 2002 and 2011, more than one in ten were fatal accidents, with 233 lives lost.

As is the case with air transport occurrences in the last 10 years, a jump in serious incidents occurred in general aviation following the introduction of the TSI Regulations in 2003 (Figure 10). This has stabilised at about 100 to 120 serious incidents per year since 2008.

The general aviation accident rate per million departures is lower than per million hours flown. In the most recent year where departures information is available (2010), the accident rate per million departures was almost four times as large in general aviation as in commercial air transport. The fatal accident rate was nine times[10] as large.

[10] This said, there are very few fatal accidents involving commercial air transport in Australia. Between the last three years (2009, 2010, and 2011), there were only three fatal accidents.

Loss of control, Aérospatiale AS350 B3 Squirrel helicopter (VH-XXW), Bankstown Airport, New South Wales (AO-2011-063)

The accident and fatality rate varies between the different types of general aviation when the whole 2002-2011 period is considered:

- Flying training has the lowest accident rate per million hours (43.5).
- The accident rate for aerial work is 1.7 times higher than flying training, and for private/business flying it is almost 3.5 times higher.
- Aerial agriculture has the highest accident rate per million hours (179.1).
- Emergency medical services and flying training also have a low rate of fatal accidents per million hours flown (1.6 and 3.1 respectively).
- The fatal accident rate for aerial work is almost three times higher than for flying training, and private and business flying has a fatal accident rate that is six times higher.
- Private and business flying has the highest fatal accident rate per million hours (18.2), followed closely by aerial agriculture (17.3).

Note that accident rates above are recorded per million hours flown, as the number of departures within each type of general aviation is not recorded.

Between 2002 and 2011, almost 19,000 aviation safety occurrences were reported to the ATSB in general aviation with no information provided on the type of flying operation. This ‘unknown’ general aviation number has been increasing over the last 10 years (from about 1,600 in 2001 to 2,200 in 2010), but has decreased in 2011 to 1,784. The increase over time has been, in part, related to the abolition of mandatory flight plans for all aircraft in the mid 1990s. A steady increase in unknown general aviation aircraft occurrences has been observed in most years since. In many general aviation occurrences where the operation type was not known, 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.

4.2.1 Aerial work

Aerial work is made up of a number of different activities, including aerial agriculture, mustering, surveying and photography, emergency medical services, search and rescue, check and training flights, and aerial fire control.

The number of reported incidents involving Australian (VH- registered) aircraft conducting aerial work has increased over the last 10 years, from 220 incidents in 2002 to 309 in 2011.

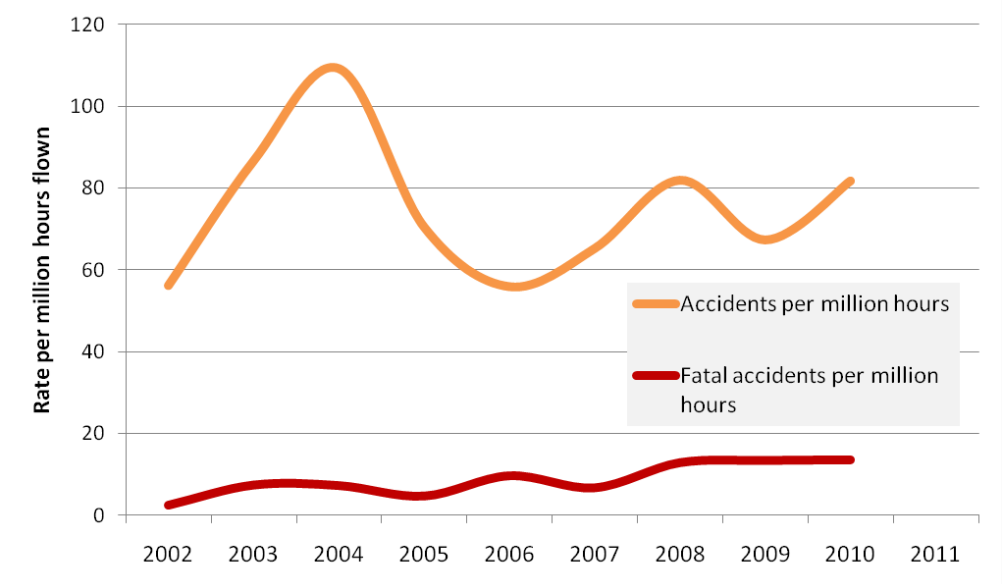
Total accident numbers varied significantly between 2002 and 2011 (Table 10), ranging between 23 and 45 accidents per year. This was also reflected in the total accident rate. Looking at the whole 10-year period, the accident rate for aerial work was about 75 accidents per million hours flown.

There were 11 serious injury and fatal accidents in 2011, resulting in nine fatalities and eight serious injuries. Fatal accidents involved single pilot operations in aerial agriculture and mustering (two fatal and four serious accidents), one search and rescue accident in which a helicopter crew member was killed while attempting to retrieve a person by winch, and two survey and photographic aircraft accidents that resulted in four fatalities and one serious injury. In addition, there was a fatal helicopter accident that killed a pilot and passenger while conducting a communications tower maintenance task in Queensland, and an accident near Mossman, Queensland, where two people were seriously injured when a helicopter conducting a weed spotting operation struck a powerline above a dense forest canopy and lost control.

Table 10: Aerial work (VH- registered aircraft) occurrences, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	220	203	202	271	279	253	274	294	282	309
Serious incidents	1	15	15	15	9	14	18	16	31	22
Serious injury accidents	0	4	6	2	2	2	7	3	5	5
Fatal accidents	1	3	3	2	4	3	6	6	7	6
Total accidents	23	35	45	30	23	29	38	30	42	37
Number of people involved										
Serious injuries	1	9	9	2	2	2	9	5	6	8
Fatalities	1	7	4	2	9	3	7	6	8	9
Rate of aircraft involved										
Accidents per million hours	56.1	86.6	109.2	70.4	55.8	67.4	81.9	67.3	81.7	
Fatal accidents per million hours	2.4	7.4	7.3	4.7	9.7	9.0	12.9	13.5	13.6	

Figure 11: Accident rate for aircraft (VH- registered) involved in aerial work (per million hours flown), 2002 to 2011



The range in accident rates seen in Figure 11 may in part reflect the changes in flying activity as the climate has changed over the last 10 years in Australia. For example, the growing cycles of crops have been affected over this period by long periods of drought. When analysing aerial work occurrence data, it also important to take into consideration that some of the aircraft conducting these activities operate by their nature within the low-level environment (e.g. crop spraying, aerial mustering), which is inherently more hazardous than flying at higher altitudes.

Wirestrike, Air Tractor AT-802 (VH-NIW), 5 km N of Mogumber, Western Australia (AO-2011-107)

In the years prior to 2011, there have been a number of accidents involving aircraft conducting aerial work that resulted in multiple fatalities. These included:

- On 11 August 2003, a Cessna 404 Titan aircraft (registered VH-ANV) impacted terrain within perimeter of Jandakot Airport during an attempt to return for an emergency landing shortly after takeoff. The aircraft was destroyed by a post-impact fire, and one of the five passengers was fatally injured. The pilot and the remaining four passengers all received serious, life-threatening burns, and one of those passengers died 85 days after the accident (200303579).

- On 2 February 2006, a Bell 206B-3 JetRanger helicopter (registered VH-MFI) arrived at Parkes from Dubbo, New South Wales, in preparation for an aerial noxious weeds survey. A few minutes after takeoff, the helicopter struck a powerline that crossed the Parkes to Orange road. The helicopter was destroyed by impact forces and a post-impact, fuel-fed fire. The three occupants of the helicopter were fatally injured. As a result of this accident, CASA introduced rules with the effect that anyone carrying out low-level operations would have to satisfy relevant low-level flying standards. In addition, the ATSB commenced discussions with the Energy Networks Association and Geoscience Australia to examine the feasibility of the establishment of a national database of information on the location of known powerlines and tall structures for access by pilots, operators, and managers of aerial campaigns (200600523).
- On 21 February 2006, a Robinson R44 helicopter (registered VH-HBS) was being operated on a series of aerial survey flights approximately 100 km to the north of Mt Isa, Queensland when it collided with terrain. The pilot and three passengers on board were fatally injured. The investigation considered that the helicopter probably descended contrary to the pilot's intentions, possibly influenced by a partial engine power loss or downdraft, and 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 (200600979).

Accidents, incidents, and flying activity in the different types of aerial work are explored in the following sections.

Aerial agriculture

There were 287 aircraft involved in agricultural occurrences between 2002 and 2011. This included 14 single-pilot fatal accidents, and 15 accidents resulting in serious injuries (Table 11). It is important to note that the number of accidents and fatal accidents are relatively small, and this introduces significant variability into the accident and fatality rates.

In 2011, there were 19 accidents during aerial agriculture operations. Most were wirestrikes that occurred when conducting spraying operations (five accidents – including ATSB investigation AO-2011-107), or runway excursions where the aircraft collided with another object, such as a fence, scrub, or a dirt mound (three accidents – including ATSB investigation AO-2011-164). At least one of these accidents was due to a wind gust on landing.

Other accidents were due to:

- collision with trees, crop, and mounds during application runs leading to aircraft damage or loss of control (three accidents, including ATSB investigation AO-2011-048);
- degraded aircraft performance at low altitude leading to a loss of control (two accidents – including ATSB investigation AO-2011-164);
- a control stick which jammed when entering a paddock for a spray run, leading to a loss of control (one accident);

- a loss of control due to the pilot being distracted by a chemical tank flow meter inside the cockpit (one accident);
- a forced landing in a paddock following an engine failure (one accident);
- a ground loop during landing (one accident);
- a birdstrike on takeoff (one accident); and
- an accident where a helicopter on approach to land suffered a sudden power loss and landed heavily (one accident – AO-2011-152).

There was also a fatal accident in 2011 where wreckage was found in a ploughed field after a PZL M-18 Dromader aircraft failed to return from a spray run. The pilot was fatally injured. At the time of writing, this accident was still under investigation by the ATSB (AO-2011-082).

When data is pooled for the last 10 years, aerial agriculture operations have the highest accident rate (179 per million hours flown) and the second highest fatal accident rate (17 per million hours flown) of any type of general aviation flying.

Collision with terrain, Eagle Aircraft Company DW-1 (VH-FTB), 28 km S of Ingham, Queensland (AO-2011-048)

Table 11: Occurrences involving general aviation aircraft conducting aerial agriculture, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	13	11	6	7	2	4	5	6	3	8
Serious incidents	0	8	9	9	3	5	7	5	17	13
Serious injury accidents	0	1	4	1	1	1	4	0	0	3
Fatal accidents	0	0	1	1	1	0	3	3	4	1
Total accidents	10	15	22	18	8	10	18	10	16	19
Number of people involved										
Serious injuries	0	1	4	1	1	1	4	0	0	3
Fatalities	0	0	1	1	1	0	3	3	4	1
Rate of aircraft involved										
Accidents per million hours	141.3	215.1	254.4	189.5	129.6	161.0	230.2	136.5	154.2	
Fatal accidents per million hours	0.0	0.0	11.6	10.5	16.2	0.0	38.4	40.9	38.5	

While there was only one fatal accident involving aerial agriculture in 2011, the following examples illustrate the nature of some accidents since 2002 when conducting low-level operations has led to death or serious injury.

- On 19 July 2004, a Bell 47G helicopter (registered VH-RTK) was contracted to spray herbicide on a property near Wodonga, Victoria. Preparations included an aerial survey of the property, and discussion with the land owner of known hazards such as powerlines. The pilot conducted a low-level return to the replenishment point, but did so outside the pre-planned safe transit route. During the return, the aircraft severed a disused powerline about 34 m above the ground. The helicopter descended into a wooded area and was destroyed, and the pilot was fatally injured. The helicopter was not fitted with a wire-strike protection system, nor could it have been (200402669).
- On 26 February 2008, two Air Tractor 502 aircraft, registered VH-ATB and VH-CJK, collided in mid-air near Wee Waa, New South Wales. VH-ATB took off from a different strip to where VH-CJK had departed from, which was about 3 km from where VH-CJK was performing reciprocal spray runs utilising turn manoeuvres. VH-ATB entered a flight path just south of the field being sprayed by VH-CJK, and the aircraft collided. The aircraft came to rest about 300 m apart. The pilot of VH-CJK was fatally injured, and the pilot of VH-ATB sustained serious injuries (AO-2008-014).

Aerial mustering

As with agricultural work, the number of aerial mustering incidents and accidents is small when year-on-year comparisons are made, and the number of occurrences varies significantly between years. After a significant rise in 2010, the number of aircraft that had accidents while performing mustering operations reduced to the long-term average (6 accidents occurred in 2011) (Table 12).

Almost all occurrences reported to the ATSB involving mustering operations were accidents, suggesting that incidents are not generally being reported to the ATSB.

Of the six aerial mustering accidents in 2011, one was fatal, and one resulted in a serious injury. One of these accidents, involving a Robinson R22 helicopter accident near Julia Creek, Queensland, is currently under investigation by the ATSB. Examination of the accident site found fragments of a broken drive belt 60 m from the main wreckage, which is consistent with a radio transmission by the pilot prior to the accident that a problem had occurred and he was unable to continue flying (AO-2011-060). The remaining accident was a helicopter that hooked a powerline with its skid as the pilot descended to move cattle away from a fence line, resulting in a loss of control and collision with the ground. The aircraft operator had previously looked into a wire alerting system utilising the onboard global position system (GPS) equipment. Following the accident, they are continuing to examine ways in which this technology could be incorporated into their operation.

Collision with terrain, Robinson R22 Beta II helicopter (VH-DSD), 85 km NW of Julia Creek, Queensland (AO-2011-060)

All of the remaining mustering accidents occurred at low level, low speed, and at unusual aircraft angles. These operating conditions are normal for aerial mustering work. As almost all mustering aircraft are helicopters, a common feature of these accidents was collision of the main or tail rotor with terrain, wires, or with trees. These types of collisions generally led to a loss of control of the aircraft. Any pilot distraction, aircraft or systems failure, adverse weather, aircraft performance loss, or handling inattention can reduce the margins for continued safe flight.

Table 12: Occurrences involving general aviation aircraft conducting aerial mustering, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	2	0	0	1	4	1	0	3	0	2
Serious incidents	0	0	0	1	1	0	1	0	2	0
Serious injury accidents	0	1	1	0	0	1	1	0	4	1
Fatal accidents	1	1	0	0	0	1	0	2	1	1
Total accidents	6	8	7	5	4	8	3	5	14	6
Number of people involved										
Serious injuries	1	1	1	0	0	1	1	0	4	1
Fatalities	1	2	0	0	0	1	0	2	1	1
Rate of aircraft involved										
Accidents per million hours	54.2	80.2	67.8	44.2	39.0	70.9	26.6	47.4	118.6	
Fatal accidents per million hours	9.0	10.0	0.0	0.0	0.0	8.9	0.0	18.9	8.5	

Some examples of fatal mustering accidents over the last 10 years are provided below:

- On 25 April 2002, a pilot and passenger of a Robinson R22 helicopter (registered VH-UXU) were conducting an aerial inspection and cattle mustering flight at a station south-west of Mount Isa, Queensland. During the flight, some cattle were observed outside the fenced area and the pilot descended to direct the cattle back towards the fence. The passenger asked the pilot to climb higher, at which point the helicopter struck a single-wire powerline. The helicopter pitched nose down and the main rotor severed the tail boom, and then collided with the ground. The pilot was fatally injured, and the passenger, although seriously injured, walked 200 m to a track and waited almost 2 hours until found by a passing motorist. The pilot had not asked the passenger about any powerline hazards prior to the flight. There was no evidence that the pilot had previously flown that area or previously made an inspection of the area to determine the presence of hazards (200201723).
- On 24 July 2007, a Robinson R22 helicopter (registered VH-VHQ) departed from a helipad at Maryfield Station, Northern Territory, to commence cattle mustering activities. The pilot reported that as the helicopter climbed to about the height of surrounding trees, it was struck by a gust of wind that resulted in a loss of height. During the recovery manoeuvre by the pilot, a person on the ground was struck in the head and was fatally injured (AO-2007-026).
- On 5 May 2009, two Robinson Helicopter Company R22 helicopters, registered VH-PHT and VH-HCB, collided in mid-air near Springvale Station, Western Australia. 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 investigation found that the converging flight paths of the helicopters, pilot fatigue and sun glare from the rising sun all contributed to the collision (AO-2009-018).

Emergency medical services

Emergency medical services (EMS) showed a general increase in the number of incidents over the reporting period; however, this is consistent with the growth of this aviation sector in the last 10 years (the number of EMS hours flown increased by 34 per cent between 2002 and 2010) (Table 13). 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.

There have been no fatal accidents involving EMS aircraft since 2003, and no accidents at all reported to the ATSB since 2009. The high number of incidents 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, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	93	101	98	133	139	132	160	156	150	170
Serious incidents	1	2	1	1	0	2	5	3	3	0
Serious injury accidents	0	0	0	0	0	0	0	2	0	0
Fatal accidents	0	1	0	0	0	0	0	0	0	0
Total accidents	1	2	0	0	0	1	0	3	0	0
Number of people involved										
Serious injuries	0	0	0	0	0	0	0	3	0	0
Fatalities	0	3	0	0	0	0	0	0	0	0
Rate of aircraft involved										
Accidents per million hrs	14.9	29.2	0.0	0.0	0.0	13.4	0.0	36.9	0.0	
Fatal accidents per million hours	0.0	14.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Of the few accidents that have occurred in EMS operations in the past decade, the most serious are discussed below.

- On 17 October 2003, a Bell 407 helicopter (registered VH-HTD) was tasked with retrieving a patient from Hamilton Island, Queensland. It took off from

Mackay, but did not arrive. The wreckage was found out to sea, off Cape Hillsborough, Queensland. The investigation was unable to specifically determine what caused the accident, but considered that it was consistent with spatial disorientation of the pilot (200304282).

- On 9 November 2009, a Bell 412 helicopter (registered VH-EMZ) departed Horn Island, Queensland, to rendezvous with a container ship located about 132 km to the west of the island. The purpose of the flight was to evacuate an ill crew member via rescue winch from the ship's forecastle deck, and transfer them to hospital. Approaching overhead the winching area, with the rescue crew officer and paramedic being lowered by the winch and about 6 m above the deck, the pilot lost sight of the ship. Shortly after, the helicopter began drifting back towards a mast that was located on the ship's forecastle. Despite assistance from the winch operator to re-establish the hover, the pilot was unable to arrest the helicopter's movement and the winch cable caught on the mast while the helicopter continued to drift rearwards. The winch cable separated and the paramedic and rescue officer fell about 10 m to the ship's deck, seriously injuring both personnel. The investigation found that there was no guidance to assist pilots to confirm that an adequate hover reference existed overhead an intended winch area, before deploying personnel on the winch (AO-2009-068).
- On 18 November 2009, an Israel Aircraft Industries Westwind 1124A aircraft (registered VH-NGA) was conducting an aeromedical flight from Apia, Samoa to Melbourne, via Norfolk Island for refuelling. On arrival to Norfolk Island at night time, the crew was faced with poor and deteriorating weather conditions, including low cloud and rain. The flight crew conducted no less than four instrument approaches to the island's airport, but were unable to land because they could not see the runway. The crew then elected to ditch before the aircraft's fuel supply was exhausted. The Westwind successfully ditched in the Pacific Ocean, 6 km to the west of Norfolk Island. The six occupants evacuated the sinking aircraft, but were unable to retrieve a life raft before the aircraft sank, and were later recovered by a rescue vessel sent from Norfolk Island. Following the accident, the aircraft operator initiated a program of checking and revalidation for the company's commercial Westwind pilots. At the time of writing, this accident is still under investigation by the ATSB (AO-2009-072).

Approaching the winching area prior to winch cable failure, Bell 412 helicopter (VH-EMZ), 132 km W of Horn Island, Queensland (AO-2009-068)

Search and rescue

The ATSB is notified of very few accidents and incidents involving aircraft conducting search and rescue operations. This is probably due to the very small amount of search and rescue flying activity (relative to other types of general aviation). In 2010, search and rescue flying contributed just 5,777 hours to the total number of hours flown in general aviation (1,338,462 hours) – this was about 0.01 per cent of all aerial work.

There has been only one accident in the last 10 years involving a search and rescue aircraft. On 24 December 2011, a helicopter crewman was fatally injured while attempting to retrieve an injured bushwalker by winch from Bridal Veil Falls on the south coast of New South Wales. At the time of writing, this accident is under active investigation by the ATSB.

In addition, there have been three serious incidents involving this operation type in the last ten years, none of which resulted in serious injuries:

- After encountering low cloud with rising terrain near Merriwa, New South Wales, a Bell 412 helicopter struck a tree. The pilot initiated a climb to clear the cloud then landed the helicopter in a nearby field.
- During cruise between Ulladulla and Wollongong, New South Wales, an Agusta AW139 helicopter came in close proximity to a converging aircraft. The helicopter pilot took evasive action.
- On descent to Badu Island, Queensland, the crew of a Coastwatch Reims F406 aircraft saw a Bell 412 helicopter (also conducting search and rescue operations) pass in close proximity from left to right beneath them. There had been no communication between the two aircraft prior to the incident.

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, despite potential hazards associated with reduced visibility, spatial disorientation, low-level manoeuvring, and high operating weight.

In 2011, there were no fire control-related occurrences reported to the ATSB, and there have not been any fire control related accidents since 2009 (Table 14). Activity data (in terms of hours flown) is not available for this type of operation.

Table 14: Occurrences involving general aviation aircraft conducting fire control operations, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	8	4	3	2	11	4	2	8	3	0
Serious incidents	0	0	1	2	1	1	1	3	0	0
Serious injury accidents	0	1	0	0	0	0	0	1	0	0
Fatal accidents	0	0	0	0	1	0	0	1	0	0
Total accidents	1	3	1	0	3	1	0	4	0	0
Number of people involved										

Serious injuries	0	1	0	0	0	0	0	2	0	0
Fatalities	0	0	0	0	1	0	0	1	0	0

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 aircraft (registered VH-FVF) was performing firebombing operations near Cootamundra, New South Wales. In manoeuvring, the aircraft made a left turn at an estimated height of 300 ft and banked left at nearly 90 degrees, inducing a stall with wing drop. There was insufficient height for the pilot to attempt recovery action, and the aircraft collided with terrain. The investigation team 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 (200600851).
- On 9 December 2009, the pilot of a Bell 206L-1 LongRanger (registered VH-MJO) was conducting a visual flight rules (VFR) fire operations flight on behalf of the New South Wales Rural Fire Service and National Parks and Wildlife Service from Dorrigo, New South Wales, with one passenger on board. Shortly after takeoff, 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, but lost control of the helicopter, which impacted the ground with significant vertical force. The passenger was fatally injured and the pilot was seriously injured. The helicopter was seriously damaged (AO-2009-077).

Survey and photography

Very few occurrences are reported to the ATSB involving aircraft conducting survey and photography aerial work. Table 15 shows that the number of incidents reported has generally increased since 2003, reflecting a willingness to report occurrences other than accidents in this sector.

In 2011, there were three serious incidents and four accidents involving survey and photography aircraft, two of which were fatal.

- On 18 August 2011, an Aérospatiale AS355 Twin Squirrel helicopter (registered VH-NTV) was operating in an area east of Lake Eyre, South Australia. The helicopter was being used to film footage for an Australian Broadcasting Corporation (ABC) 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, South Australia, 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 (AO-2011-102).

- On 3 September 2011, a Robinson R44 II helicopter collided with terrain 180 km south west of Newman, Western Australia. The pilot and passenger both received fatal injuries in the accident. While this occurrence was still under investigation by the ATSB at the time of writing, initial review of the wreckage did not identify any mechanical abnormality that would have prevented the helicopter from operating normally (AO-2011-109).

Collision with terrain, Aérospatiale AS355 F2 Twin Squirrel helicopter (VH-NTV), 145 km N of Marree, South Australia (AO-2011-102)

The remaining accidents and serious incidents in 2011 involved:

- a near-collision between an aircraft conducting a low-level survey flight and another aircraft that the pilot did not see (AO-2011-121),
- another near-collision near Katoomba, New South Wales, between a descending survey aircraft and another aircraft on a reciprocal track which was not in radio communication,
- two wirestrike accidents involving aircraft conducting low-level surveys in regional New South Wales at 130 ft above ground level (AO-2011-006, AO-2011-030), and
- a case of a partial power loss (suspected water in fuel) that led to a forced landing on a golf course.

Over the last 10 years, there have been nine fatal accidents resulting in 17 fatalities. Significant variability is seen in the accident and fatal accident rate per million hours.

Table 15: Occurrences involving general aviation aircraft conducting survey and photography operations, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	8	4	8	14	17	18	24	38	38	35
Serious incidents	0	0	0	0	1	1	1	2	3	3
Serious injury accidents	0	0	0	1	1	0	1	0	1	0
Fatal accidents	0	1	0	0	2	2	2	0	0	2
Total accidents	0	2	0	2	3	3	7	3	5	4
Number of people involved										
Serious injuries	0	4	0	1	1	0	3	0	2	1
Fatalities	0	2	0	0	7	2	2	0	0	4
Rate of aircraft involved										
Accidents per million hours	0.0	37.9	0.0	61.2	67.0	55.3	108.6	78.2	85.5	
Fatal accidents per million hours	0.0	19.0	0.0	0.0	44.7	36.9	31.0	0.0	0.0	

Some examples of survey and photography accidents prior to 2011 include the following:

- On 2 February 2006, a Bell 206B III JetRanger helicopter (registered VH-MFI) struck powerlines while on a noxious weeds survey near Parkes, New South Wales. The helicopter continued a further 88 m before striking the ground. The pilot and two passengers received fatal injuries (200600523).
- On 19 November 2008, a pilot and two linesmen were operating a McDonnell Douglas 369D helicopter (registered VH-PLJ) to test a high-voltage power line between Mannum and Mobilong, South Australia. While manoeuvring to test a conductor joint, the helicopter's main rotors struck a conductor and the helicopter impacted the ground. One linesman was fatally injured and the other sustained minor injuries, and the pilot sustained serious injuries (AO-2008-078).
- On 15 May 2008, a Cessna 210 aircraft (registered VH-IDM) lost altitude during a left turn while on a low-level geophysical flight north-east of Georgetown, Queensland. The aircraft impacted the ground in a steep left-wing-down attitude, consistent with a loss of control. The investigation found that the loss of control was most likely due to pilot loss of consciousness as a result of a heart arrhythmia associated with focal scaring or chronic heart muscle inflammation (AO-2008-035).

4.2.2 Flying training

Between 2002 and 2011, there were 3,235 flying training aircraft involved in incidents and accidents that were reported to the ATSB. The number of reported incidents per year has declined consistently since 2005, reaching a 10-year low in 2011 of 232 incidents. The number of accidents (13) was also at its lowest in 10 years (Table 16).

Over this period, flying training activity has grown until 2009 at slightly under 500,000 hours flown per year before declining markedly in 2010. The declining trend of reported incidents and accidents per million hours flown (Figure 12) may reflect a positive safety outcome in this sector of general aviation.

Of the 13 accidents involving flying training in 2011, one was fatal. There were also 22 serious incidents:

- On 4 February 2011, a Robinson R44 helicopter (registered VH-HFH) was conducting circuit training at Cessnock Aerodrome, New South Wales. Following a simulated failure of the helicopter's hydraulic-boost system, the instructor assessed that the hydraulic system had actually failed. He decided to reposition the helicopter on the aerodrome to facilitate further examination. Upon becoming airborne, control of the helicopter was lost, it collided with the runway and, shortly after, there was a fire. The pilot, who received serious injuries, managed to exit the helicopter; however, the instructor and passenger were fatally injured. Examination of the wreckage found that a bolt securing part of the flight control system had detached. At the time of writing, this accident was still under investigation by the ATSB (AO-2011-016).

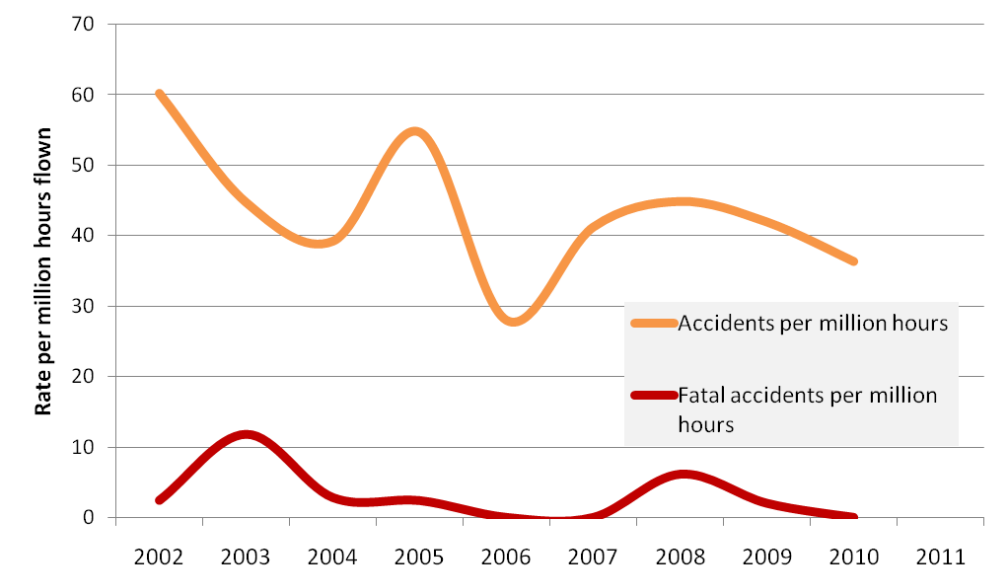
Many of the remaining accidents and serious incidents for 2011 showed common themes:

- a near collision between two aircraft on parallel tracks at the same altitude (five occurrences)
- a near collision between an aircraft in the circuit and another aircraft (conducting a missed approach, following in the circuit, entering the circuit, or enroute crossing the aerodrome) (five occurrences – including ATSB investigation AO-2011-119)
- a conflict between two aircraft on final approach to land (four occurrences)
- heavy landing due to a low-level loss of control, often leading to a gear collapse (four occurrences)
- loss of control of a helicopter on short final approach or in hover, leading to a rollover or a heavy landing (three occurrences – including ATSB investigations AO-2011-141 and AO-2011-157).

Table 16: Flying training (VH- registered) aircraft occurrences, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	281	277	294	366	353	338	248	257	235	232
Serious incidents	0	13	11	12	22	18	18	24	30	22
Serious injury accidents	1	1	1	0	1	0	0	1	2	0
Fatal accidents	1	5	1	1	0	0	3	1	0	1
Total accidents	25	19	14	23	12	19	22	21	16	13
Number of people involved										
Serious injuries	1	2	2	0	1	0	0	1	3	1
Fatalities	1	7	2	1	0	0	4	1	0	2
Rate of aircraft involved										
Accidents per million hours	60.2	44.7	39.2	54.7	28.0	41.2	44.9	42.0	36.6	
Fatal accidents per million hours	2.4	11.8	2.8	2.4	0.0	0.0	6.1	2.0	0.0	

Figure 12: Accident rate for aircraft (VH- registered) involved in flying training (per million hours flown), 2002 to 2011



Some notable flying training fatal accidents since 2002 include:

- On 29 July 2002, two Cessna 172R aircraft (registered VH-CNW and VH-EUH) collided while on short final approach to the same runway at Moorabbin, Victoria. The two aeroplanes were entangled when they impacted the runway. The student pilot and instructor of VH-EUH were able to exit their aircraft before fire engulfed both aeroplanes. The solo pilot of VH-CNW sustained fatal injuries (200203449).
- On 20 June 2003, a Robinson R22 helicopter (registered VH-OHA) was being used to conduct flying training in the Bankstown training area with

an experienced flight instructor and student pilot on board. The helicopter was observed and heard by witnesses to be flying in a normal manner. Witnesses reported subsequently hearing a number of loud bangs, and one witness observed what appeared to be a main rotor blade separating from the helicopter. The helicopter descended to the ground in an inverted attitude and both occupants were fatally injured (200302820).

- On 11 November 2003, a qualified pilot and a flight instructor were undertaking multi-engine aircraft training in a Piper PA-34 Seneca aircraft (registered VH-CTT). The Seneca departed Bankstown and turned right to operate in the southern training circuit. They completed three circuits, and were on final approach for a fourth touch and go. Witnesses reported that when the aircraft was almost over the threshold, it started to diverge right, while maintaining a low height. They reported that when the aircraft was abeam the mid length of the runway, its nose lifted and the aircraft banked steeply to the right before impacting the ground in a near vertical nose-down attitude. The pilot was fatally injured. The instructor received severe burns, and was treated in hospital for three and a half weeks before succumbing to those injuries (200304589).
- On 18 December 2008, a Cessna 152 aircraft (registered VH-FMG) and a Liberty XL2 aircraft (registered VH-XLY) were being used for flight training from Bankstown Airport when they collided in midair over Casula, New South Wales, in the proximity of the 2RN reporting point, south-west of the airport. The Liberty remained flyable and landed at Bankstown approximately 6 minutes later, while the Cessna descended to the ground and was destroyed. Both occupants of the Cessna were fatally injured (AO-2008-081).

Collision with terrain - Robinson R44 helicopter, VH-HFH, Cessnock Aerodrome, New South Wales, 4 February 2011 (AO-2011-016)

4.2.3 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. 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 here. Sports and recreational aircraft that are registered under other schemes (such as by Recreational Aviation Australia) are not considered in this report. The reason for this is twofold: activity data (the number of hours flown) for these aircraft are recorded by the registering associations using various methods that can be inconsistent and unverifiable; and occurrences reported to the ATSB involving these aircraft are sporadic.

Incidents for private/business and sports aviation increased from 2005 to 2007, but have shown decline since then (the number has increased slightly in 2011 compared to 2010). The number of aircraft involved in serious incidents has risen as a result of the introduction of the TSI Regulations in 2003. Although there is some variability in total accident figures, 2011 recorded the least private/business/sport aviation accidents in the last decade. Fatal accidents have also declined since a peak in 2006 (15), to nine in 2011 (Table 17).

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.

Table 17: Private/business/sports aviation (VH-registered) aircraft occurrences, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	264	222	215	240	289	319	277	285	197	220
Serious incidents	1	3	22	13	14	24	17	22	20	33
Serious injury accidents	8	6	7	2	5	5	9	6	8	6
Fatal accidents	4	5	7	13	15	9	13	9	5	9
Total accidents	79	63	83	64	56	66	65	66	64	56
Number of people involved										
Serious injuries	12	8	10	3	10	7	14	7	10	11
Fatalities	10	13	16	18	25	18	23	9	7	17

Private/Business

There were 2,890 aircraft involved in occurrences in the last 10 years when being used for private or business flying (Table 18). Incidents reported to the ATSB increased between 2004 and 2007, but have decreased since then (despite showing a slight increase between 2010 and 2011).

As the amount of flying activity (in terms of hours flown) has been relatively constant in private and business aviation over the last decade at about 370,000 to

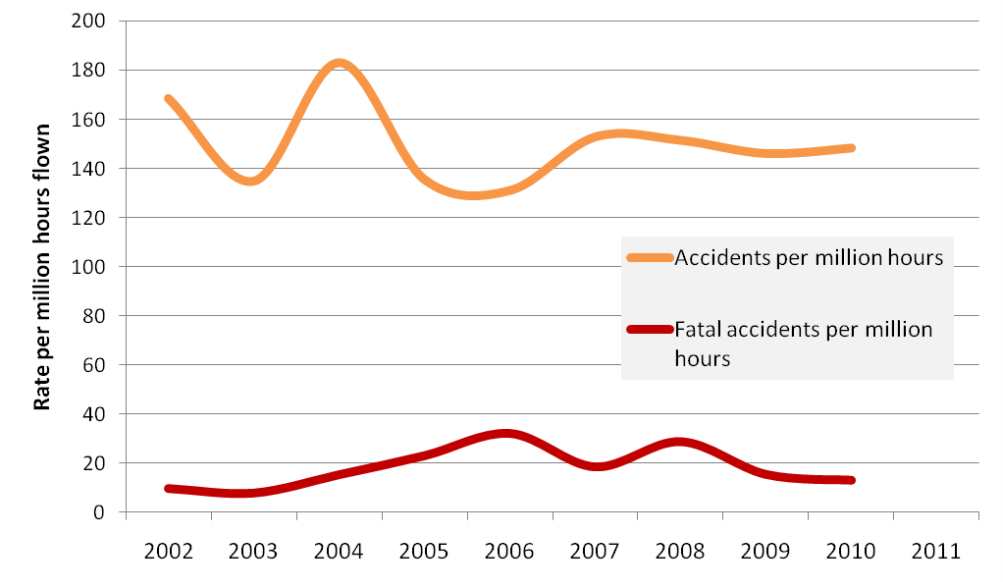
400,000, and the fairly stable rate of accidents per year, this suggests the possibility, in part, of a decline in the reporting of occurrences to the ATSB.

Serious incidents have increased over the last 10 years, but this is primarily linked to different reporting requirements since the introduction of the TSI Regulations in 2003. Seventy-one aircraft conducting private and business flying have been involved in fatal accidents over this period, resulting in 135 fatalities. Another 37 private/business aircraft accidents led to serious injuries.

Table 18: Occurrences involving general aviation aircraft conducting private and business operations, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	217	178	171	208	275	293	236	258	157	191
Serious incidents	1	2	19	12	13	19	14	17	14	26
Serious injury accidents	5	2	3	0	4	4	7	3	5	4
Fatal accidents	4	3	6	9	12	7	11	6	5	8
Total accidents	70	52	72	53	49	58	58	57	57	43
Number of people involved										
Serious injuries	8	2	6	1	9	6	12	3	6	9
Fatalities	10	11	15	14	21	15	20	6	7	16
Rate of aircraft involved										
Accidents per million hours	168.8	134.9	183.4	135.6	131.1	153.0	151.6	146.2	148.5	
Fatal accidents per million hours	9.6	7.8	15.3	23.0	32.1	18.5	28.8	15.4	13.0	

Figure 13: Accident rate for aircraft (VH- registered) involved in private and business flying (per million hours flown), 2002 to 2011



While the accident rate (per million hours flown) for this operation type has shown variability over the last 10 years, it has been fairly stable over the past 4 years, but with some decrease. The fatal accident rate has decreased in 2011 to levels similar to those in 2002 to 2004, after a spike in fatal accidents in 2006 and 2008 (Figure 13). However, 2011 recorded the lowest number of accidents (43) for the past decade, which averaged 57 accidents per year for private and business.

Private/business operations recorded the highest average accident rate of any Australian aviation operation type, at about 150 accidents per million hours. It was a similar story for the fatal accident rate, which was 18 per million hours flown. This is higher than other higher risk operation types, such as aerial agriculture and survey/photography flying.

In 2011, the 43 accidents in private and business operations included seven fatal accidents:

- On 10 January 2011, an amateur-built Pitts 12 aircraft (registered VH-DZN) collided with terrain during manoeuvres over a cane field near Ingham, Queensland. The pilot and passenger were both fatally injured.
- On 30 March 2011, a Piper PA-32 aircraft (registered VH-LKI) was returning to Moree from Brewarinna, New South Wales. The aircraft was reported to have flown overhead Moree Airport before the pilot conducted what was reported to be a left circuit for a landing. The aircraft was observed on a low approach path as it flew toward the runway during the final approach leg, before contacting trees and impacting a field about 550 m short of the runway threshold, narrowly avoiding a caravan park. Of the six people on board, four people sustained fatal injuries and the remaining two passengers were seriously injured. The investigation found that the pilot did not satisfy the recency requirements of his night visual flight rules rating and the aircraft's take-off weight was in excess of the maximum allowable for the aircraft. In addition, the aircraft's centre of gravity was probably outside that specified in the aircraft flight manual, with the potential to significantly diminish the aircraft's in flight performance and pitch stability. (AO-2011-043).
- On 24 April 2011, a Robinson R44 helicopter (registered VH-RUR) with a pilot and one passenger on board, collided with the sea off the northern headland of Lilli Pilli Bay, New South Wales. The helicopter was being flown after last light, and was on approach to a helicopter landing site when the accident occurred. The pilot was not approved, nor was the helicopter equipped, to fly at night. The occupants managed to escape from the sinking helicopter, and a witness to the accident assisted the pilot onto nearby rocks, but the passenger was fatally injured. The ATSB investigation did not identify any organisational or systemic issues that might adversely affect the future safety of aviation operations, however, the accident does provide a reminder of the importance of appropriate flight planning and informed in-flight decision making (AO-2011-051).
- On 22 July 2011, a Bell 206L LongRanger helicopter (registered VH-CIV) collided with steep terrain near South Turramurra in suburban Sydney while enroute from Wyee, New South Wales to Sydney Adventist Hospital. The pilot and passenger on board were both fatally injured. The weather conditions around the time of the accident were not ideal, with low cloud and rain showers in the area. Initial investigation of the wreckage distribution and key components by the ATSB has indicated that a section of the helicopter's tail

boom separated in flight, after multiple main rotor blade strikes. There was evidence that power was being delivered to the main rotor blades until the helicopter impacted the terrain. Examination of the flight control system did not reveal any preliminary indications of a failure or pre-existing condition that would have led to the separation of the tail boom section. At the time of writing, the ATSB investigation was continuing (AO-2011-085).

- On 27 July 2011, a sole-pilot operated Robinson R22 helicopter (registered VH-YOL) collided with terrain while conducting operations near Fitzroy Crossing, Western Australia. The pilot sustained fatal injuries. At the time of writing, this accident was still under active investigation by the ATSB (AO-2011-087).
- On 15 August 2011, a Piper PA-28-180 aircraft (registered VH-POJ) collided with terrain 40 km to the north of Horsham Airport, Victoria while on a flight from Essendon Airport to Nhill Aerodrome. The purpose of the flight was to return the passengers to Nhill, as one of them has been in Melbourne for non-emergency medical care. The flight has been organised as an Angel Flight by the charity Angel Flight Australia. The pilot and two occupants were fatally injured. At the time of writing, this accident was still under active investigation by the ATSB (AO-2011-100).
- On 30 November 2011, a Bede-4 amateur-built aircraft collided with terrain. The two occupants were fatally injured.
- On 7 December 2011, a sole-pilot operated Cessna 210 Centurion (registered VH-WBZ) collided with terrain about 25 km north of Injune, Queensland while on a private flight from Roma to Dysart, Queensland. The pilot was fatally injured. At the time of writing, this accident was still under active investigation by the ATSB (AO-2011-160).

Of the 35 aircraft involved in non-fatal accidents in private operations in 2011, about 60 per cent occurred on approach or landing, which are the highest risk phases of flight. This included two accidents where the aircraft collided with an object in the approach path. Fifteen per cent each happened in cruise and takeoff/initial climb.

- The most common types of accidents were power losses that led to forced landings in paddocks, mud flats, and into powerlines and trees (7 accidents)
- Two additional forced landings were due to fuel mismanagement or accidental leaning of mixture, leading to power loss.
- Four accidents were runway excursions where the pilot had lost aircraft performance during a takeoff or landing, and had tried to increase engine power for a go-around before losing directional control.
- Another four accidents were due to ground loops, gusting crosswinds, or willy-willies.

Engine failure, Piper PA-28-181 Archer (VH-NRF), 8 km NE of Bankstown Airport, New South Wales (AO-2011-018)

Some examples of private/business accidents in the last 10 years resulting in fatalities are discussed below.

- On 7 February 2004, a Piper PA-28R Arrow aircraft (registered VH-TRZ) was conducting a private sightseeing flight over Lake Eildon in Victoria. The Arrow was flying at low level above the lake without authorisation, and struck a high voltage power line about 133 ft above the water level of the lake. The impact dislodged the left wing of the aircraft, and the aircraft quickly collided with the water. The four aircraft occupants were fatally injured in the collision (200400437).
- On 28 July 2004, a Piper PA-31T Cheyenne aircraft (registered VH-TNP) was conducting a private, instrument flight rules flight from Bankstown, New South Wales to Benalla, Victoria. With a pilot and five passengers. During a non-precision GPS approach to Benalla Airport, the aircraft collided with terrain. All occupants were fatally injured and the aircraft was destroyed by impact forces and fire. The flight did not follow the usual route to Benalla, but diverted south along the coast before tracking to the northernmost initial approach waypoint for the intended runway. While tracking to the approach waypoint, the aircraft diverged left of track without the pilot being aware of the error. The ATSB investigation drew

pilots' attention to the need to pay careful attention to the use of automated flight and navigation systems, and also demonstrated the need for effective communication between controllers and pilots to clarify any apparent tracking anomalies (200402797).

- On 2 December 2005, a Piper PA-31-350 Chieftain aircraft (registered VH-PYN) departed Archerfield, Queensland, on a private flight to Griffith, New South Wales. On board were the pilot, an observer-pilot, and two passengers. The enroute weather was forecast to include occasional thunderstorms. A few minutes after takeoff, a SIGMET (significant meteorological information) alert was issued advising of frequent observed thunderstorms on VH-PYN's intended flightpath. Air traffic services did not (and was not required to) pass this information to the pilot of the aircraft, and there was no request from the pilot for weather information at any stage during the flight. When the aircraft passed the area of thunderstorm activity, the pilot reported diverting left of track due to weather. The aircraft then came within air traffic control radar coverage, which showed it flying parallel to track at 10,000 ft, at a groundspeed of 200 to 220 kts. The aircraft then disappeared from radar and no further radio transmission was received from the pilot. Ten minutes later, the wreckage of the Chieftain was found north of Condobolin, New South Wales. The wreckage trail extended for more than 4 km. The wing section outboard of the engine nacelles, the right engine, and sections of the empennage had separated from the aircraft in flight. The remaining structure impacted the ground inverted and was destroyed by a post-impact fire. No evidence was found that aerodynamic flutter, in-flight fire or explosion, or lightning strike damage contributed to the circumstances that led to the break-up. The ATSB investigation identified that immediately before the accident, the aircraft was likely to have been surrounded to the east, west, and south by a large complex of storms. The aircraft was not fitted with weather radar (200506266).
- On 17 November 2007, the owner-pilot of a Cessna 337G Skymaster aircraft (registered VH-CHU) was conducting a private flight with a number of passengers in accordance with visual flight rules from Moorabbin, Victoria to Merimbula, New South Wales. The aircraft wreckage and three of the deceased occupants were found on a beach between Venus Bay and Cape Liptrap, Victoria. The ATSB investigation found that the pilot was manoeuvring over water at low level, and in reduced visibility conditions. It is likely that the pilot became spatially disorientated, and inadvertently descended into the water (AO-2007-061).
- On 10 November 2007, a Cessna 172N Skyhawk (registered VH-WLQ) with two pilots and a passenger on board departed Katherine, Northern Territory, on a private visual flight rules flight to Tennant Creek. Part way through the flight, the aircraft descended to 500 ft above ground level, and struck a powerline which spanned the Stuart Highway north of Elliott, Northern Territory. The aircraft's tail section was broken rearwards from the aft fuselage, making the aircraft uncontrollable and causing it to impact the highway in a steep nose-down attitude. The three occupants were fatally injured, and the aircraft was destroyed. The ATSB investigation found no evidence of an aircraft or operational reason for flying so low, and that the flight at low level was probably as a result of a conscious decision by the pilots (AO-2007-058).

Total power loss and runway undershoot, Piper PA-46-310P Malibu (VH-FAL), Meekatharra Aerodrome, Western Australia (AO-2011-072)

Sports aviation

Sports aviation includes gliding, parachute operations, and aerobatics in VH-registered aircraft. Accident numbers in sports aviation are low and have generally reduced since 2005. This may be in part due to an increasing shift of this type of operation to aircraft that are not VH- registered, such as those registered by Recreational Aviation Australia.

There was, however, a spike in sports aviation accidents in 2011 (Table 19). This represented 13 accidents, including one fatal accident:

- On 14 July 2011 while ridge soaring 85 km from Albany, Western Australia, the Glasflugel Hornet glider encountered turbulence, resulting in a loss of control and collision with terrain. The pilot was fatally injured.

The remaining 12 accidents and seven serious incidents in 2011 involving sports aviation involved six balloons, nine gliders, and five aeroplanes. Most involved balloons contacting powerlines while flying at low level, or descending to land. There were also several cases of balloons striking trees due to changes in the wind direction. Several serious incidents involved a near-miss between a glider and another general aviation aircraft, often in the approach path of an aerodrome. Ground loops, collision with the ground while turning on the base circuit leg at low level, and undershoots when attempting a landing were other common accidents involving gliders.

In two accidents involving powered sports aircraft, the aircraft's engine failed while manoeuvring and the pilot conducted a forced landing into a field near the aerodrome. Inspections revealed that fuel system components (the fuel breather and the carburettor main jet) were blocked by insect nests.

Table 19: Occurrences involving general aviation aircraft conducting sports aviation, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	47	44	44	32	14	26	41	27	40	29
Serious incidents	0	1	3	1	1	5	3	4	6	7
Serious injury accidents	3	4	4	2	1	1	2	3	3	2
Fatal accidents	0	2	1	4	3	2	2	3	0	1
Total accidents	9	11	11	11	7	8	7	9	7	13
Number of people involved										
Serious injuries	4	6	4	2	1	1	2	4	4	2
Fatalities	0	2	1	4	4	3	3	3	0	1

4.2.4 Foreign general aviation

There have been very few accidents involving foreign registered general aviation aircraft in Australia in the last 10 years. In 2011, there were no accidents, and no fatalities or serious injuries (Table 20).

Table 20: Foreign registered general aviation aircraft occurrences, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of aircraft involved										
Incidents	34	19	12	31	43	47	56	50	66	57
Serious incidents	0	0	1	1	0	1	0	0	1	0
Serious injury accidents	1	0	0	0	0	0	0	0	0	0
Fatal accidents	0	0	1	0	0	0	0	0	1	0
Total accidents	3	0	1	0	1	1	1	0	2	0
Number of people involved										
Serious injuries	1	0	0	0	0	0	0	0	0	0
Fatalities	0	0	2	0	0	0	0	0	1	0

There have only been three accidents involving foreign-registered general aviation aircraft since 2002 that have resulted in fatal or serious injuries:

- On 9 March 2002, a United States-registered Cessna 340 aircraft (registered N79GW) was enroute from Bankstown, New South Wales to Cairns, Queensland. Some distance from Cairns Airport, the pilot advised air traffic services (ATS) that he had minimum fuel remaining. ATS declared a distress phase and advised the pilot to track direct for Cairns. They also advised him of the location of Atherton and Mareeba aerodromes; however, the pilot elected to continue to Cairns. About 10 minutes later, the pilot advised ATS that fuel was exhausted and asked if there were any landing strips in the vicinity. He was advised by ATS of the approximate position of an unregistered airfield at Green Hill, south-west of Cairns. An overflying aircraft in the vicinity of Green Hill observed the Cessna almost to the ground, but lost sight of it before reporting smoke and wreckage near Green Hill. The Cairns-based rescue helicopter was dispatched and confirmed that the aircraft had crashed. The occupants survived the crash, but sustained serious injuries (200200885).
- On 30 August 2004, the owner-pilot of a Swiss-registered Cessna 421C Golden Eagle (registered HB-LRW) took off from El Questro authorised landing area, Northern Territory, on a private flight to Broome, Western Australia, where the pilot intended resuming the aircraft delivery flight from Switzerland to Perth. Witnesses to the takeoff stated that, shortly after lift-off from the runway, the aircraft commenced a slight left bank and drift before striking the trees to the side of the runway and impacting the ground. The aircraft was destroyed by the impact forces and post-impact fire. The pilot and passenger were fatally injured (200403202).
- On 24 December 2010, a Finnish-registered Schleicher glider struck powerlines and impacted the ground. The pilot received fatal injuries.

5 OCCURRENCES BY AIRCRAFT TYPE

This chapter examines occurrences by the type of aircraft involved, and the type of operation being conducted. It primarily considers the number of occurrences in relation to the number of hours flown by the type of aircraft within an operation category.

Of the 14,663 aircraft on the Australian civil aircraft (VH-) register in February 2012, fixed-wing aircraft (aeroplanes) accounted for 84 per cent of all aircraft (12,372 powered fixed-wing aircraft and gliders). Rotary-wing aircraft (helicopters), accounted for 13 per cent (the other 3 per cent were balloons).

5.1 Differences between operation groups and fixed/rotary-wing accidents

Generally, the accident rate in helicopters in any type of operation is higher than that for aeroplanes performing the same type of operation. This ranges from 1.2 times more accidents in aerial work, up to 2.5 times more in flying training. The exception is in charter operations, where there are slightly more accidents involving aeroplanes than helicopters (about 1.2 times more) (Table 23).

When general aviation aeroplanes and helicopters were compared using pooled data between 2002 and 2010, general aviation helicopters had an accident rate of about 122 per million hours flown (293 accidents for about 2.4 million hours flown) and general aviation aeroplanes had about 92 accidents per million hours flown (820 accidents for about 8.9 million hours flown). This represents an accident rate in general aviation helicopters that is about 1.3 times higher than general aviation 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.

Table 21: Number of VH- registered powered aeroplanes and helicopters involved in accidents, 2002 to 2011

Aeroplanes	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Air transport	25	28	12	12	11	17	23	10	20	16
General aviation	100	81	99	78	60	85	84	79	85	74
Helicopters										
Air transport[11]	2	3	4	0	1	5	6	1	3	5
General aviation	21	27	34	31	25	26	35	34	36	25

[11] There were no high capacity or low capacity regular public transport (RPT) helicopter aircraft operations in Australia during the period 2002 to 2011. All air transport operations involving helicopters were charter operations.

Overall, helicopters were involved in about 36 per cent of all accidents (Table 21) in general aviation in the last 10 years, and 47 per cent of all fatal accidents (Table 22), even though they account for only 13 per cent of the Australian civil fleet. In terms of the amount of flying performed, helicopters fly far fewer hours than aeroplanes (for general aviation, 2.4 versus 8.9 million hours).

In 2011, there were about four to five general aviation aeroplane accidents for every air transport accident. Pooled data between 2002 and 2010 demonstrated that there were slightly less than 13 accidents per million hours in aeroplanes performing air transport (175 accidents for about 13.7 million hours flown), versus about 92 accidents per million hours in general aviation aeroplanes.

For helicopters, about 10 general aviation helicopter accidents happened for every accident involving a helicopter conducting air transport operations (with air transport equating to charter helicopter flying[11]). Between 2002 and 2010, 30 charter helicopters were involved in accidents for 737,751 charter helicopter hours flown (about 40 accidents per million hours flown). In comparison, there were around 122 accidents per million hours flown for general aviation helicopters.

Table 22: Number of VH- registered powered aeroplanes and helicopters involved in fatal accidents, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Aeroplanes										
Air transport	3	1	0	2	1	1	2	0	1	2
General aviation	5	8	7	10	12	9	18	7	8	6
Helicopters										
Air transport	1	1	0	0	0	1	1	0	0	0
General aviation	1	5	4	3	4	2	2	8	4	9

Wirestrike, Bell 206B III JetRanger helicopter (VH-BHU), near Mossman Hospital, Queensland (AO-2011-067) (image courtesy of Queensland Police)

5.2 Differences between operation types and fixed/rotary-wing accidents

There is significant variability when comparing the accident rate of aeroplanes and helicopters by operation type (Table 23).

There were no high or low capacity regular public transport (RPT) helicopter aircraft operations in Australia during the period 2002 to 2011.

Table 23: Accidents, fatal accidents, and number of fatalities by operation type and aircraft type, 2002 to 2011[12]

Operation	Aircraft type	Accidents per million hours	Fatal accidents per million hours	Number of fatalities
Charter	Helicopters	39.8	2.5	13
	Aeroplanes	35.0	3.9	22
Aerial work	Helicopters	81.4	12.6	22
	Aeroplanes	70.1	9.4	34
Flying training	Helicopters	95.5	13.6	7
	Aeroplanes	36.7	2.0	11
Private/Business	Helicopters	211.3	32.0	18
	Aeroplanes	138.8	16.5	117

Charter

Charter aeroplanes and helicopters have similar accident rates (35 versus 40 accidents per million hours flown over the last 10 years). Year-on-year comparisons between charter aeroplane and helicopter accidents show greater fluctuations in the helicopter accidents rates, as the total number of charter helicopter accidents is small (30 between 2002 and 2011).

Fatal accidents over the last 10 years in charter helicopter operations are lower (as a proportion of total flying activity) than for fixed-wing aeroplanes (2.5 versus 3.9 per million hours flown). Correspondingly, there were fewer fatalities in charter helicopter accidents (13) than in charter aeroplane accidents (22). However, when corrected for flying activity, the number of fatalities per million hours flown was higher for charter helicopters than for charter aeroplanes (15.7 versus 5.5 per million hours flown). This indicates that while more fixed-wing charter aircraft were involved in fatal accidents, they tended to have either less people on board or were more survivable for some of the occupants than those accidents involving helicopters.

Aerial work

When the accident rate in aeroplanes and helicopters performing any type of aerial work was compared, the helicopter accident rate (about 81 per million hours flown) was higher than the aeroplane rate (about 70 accidents per million hours flown).

[12] Rate figures are based on accidents and fatal accidents from 2002 to 2010 only, as activity data was not yet available for 2011 at the time of writing.

There are, however, significant differences in the types of aerial work that are performed by fixed-wing aircraft, and that performed by rotary-wing aircraft. 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.

Wirestrike, Robinson R22 Beta II helicopter (VH-HSW), 90 km SW of Cunnamulla, Queensland (AO-2011-080) (image courtesy of Queensland Police)

The fatal accident rate in aerial work for helicopters (about 13 per million hours flown) is similar to the aeroplane fatal accident rate (slightly over 9 per million hours). Aeroplanes and helicopters perform a similar number of hours in aerial work – in 2010, about 195,000 hours were flown by fixed-wing aircraft, and about 210,000 hours by rotary-wing aircraft.

In the last 10 years, less people were killed in aerial work accidents involving helicopters than those involving aeroplanes. The number of fatalities per million hours flown was also lower for helicopters (8.8) than for aeroplanes (17.6).

Flying training

Helicopters performing flying training were involved in a lot more accidents that fixed-wing flying training aircraft. The average rotary-wing accident rate in the 2002 to 2010 period was 95.5 accidents per million hours flown, which was more than double the rate of aeroplanes (36.7 accidents per million hours). Most flying training is done in fixed-wing aircraft – in 2010, almost 400,000 hours (compared with 44,000 for helicopters).

The fatal accident rate in helicopters performing flying training was six times higher than for aeroplanes. The rate of fatalities per million hours flown was even higher (3 fatalities per million hours for aeroplanes, compared with 19 for helicopters). Given the limited number of people on board training flights, this suggests that fixed-wing training accidents were generally more survivable than helicopter training accidents. A review of the fatal accidents involving helicopters

involved in flying training since 2002 found that most involved a loss of control from a hover, or a catastrophic failure in-flight (such as the loss of rotor blade) – both situations where the accident is highly likely to be uncontrolled. In comparison, fatal accidents involving fixed-wing flying training aircraft often involved collisions with other aircraft or objects. In many of these cases, the aircraft were able to conduct a forced landing.

In the last 10 years, 18 people were killed in flight training accidents (7 in helicopters, and 11 in fixed wing aircraft).

Private/Business

Helicopters performing private or business flying have an accident rate about 50 per cent higher than that for fixed-wing aeroplanes. Using aggregated data from 2002 and 2010, the private and business helicopter accident rate over the last 10 years was about 211 per million hours, while aeroplanes have an accident rate of about 139 per million hours flown.

Helicopters also had a higher fatal accident rate, with about twice as many fatal accidents involving helicopters than aeroplanes when corrected for flying activity (32 versus 17 fatal accidents per million hours flown); however, for the 15 fatal helicopter accidents in private/business operations between 2002 and 2010, there were 18 fatalities. In comparison with this figure, private/business aeroplanes had 56 fatal accidents, but 117 fatalities. In other words, there were more fatalities in an aeroplane accident than in a helicopter accident. 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 2010, private/business fixed-wing aircraft flew about 323,000 hours, whereas helicopters flew for only 60,000 hours of private and business use.

Loss of control, Robinson R44 helicopter (VH-ETT), 4 km SE of Kilmore, Victoria (AO-2011-055)

6 OCCURRENCE TYPES: WHAT HAPPENED

Accidents and incidents are usually the result of a complex set of circumstances, often 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 in the occurrence, and how the sequence of events played out to lead to the 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 accidents and incidents (detailed in Appendix A):

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

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. For occurrences involving multiple aircraft, aircraft with the same operation type are recorded twice; aircraft with different operation types are recorded against the corresponding operation type.

Occurrence types do not explain why an accident or incident happened, but generally are a description of what occurred. This report does not cover the safety factors (individual actions, local conditions, risk controls, or organisational influences) that explain what led to an occurrence, as these are more valuable when considered in a cluster of accidents and incidents that have a similar occurrence type.

The count of occurrence types does not necessarily reflect their importance. For example, fuel-related events may be relatively rare (when compared with fumes events), but fuel starvation can be very serious. 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.

6.1 Commercial air transport

In 2011, the top five types of accidents and serious incidents involving air transport operations were aircraft separation, powerplant and propulsion, terrain collisions, and a combination of runway events and ground operations events (Table 24). For incidents, the top five occurrence types were wildlife strikes, failure to comply (FTC) with air traffic services instructions, mechanical systems and airframe events, and a combination of airframe events and fumes, smoke or fire events (Table 25).

6.1.1 Accidents and serious incidents

The top accident and serious incident types involving air transport aircraft in 2011 were aircraft separation events, powerplant and propulsion problems, terrain collisions, runway events, ground operations, and crew and cabin issues.

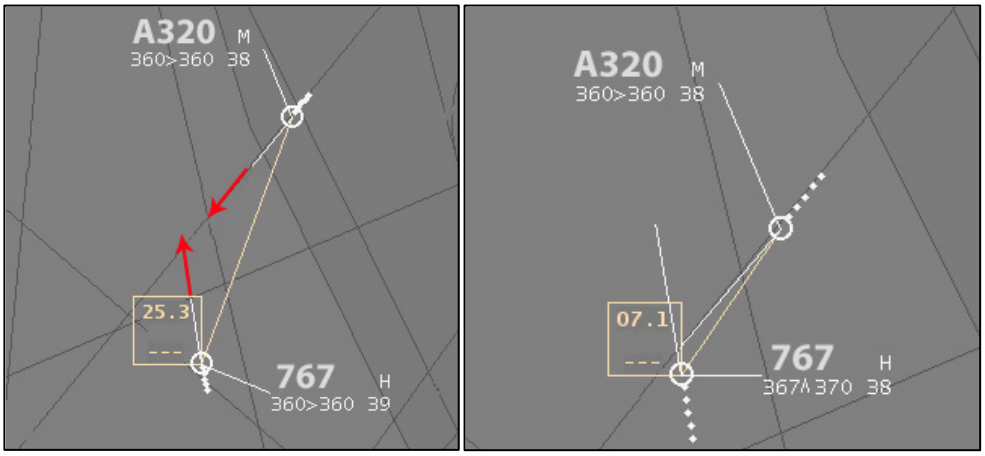
Table 24: Accidents and serious incidents in air transport operations, by occurrence type, 2002 to 2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Aerodrome and airways facility											
Aerodrome related	0	0	1	1	0	0	0	0	0	0	2
Airspace											
Aircraft separation	4	16	14	9	5	21	11	10	19	11	120
FTC (Operational Non-compliance)	0	1	2	4	0	5	5	3	2	1	23
ATC Procedural Error	2	1	2	4	1	3	1	2	0	6	22
VCA (Airspace incursion)	0	0	0	0	0	1	1	1	0	0	3
Breakdown of co-ordination	0	0	0	0	0	0	0	0	1	0	1
Other	0	0	0	0	0	1	0	0	0	0	1
Environment											
Weather	1	2	3	1	0	5	6	1	2	0	21
Wildlife	1	0	1	0	0	2	0	0	1	0	5
Mechanical											
Powerplant / propulsion	8	6	9	6	6	10	17	8	11	11	92
Airframe	12	9	8	7	2	9	7	9	4	4	71
Systems	3	1	4	6	3	5	10	5	1	4	42
Operational											
Aircraft control	14	13	8	6	6	17	20	13	14	4	115
Crew and cabin safety	3	1	5	7	3	12	15	7	4	5	62
Runway events	6	6	1	2	5	8	9	1	5	7	50
Terrain Collisions	3	3	4	5	4	5	8	3	4	9	48
Ground operations	2	6	2	0	2	5	5	1	5	7	35
Fuel related	3	4	7	2	0	4	6	3	0	2	31
Miscellaneous	1	1	4	2	2	2	12	3	4	0	31
Communications	2	3	3	1	2	2	6	1	4	4	28
Fumes, Smoke, Fire	1	2	4	4	1	1	7	3	1	1	25
Flight preparation / Navigation	1	0	1	4	0	4	0	1	3	0	14
GPWS / TAWS	1	0	1	1	0	2	0	1	0	0	6
Regulations and SOPs	2	1	0	1	1	0	1	0	0	0	6
Aircraft loading	1	1	1	0	0	0	0	0	1	0	4

Aircraft separation

Aircraft separation was the most common type of accident and serious incident involving air transport aircraft in 2011, and across most years since 2002 (Table 24). Across the last 10 years, all but one of the aircraft separation events involving air transport aircraft were serious incidents.

These included both airprox[13] and breakdown of separation[14] (BOS) events. By their nature, these events indicate a reduced safety margin between two aircraft, and an increase in the risk of a mid-air collision.



Breakdown of separation, Boeing 767-300 (VH-OGG) and Airbus A320-200 (VH-VNC), 74 km NW of Tamworth Airport, New South Wales (AO-2010-050)

The single accident that involved reduced aircraft separation between two air transport aircraft in the last decade was a mid-air collision in 2003 between two Pitts Special aircraft. The two Pitts Specials were being flown on a 'thrill seeker' flight to the west of the Sydney metropolitan area, which involved a choreographed set of aerobatic manoeuvres designed to simulate a World War One air combat scenario. During the sequence, the two aircraft collided. One aircraft sustained damage to the upper right wing and propeller, while the other incurred damage to the right landing gear and the fuselage belly. Both pilots carried out control checks and mutual in-flight inspections of each others' aircraft. The pilots declared an emergency (PAN) and returned to Bankstown Airport in formation. Emergency services were placed on standby; however, both aircraft subsequently landed without further incident. There were no injuries. One of the pilots reported that during the manoeuvres, he had lost sight of the lead aircraft due to sun glare. The collision occurred during subsequent manoeuvring to regain visual contact.

In 2011, most aircraft separation serious incidents were BOSs (six aircraft involved in three events), with three events involving alerts from the traffic collision avoidance system (TCAS). The remainder were airprox events (one event involving two aircraft). All three of the BOS events involved at least one high capacity air

---

[13] An airprox as defined by the TSI Regulations is an occurrence in which two or more aircraft come into such close proximity that a threat to the safety of the aircraft exists or may exist, in airspace where the aircraft are not subject to an air traffic separation standard or where separation is a pilot responsibility.

[14] A breakdown of separation as defined by the TSI Regulations is an occurrence where there is a failure to maintain a recognised separation standard (vertical, lateral or longitudinal) between aircraft that are being provided with an air traffic service separation service.

transport aircraft. Two of the BOS events were assessed to have a medium collision risk – in one case, two aircraft were separated by only 0.7 nautical miles horizontally and 400 feet vertically. In this case, the flight crew were alerted to the separation breakdown by TCAS, and took avoiding action.

Most BOS events occurred in a critical phase of flight – for example, one aircraft was climbing while one was on approach, or one was taxiing while the other was taking off.

In early 2012, the ATSB initiated a research investigation to review all breakdowns of separation and loss of separation assurance events involving air transport aircraft since 2008. The aim of this investigation is to look for patterns in these occurrences and common contributing factors that lead to loss of separation between aircraft in controlled airspace.

Powerplant / propulsion

All powerplant and propulsion-related accidents and serious incidents in 2011 affecting air transport aircraft were in passenger charter operations.

About 60 per cent of these were total engine failure events. Twenty per cent were partial power loss, and the remainder involved abnormal engine indications or other types of powerplant issues. Luckily, in all of the total power loss events, the aircraft involved were able to conduct a forced landing without significant injury to those on board. In many cases, a potentially deadly outcome was prevented due to emergency training and quick thinking by the pilot:

In hot water
On 3 January 2011, a Robinson R44 helicopter departed Cairns on a half an hour charter flight. On board the helicopter were the pilot and three non-English speaking passengers. About 25 minutes into the flight, and at about 400 ft above sea level, the engine failed and the rotor low RPM horn (indicating that the main rotor was turning too slowly) sounded. The pilot broadcast a Mayday and initiated an autorotation.

During the descent the pilot deployed the inflatable floats; however, the right float did not fully inflate. The pilot stated that at 50 ft above the sea, the helicopter entered an uncommanded 360 degree yaw to the left. The pilot was unable to control the yaw and the helicopter impacted the water heavily and turned onto its right side. The pilot assisted the passengers to egress the helicopter and inflated their life preservers. They were rescued from the water by fishermen in a small boat.

ATSB investigation AO-2011-001

Common reasons for total and partial power loss were failed fuel pumps, a cracked rotor blade, fuel venting from an incorrectly fitted fuel filler cap, and suspect spark plugs. In two accidents, the cause of the power loss is still under investigation. In one accident, the helicopter suffered a sudden loss of cylinder head temperature and had to ditch into the sea. While all of the occupants were rescued, the helicopter wreckage could not be recovered for examination before it drifted into the path of an oncoming cyclone.

Terrain collisions

There were nine accidents and serious incidents in air transport in 2011 involving terrain collisions, all in charter operations (Table 24).

Most of these were a collision with terrain event. Three of these events involved an approach to land where the aircraft landed short of the runway. Some involved pilot distraction during the approach, by fuel-related issues and mechanical problems, or by the need to maintain clearance with obstacles in the approach path. In one serious incident, a hot air balloon pilot descended to take advantage of the winds at a lower level. The balloon was affected by a temperature inversion and could not climb, striking trees and sustaining minor damage before the balloon made landfall at the next available landing spot.

The remaining two accidents and serious incidents were a wirestrike by a helicopter operating joy flights at a food and wine festival (AO-2011-046), and a ground collision where the pilot forgot to extend the landing gear on the second attempt to land after conducting a missed approach, damaging the propeller.

Runway events

There were seven runway events in 2011 in air transport that led to an accident or serious incident (Table 24). They were a mixture of runway undershoots, incursions, and excursions.

Most involved aircraft conducting charter operations, but one serious runway incursion occurred between a high capacity and a low capacity air transport aircraft (AO-2011-010). In this case, air traffic control had provided the instruction for the high capacity jet to cross the runway based on the expectation that the low capacity aircraft would have commenced its takeoff soon after receiving a take-off clearance, which was not the case.

In the second runway incursion, which occurred at a non-controlled aerodrome (Weipa, Queensland), a Rockwell AC50 Aero Commander was about to touch down, but during the flare, another aircraft entered the runway. The AC50 pilot applied maximum braking and took avoiding action, passing in close proximity to the other aircraft. The crew of both aircraft advised making appropriate radio calls.

In one runway excursion accident, an aircraft contacted standing water on the runway at Garden Point Aerodrome, Northern Territory, during a landing roll and aquaplaned. As the aircraft overran the runway and clearway, the nosewheel collapsed and the aircraft slid sideways into the perimeter fence. The aircraft was seriously damaged. While this aircraft was only on a test and ferry flight, the other runway excursion involved a passenger charter service where the aircraft overran the runway at Kalumburu, Northern Territory, and was seriously damaged (AO-2011-153).

Ground operations

The seven serious incidents and accidents involving ground operations in 2011 affecting air transport aircraft (Table 24) involved collisions on ground and jet blast occurrences.

The jet blast occurrences both involved high capacity air transport occurrences, and included the serious incident where a first officer was blown off a set of portable

stairs (AO-2011-137). In another occurrence, an Airbus A320 aircraft turning from a terminal bay to face a taxiway at Perth Airport held breakaway thrust through the turn, exposing passengers and ground staff at nearby bays to moderate jet blast.

The collisions on ground included a large helicopter that collided with a light pole while taxiing and rolled onto its side at Port Keats Aerodrome, Northern Territory. In another accident, the wingtip of a Boeing 737 collided with the horizontal stabiliser of a parked aircraft.

Collision with obstacle, Aérospatiale AS.332 L1 Super Puma (VH-LAG), Port Keats Airport, Northern Territory (AO-2011-083)

Crew and cabin safety

Crew and cabin safety accounted for five accidents and serious incidents involving air transport operations in 2011 (Table 24). These events mostly involved crew incapacitation, affecting the pilot in command (PIC) in one occurrence, and another flight crew member (such as the first officer) in three occurrences. In the occurrence involving the PIC, the first officer took the incapacitated captain's place and landed the aircraft.

In the remaining occurrence (a depressurisation), the crew of a Boeing 737 aircraft received an air-conditioning and right wing body overheat warning during the descent. This was followed shortly thereafter by a left system air-conditioning and bleed trip off warning. The crew conducted an emergency descent to 10,000 ft, and completed the flight uneventfully. The subsequent engineering inspection revealed a faulty sensor in the right pack and a faulty valve in the left pressurisation system.

6.1.2 Incidents

The top five types of incidents involving air transport aircraft in 2011 were wildlife (bird and animal) strikes, failure to comply with air traffic control instructions or

published procedures, mechanical system problems, weather-related events, and airframe events and fumes, smoke and fire events (Table 25).

Table 25: Incidents in air transport operations, by occurrence type, 2002 to 2011

Occurrence Type	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Aerodrome and airways facility											
Airways facility	28	38	27	52	16	17	13	12	22	11	236
Aerodrome related	17	18	21	16	20	20	24	28	18	14	196
Airspace											
FTC (Operational Non-compliance)	410	426	543	761	633	770	813	727	1,005	907	6,995
Aircraft separation	306	266	305	320	204	180	254	238	234	287	2,594
ATC Procedural Error	156	205	200	285	285	206	188	146	98	70	1,839
Breakdown of co-ordination	112	111	176	207	150	180	163	195	252	200	1,746
VCA (Airspace incursion)	47	55	72	58	50	93	73	52	51	59	610
Other	23	22	7	15	17	6	7	7	2	3	109
Environment											
Wildlife	614	645	855	951	921	960	1,052	1,164	1,331	1,404	9,897
Weather	122	101	172	173	174	206	225	180	231	319	1,903
Mechanical											
Systems	288	204	278	316	323	324	388	325	418	477	3,341
Airframe	228	170	174	235	197	269	325	289	262	308	2,457
Powerplant / propulsion	214	159	162	170	163	210	216	221	196	234	1,945
Operational											
Miscellaneous	159	109	112	147	226	245	349	319	258	263	2,187
Fumes, Smoke, Fire	102	72	74	105	101	131	154	139	272	299	1,449
Communications	85	92	165	146	117	93	150	103	72	78	1,101
GPWS / TAWS	69	67	163	242	149	83	36	22	18	36	885
Crew and cabin safety	99	43	57	68	53	99	74	62	80	115	750
Aircraft control	49	27	57	69	87	76	68	57	82	129	701
Aircraft loading[15]	25	10	13	20	60	67	63	41	126	234	659
Ground operations	59	53	55	45	55	67	72	56	50	77	589
Flight preparation / Navigation	76	42	65	74	60	74	56	29	39	48	563
Runway events	36	48	46	34	40	41	57	40	48	61	451
Fuel related	40	21	31	23	32	55	53	35	30	36	356
Loading related	8	6	23	21	19	63	45	30	0	0	215
Regulations and SOPs	12	3	7	7	10	28	22	5	0	0	94
Terrain Collisions	10	8	9	11	10	6	13	8	8	7	90

[15] Aircraft loading events have shown large growth over the last decade. Improved coding practices, and more effective collection of data on loading events by airlines (followed on by more thorough reporting of these occurrences to the ATSB) have all played a part in this increase.

The tabulated number of aircraft loading incidents has changed significantly since the 2010 version of this publication, due to an ATSB review of the coding of all loading-related occurrences in the last 10 years.

Wildlife

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 regular public transport (RPT) operations over the same period (Table 25). The ATSB, airport and airline operators have also worked together over this time to instil a better reporting culture of confirmed and suspected birdstrikes. This has resulted in a modest increase in the rate of birdstrikes per aircraft movement.

While often the type of bird is not known when a strike is reported, in 2011, there were 10 bird and bat types that accounted for more than 20 strikes each. In order of frequency these were Galah (75 strikes), Kite (71 strikes), Swallow/Martin (71 strikes), Bat/Flying Fox (66 strikes), Lapwing/Plover (65 strikes), Nankeen Kestrel (54 strikes), Magpie-lark (37 strikes), Magpie (32 strikes), Silver Gull (23 strikes), and Pipit (23 strikes). About 7 per cent of bird strikes resulted in minor damage.

In relation to animal strikes, most animal strikes either involved rabbits or hares. Only two incidents resulted in any recorded aircraft damage.

Failure to comply (operational non-compliance)

After steady increase from 2002 to 2010, there was a drop in the number of reported failures to comply (FTC) with air traffic services instructions incidents that involved air transport aircraft (Table 25). This said, FTCs are still the second most common type of incident involving air transport aircraft. Most FTC occurrences are of a minor safety nature, and are rapidly picked up through communication between air traffic control and flight crews.

About 80 per cent of FTC incidents involved high capacity RPT aircraft, and the increasing trend partially reflects the growth in high capacity traffic; however, all three air transport types (high capacity RPT, low capacity RPT and charter) showed an increase in the rate of FTC incidents per aircraft departure over the 10 years.

In 2011, about 68 per cent of FTC events were related to verbal instructions and the remainder were related to published information. Most happened in 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). About 17 per cent of FTC incidents took place on the ground (usually during taxiing).

In relation to phase of flight, about 20 per cent of FTC incidents occurred on the ground, mainly during taxiing. Of the FTC incidents in flight, about 25 percent occurred on the initial climb, or climb to cruise, 50 per cent occurred during cruise, and 25 per cent occurred during descent and approach.

Failures to comply were most commonly related to aircraft route and altitude while in the air, and failure to comply with a taxi or pushback clearance while on the ground. For FTC incidents relating to published information, about 33 per cent 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 in other AIS categories included pilots operating instrument flight rules (IFR) aircraft

without serviceable radio equipment, failure to update waypoint estimates, turning away from the direction specified in a SID or STAR, and not making radio calls.

Mechanical systems

The number of mechanical systems incidents reported for air transport operations has shown a marked increase from 2002 (288 incidents) to 2011 (477 incidents) (Table 25).

In 2011, mechanical systems events were chiefly related to avionics/flight instruments, hydraulic systems, air/pressurisation, flight controls, and electrical systems.

Avionics/flight instruments events were related to error messages associated with primary flight controls in 23 per cent of events, communication systems in 22 per cent of events, navigational systems in about 18 per cent of events, and the remainder were a mixed group of auto flight control and secondary flight systems.

Hydraulics systems events were mostly of the primary system (the type of hydraulic system was identified in only about 40 per cent of hydraulics-related incidents).

Air and pressurisation events were commonly related to pressurisation (37 per cent) and bleed air (30 per cent) systems, with about a fifth relating to air conditioning.

Flight control issues were usually related to flaps or slats. Electrical events mainly featured alternator or generator failures, with the remainder being battery failures.

Weather

Reported weather occurrences affecting air transport operations have increased significantly in 2011 compared with 2010 (almost a third higher) (Table 25).

Often, different types of weather events are associated with each other; so many occurrences had more than one weather event recorded. Most weather-related incidents (66 per cent) involved windshear and microburst. Over half involved turbulence (56 per cent), and 31 per cent involved lightning.

Windshear/microburst events usually occurred on approach, and in about 40 per cent of cases led to an overshoot. In most windshear situations, rather than landing on the first attempt, the flight crew conducted a missed approach and made a successful landing on the second attempt. Minor airframe overspeed events happened in 10 incidents, often involving a flap overspeed (usually less than 10 knots). The remaining windshear/microburst occurrences led to aircraft sink on approach, or an undershoot. A missed approach was usually the outcome of these occurrences.

Where the type of turbulence was reported, reports were split between clear air (32 occurrences), wake (29 occurrences), and in-cloud (19 occurrences) turbulence. Turbulence events were reported across a mixture of cruise, descent, and approach phases of flight. Twenty-six air transport incidents where turbulence was reported resulted in injuries.

In the 89 occurrences where an air transport aircraft was struck by lightning in 2011, most resulted in no reported damage or injury. The strikes occurred at different times of the year, in different locations, and at different altitudes. In the small number of cases where damage was reported (five occurrences), damage was

confined to the skin or composite ply in the extremities of the aircraft (wingtips, elevators). In one case, a lightning strike while an aircraft was descending was associated with a spurious low tyre pressure alarm.

Damage to window reveal (L) and overhead locker (R) – Turbulence event, Boeing 767-300 (VH-OGR), near Perth Airport, Western Australia (AO-2011-064)

6.2 General Aviation

6.2.1 Accidents and serious incidents

The top accident and serious incident types involving general aviation operations in 2011 were terrain collisions, aircraft separation issues, aircraft control problems, powerplant and propulsion issues, and runway events (Table 26).

Table 26: Accidents and serious incidents in general aviation operations, by occurrence type, 2002 to 2011

Occurrence Type	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Aerodrome and airways facility											
Aerodrome related	0	1	0	0	1	0	0	1	0	0	3
Airspace											
Aircraft separation	8	37	38	25	40	34	63	50	66	73	434
FTC (Operational Non-compliance)	0	2	8	8	12	5	23	13	5	11	87
ATC Procedural Error	0	1	2	2	3	0	7	4	2	4	25
VCA (Airspace incursion)	0	0	0	2	1	1	3	4	1	2	14
Breakdown of co-ordination	2	0	0	0	0	0	0	0	0	0	2
Environment											
Weather	4	0	1	1	4	14	3	12	9	4	52
Wildlife	4	2	2	5	0	2	2	3	3	4	27
Mechanical											
Powerplant / propulsion	16	18	47	27	38	68	41	55	45	34	389
Airframe	17	23	12	12	12	11	12	14	10	6	129
Systems	4	6	6	4	2	4	6	7	11	8	58
Operational											
Terrain Collisions	44	68	81	82	74	84	113	68	125	91	830
Aircraft control	65	38	54	46	36	51	52	48	37	43	470
Runway events	17	19	15	10	11	24	26	25	22	18	187
Ground operations	14	9	10	7	4	22	16	23	19	15	139
Miscellaneous	6	7	13	11	5	7	13	15	5	3	85
Fuel related	4	5	4	8	4	6	9	8	15	16	79
Communications	0	7	12	2	2	1	15	7	10	17	73
Fumes, Smoke, Fire	2	4	4	3	4	5	5	4	7	4	42
Crew and cabin safety	0	5	3	3	3	3	5	3	2	2	29
Flight preparation / Navigation	1	3	4	2	2	4	4	5	0	2	27
Regulations and SOPs	0	1	1	3	1	1	1	0	0	0	8
Aircraft loading	0	2	0	0	0	1	1	1	0	0	5

Terrain collisions

In 2011, most collisions with terrain involving general aviation aircraft were collisions with the ground or obstacles (60 per cent), with wirestrikes making up almost all of the remaining 40 per cent.

Most of these collisions happened on level terrain. About half of the aircraft (where the type of terrain was known) collided with open ground, and a third with trees. Collisions with terrain resulted in 26 general aviation pilot and passenger fatalities in 2011.

About half of the general aviation aircraft that collided with terrain were performing aerial work (particularly types that involve aircraft flying at low level, such as agriculture and mustering), and half were in the private/business/sport category. Most (45 per cent) were during manoeuvring operations, such as cleaning up after a spray run, or turning to muster cattle. Twenty-two per cent of collisions with terrain happened on approach or landing.

Wirestrikes resulted in 32 general aviation accidents in 2011; 21 involving fixed-wing aeroplanes, five involving helicopters, three hot air balloons, and three unknown aircraft. Like collisions with terrain, the vast majority of wirestrike accidents (24 of 32) involved operation types where low-level flying is normal, in particular aerial agriculture. 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. Most wires involved were standard powerlines. At least eight accidents were ‘unreported’ wirestrikes, which were not reported at the time of accident and were identified only through the ATSB working with electricity transmission infrastructure owners.

There was one controlled flight into terrain (CFIT) accident in 2011, involving a Robinson R44 helicopter operating on a pleasure/travel flight with a pilot and a passenger on board on 24 April. The helicopter was being flown after last light and was on approach to a helicopter landing site when it collided with the sea off the northern headland of Lilli Pilli Bay, New South Wales. The pilot was not approved, nor was the helicopter equipped, to fly at night. The occupants escaped from the helicopter after the impact with the water. A witness to the accident assisted the pilot onto nearby rocks, but the passenger was fatally injured.

Aircraft separation

Over 90 per cent of aircraft separation serious incidents in 2011 were airproxes, with a medium to high risk of a mid-air collision. Unsurprisingly, many happened in the circuit, approach, or initial climb when there are likely to be aircraft in close proximity.

Where the aircraft’s operation type was known (about 55 per cent of cases), the majority were performing dual pilot flying training.

Most airproxes occurred when the aircraft involved were on crossing tracks (24), reciprocal (head-to-head) (17), or on the same track (16 cases). Avoidance manoeuvres were taken by at least one aircraft in about 70 per cent of airprox occurrences.

The pilots of the general aviation aircraft involved were only aware of the other aircraft in about half of these 67 airproxes, and in just 12 were both pilots aware of each other's presence.

In about 70 per cent of cases (including those where the pilots had not been aware of the other aircraft), there was no alert of a potential collision. Where there was an alert of a potential collision, it generally came from air traffic services (ATS) than from other sources (such as from traffic collision and avoidance systems (TCAS)).

There was only one aircraft separation accident involving general aviation aircraft in 2011. A Grumman AA-5 aircraft and a Jabiru J230 aircraft were on short final approach to a runway at Tumby Bay, South Australia, but neither of the pilots was aware of the other aircraft. The AA-5's propeller collided with the tail of the Jabiru prior to touchdown, causing serious damage. The pilot of the AA-5 reported that he was not maintaining a listening watch on the appropriate radio frequency.

Aircraft control

During 2011, hard landing, loss of control, and wheels-up landings featured commonly in general aviation aircraft control accidents and serious incidents. This was a similar pattern of accidents and serious incidents to that seen in 2010.

About a third of hard landings involved aircraft conducting solo flying training operations. Most of the remainder involved private flying operations, or aerial agriculture and mustering. Five of the 12 hard landings involved helicopters.

Loss of control, Kawasaki 369HS helicopter (VH-XAA), 42 km WSW of Canberra Airport, New South Wales (AO-2011-069)

Loss of control occurrence type events were roughly an even split between operations in the air, and those 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. Those loss of control occurrences involving helicopters tended to result in substantial aircraft damage and occupant injury.

Most wheels-up landings were unintentional, involving a variety of single and twin-engine aircraft. In some cases, this was due to the pilot being distracted by another aircraft problem.

An oily mess
On 25 September 2011, a Cessna 182 Skylane aircraft departed Normanton, Queensland, to conduct some aerial work. During the takeoff and initial climb, the air speed indicator began to behave erratically, and then failed. The pilot observed oil leaking from the engine cowling, and flowing onto the windscreen in large amounts.

Concerned about the risk of the engine seizing, the pilot cut short a circuit to return to Normanton as quickly as possible. The pilot reported that he was distracted by trying to fly without an airspeed indicator, and was concerned about the reliability of a groundspeed reading from the aircraft's global positioning system (GPS) equipment due to a gusting wind. In addition, the oil on the windscreen was impacting on visibility.

After a successful approach, the pilot inadvertently landed with the landing gear retracted. He was uninjured, but the propeller, engine, and fuselage were seriously damaged in the wheels-up landing.

An inspection revealed that while the pilot had checked the oil level prior to takeoff, the oil filler cap had not been secured. The pilot reported that he did not hear the warning buzzer that should have sounded during the take-off roll when the oil pressure was low and the flaps were extended.

Powerplant / propulsion

The majority of powerplant/propulsion-related accidents and serious incidents involving general aviation aircraft in 2011 were total power losses or engine failure (85 per cent). The remaining occurrences involved partial power losses/rough running, or transmission and gearbox problems.

Total power loss events involved a range of primarily single-engine aircraft, usually conducting private operations. The reason for the engine failure was only known in about two-thirds of cases, but common causes were fuel pump failure (five cases), carburettor icing or fuel filter blockages (three cases), fuel imbalance (three cases), and holes or cracks in the cylinder (two cases).

Most resulted in a forced landing or diversion; some of these events resulted in collision with terrain, hard landing, ground strike and runway excursion or undershoot. The most common phases of flight where total power loss/engine failure accidents and serious incidents happened were approach and cruise (nine cases each).

Runway events

In 2011, most accidents and serious incidents in general aviation involving runway events were runway excursions (9 of 18 cases). About half were veer-offs (the aircraft departed to the left or right of the runway strip). Veer-offs were reported to be due to wind gusts, bouncing on landing, and general loss of directional control by the pilot.

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 take-off 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.

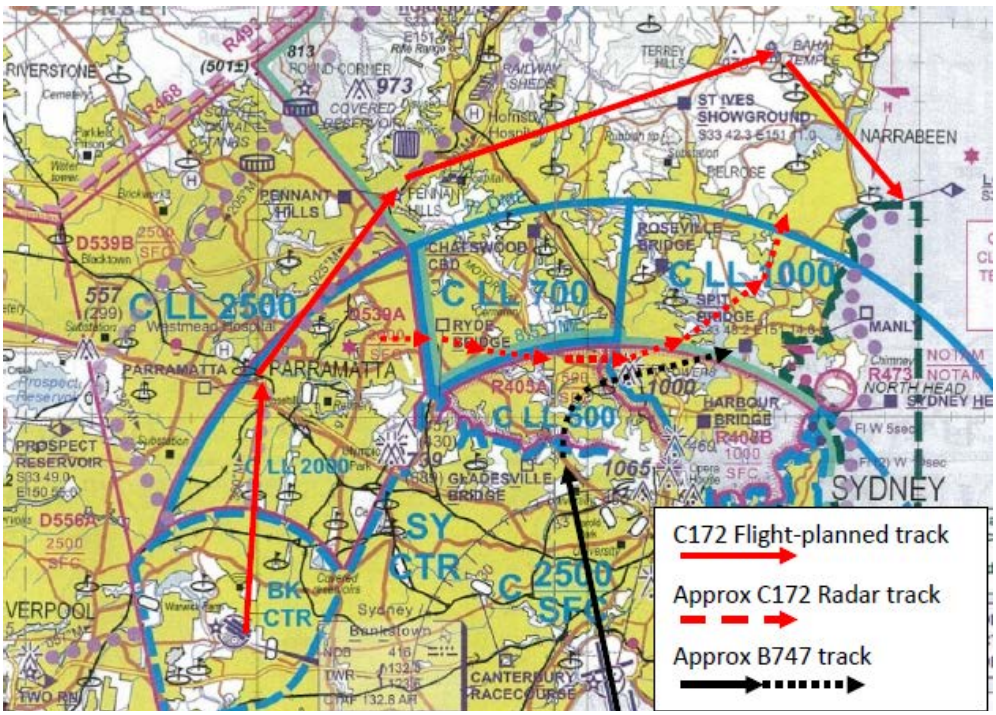
Only one runway excursion was reported that occurred in wet weather.

The remaining nine runway accidents and incidents involved several runway incursions (one resulting from an aircraft that took off from a different runway to the one it was assigned to), two instances of aircraft departing or landing on an incorrect runway, and three runway undershoots.

6.2.2 Incidents

The most common types of incidents involving general aviation aircraft in 2011 were largely airspace related (particularly airspace incursions and non-compliance with published procedures, information, or verbal ATC instructions, which were the most and second most common reported incidents). The top five was rounded out by wildlife strikes (animals and birds), reduced aircraft separation, and runway events (Table 27).

The significant reduction in miscellaneous airspace-related events over the last 10 years is a result of refinements in the classification of incidents by the ATSB.



Breakdown of separation, Cessna 172 Skyhawk (VH-WYG) and Boeing 747 (N171UA), 19 km NW of Sydney Airport, New South Wales (AO-2011-095)

Table 27: Incidents in general aviation operations, by occurrence type, 2002 to 2011

Occurrence Type	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Aerodrome and airways facility											
Aerodrome related	7	12	3	10	10	7	6	4	10	3	72
Airways facility	7	16	2	4	10	1	5	2	4	5	56
Airspace											
VCA (Airspace incursion)	1,017	892	1,161	1,167	1,286	1,261	1,132	1,214	1,207	1,013	11,350
FTC (Operational Non-compliance)	374	257	167	336	645	820	1,125	910	986	789	6,409
Aircraft separation	192	147	175	181	198	195	268	304	229	324	2,213
ATC Procedural Error	58	54	61	66	91	74	77	59	36	38	614
Breakdown of co-ordination	51	64	50	45	51	61	57	43	66	67	555
Other	80	42	6	11	6	1	4	1	2	1	154
Environment											
Wildlife	217	256	294	387	386	382	361	403	409	363	3,458
Weather	12	11	9	10	13	19	18	12	21	21	146
Mechanical											
Systems	99	109	198	186	179	151	151	158	174	168	1,573
Powerplant / propulsion	155	168	135	149	129	173	174	153	134	164	1,534
Airframe	127	100	126	112	164	171	181	167	127	154	1,429
Operational											
Runway events	148	149	169	236	273	240	314	480	320	298	2,627
Communications	119	94	105	85	190	138	217	161	152	137	1,398
Flight preparation / Navigation	114	101	71	106	115	115	70	70	65	52	879
Aircraft control	38	36	51	73	55	69	51	60	36	57	526
Miscellaneous	38	29	33	39	39	43	47	49	42	36	395
Fumes, Smoke, Fire	23	35	38	29	37	41	37	36	44	47	367
Ground operations	28	29	37	40	28	32	34	42	44	28	342
Terrain Collisions	34	25	35	35	25	35	35	41	23	31	319
Fuel related	25	27	16	20	13	18	19	13	21	20	192
Crew and cabin safety	8	4	8	10	7	9	2	5	7	7	67
Regulations and SOPs	3	3	7	3	2	9	15	4	0	0	46
Aircraft loading[16]	2	0	1	2	2	4	4	1	3	1	20
GPWS / TAWS	0	0	1	4	0	0	0	1	2	1	9

Airspace incursions

Airspace incursions are by far the most commonly reported incident involving general aviation aircraft in the last 10 years. In 2011, the number of airspace incursions (1,013) was somewhat lower than the long term average of 1,135 per year (Table 27).

[16] Prior to 2008, occurrences of this type were categorised as 'Loading related'.

In 2011, most airspace incursion incidents involving general aviation aircraft related to incursions into controlled airspace (68 per cent). About 77 per cent of these involved the aircraft going from uncontrolled (Class G) airspace to controlled general and terminal (Class C) airspace. Another 11 per cent were an incursion from uncontrolled Class G airspace to controlled terminal (Class D) airspace. Of the remaining 82 controlled airspace incursions by general aviation aircraft, 26 involved aircraft going from one class of controlled airspace to another without a clearance, and 18 involved general aviation aircraft operating in the vicinity of non-towered aerodromes entering controlled airspace without a clearance. The remainder were airspace incursions from uncontrolled Class G airspace to controlled Class A and E airspace, or from Class G control areas (CTAs) into Class C, D, or E airspace.

In Class G to Class C (or Class 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 involved general aviation aircraft entering prohibited, restricted or danger (PRD) areas[17]. Most involved incursions into restricted military airspace by civilian aircraft. The most frequent locations where aircraft inadvertently entered PRD airspace were around area R350, which accounted for 26 of the 325 PRD incursions in 2011 (particularly in the vicinity of Puckapunyal, Victoria, where there were eight incursions). There were also 24 incursions into area R564A (near Singleton, New South Wales), 17 incursions into R358D (in East Gippsland, Victoria), 14 incursions into R289A (near Murray Bridge, South Australia), 13 incursions into R634A (near Canungra, Queensland), and 11 incursions into area R643A (near Oakey, Queensland). All of these areas contain Australian Defence Force bases or ranges that are used for live firing exercises. It does not follow that live fire exercises were taking place at the same time as all of these airspace incursions, but there is obviously a higher potential safety risk associated with incursions into PRD areas.

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. The incursion type was unknown in the remaining 74 airspace incursions.

Failure to comply (operational non-compliance)

The number of incidents where general aviation pilots failed to comply with air traffic services instructions rose markedly between 2004 (167 incidents) and 2008 (1,125 incidents), but has reduced in subsequent years. In 2011, there were 789 incidents involving an FTC (Table 27).

About 73 per cent of FTC incidents involved a failure to comply with verbal instructions from air traffic control. Of the incidents where the type of verbal instruction was reported to the ATSB, 32 per cent were altitude assignments, 17 per cent were route changes, and about 9 per cent were heading changes. The remaining

---

[17] 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.

verbal instruction FTC incidents were a mixture of instructions from ATC, such as taxiing, entering the runway, or taking off without a clearance.

The remaining 27 per cent of FTCs were failures to comply with published information, such as SIDs and STARs. Many occurrences involved deviations from track, climbing above the published altitudes for a circuit or a standard departure, and failure to update waypoint arrival estimates.

About 20 per cent of all FTC incidents involving general aviation aircraft occurred on the ground during taxiing or pushback. Another 12 per cent occurred during the takeoff or landing roll. The remainder occurred in the air, most commonly during the critical approach and landing phases of flight, or during the cruise.

Wildlife

Reports of wildlife strikes involving general aviation aircraft have remained fairly stable since 2006. In 2011, there were 363 wildlife strike incidents (Table 27).

The most common types of wildlife struck in 2011 by general aviation aircraft were birds and bats. In particular, the most commonly struck species groups were bats and flying foxes (34), lapwings and plovers (33), magpies (27), galahs (22), and Nankeen kestrels (21 strikes). In about 22 per cent of strikes, the species of animal struck was not known or was not reported.

Only 11 incidents were reported where a general aviation aircraft struck another kind of animal. These were usually wallabies, kangaroos, rabbits and hares, but included snakes and turtles.

Forty-eight wildlife strikes in 2011 resulted in aircraft damage that was reported to the ATSB (about 13 per cent of all strikes). Most reported damage was minor in nature, and included delamination of propeller blades, broken lamp covers, and shattered windscreens. Serious or substantial damage to a general aviation aircraft occurred in two wildlife strikes.

Aircraft separation

Most general aviation aircraft separation incidents 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, many incident reports of this type received by the ATSB from general aviation pilots are not clear on ‘how close’ the aircraft got, and it is difficult to determine what the likelihood of a mid-air collision was. These accounted for over half of all reported aircraft separation incidents.

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 general aviation aircraft were related to breakdowns of separation in controlled airspace (where separation standards apply). All BOS events were conflicts with other aircraft, and these occurred mainly in Class C and Class D airspace. About 30 per cent of BOS events 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 50 per cent of BOS events, procedural standards in about 20 per cent and runway standards in 30 per cent of events. The remaining breakdowns of separation were related to breakdown of visual separation standards.

About 10 per cent of aircraft separation incidents were loss of separation assurance, airprox, and TCAS alerts.

Runway events

The number of runway-related incidents involving general aviation aircraft has doubled since 2002, from 148 to 298 in 2011 (Table 27). Runway incursions accounted for about 75 per cent of all runway events in 2011.

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

Other runway events mostly involved landing or taking off from the wrong runway (about 24 per cent). The remaining runway events involving general aviation aircraft were runway excursions or undershoots.

APPENDIX A: 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
		Airframe overspeed
		Stall warnings
		Other
	Aircraft loading	Dangerous goods
		Loading related
		Other
	Crew and Cabin Safety	Cabin communications
		Crew incapacitation
		Depressurisation
		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

Occurrence Type Level 1	Occurrence Type Level 2	Occurrence Type Level 3
		Other
	Fumes, Smoke, Fire	Fire
		Fumes
		Smoke
	GPWS / TAWS	
	Ground operations	Collision on ground
		Foreign object damage / debris
		Ground handling
		Ground prox
		Jet blast / Prop / Rotor wash
		Other
	Miscellaneous	Missing aircraft
		Security related
		Unauthorised low flying
		Warning Device Other
		Laser Related
		Other
	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
		Fire protection

Occurrence Type Level 1	Occurrence Type Level 2	Occurrence Type Level 3
		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

24 Hours 1800 020 616
Web www.atsb.gov.au
Twitter @ATSBinfo
Email atsbinfo@atsb.gov.au

Research

ATSB Transport Safety Report
Aviation Occurrence Statistics 2002-2011
AR-2012-025
Final