Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Aviation Research and Analysis Report B20070099
Final

An analysis of fixed-wing and rotary-wing aircraft accidents involving private operations, 2001 to 2005

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Abstract

This study provides an overview of accidents involving private aircraft operations between 2001 and 2005. With approximately 400,000 flying hours conducted annually, private flying accounts for around a quarter of general aviation activity. Within private operations, rotary-wing activity now contributes about 10 per cent of all hours flown.

The accident rate in private aviation activities generally declined over the five-year study period, but the fatal accident rate for fixed-wing aircraft remained generally stable. There was an apparent increase in the rotary-wing fatal accident rate.

The pattern of accident types showed similarities for both fixed-wing and rotary-wing aircraft. Most accidents can be classified against a small number of accident types: collisions, loss of aircraft control, airframe, and powerplant issues. Additionally, collision accidents and those involving a loss of aircraft control account for most of the fatal accidents.

Differences between fixed-wing and rotary-wing aircraft occurrences are more apparent when accidents are examined by phase of flight. More than half of all fixed-wing accidents occur in the landing phase of flight, but manoeuvring and cruise are among the most common phases of flight for accidents involving rotary-wing aircraft. These phases of flight are also associated with fatal accidents.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

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

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

Purpose of safety investigations

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

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

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Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

EXECUTIVE SUMMARY

Private flying operations in Australia cover a potentially diverse range of flying activities for personal use, including for travel, or as a business tool to support a variety of tasks including aerial mustering or aerial survey. At present, there are about 16,000 private pilot licence holders with a current medical certificate in Australia.

Approximately 90 per cent of private flying involves fixed-wing aircraft. However, over the last decade rotary-wing operations have become more common and now account for a larger proportion of flying activity than was the case just a few years earlier.

The purpose of this report was to examine accident and fatal accident rates for fixed-wing and rotary-wing aircraft engaged in private operations between 2001 and 2005. Accident and fatal accident rates for private operations are among the highest for any general aviation activity. Rotary-wing aircraft generally have a higher accident rate than fixed-wing aircraft for general aviation, but this difference is less apparent when looking solely at private operations. The year 2005 was an exception, with rotary-wing accident rates for private operations increasing to more than three times the accident rate for fixed-wing aircraft.

The study also investigated accidents by phase of flight and accident type to determine similarities and differences between both aircraft types. Because the number of accidents involving rotary-wing aircraft is low (n = 42) compared with fixed-wing aircraft (n = 282), some limits apply to the conclusions that might be drawn from the data. Nevertheless, sufficient data exists to provide some early indication of patterns.

The analysis of accidents by phase of flight suggests some differences between fixed-wing and rotary-wing aircraft. Fixed-wing accidents in private operations are dominated by landing accidents. Just over half of all recorded accidents (50.4 per cent) occurred in this phase, although none of these were fatal accidents. Other phases of flight each accounted for 10 per cent or less of fixed-wing accidents, and initial climb, cruise, manoeuvring, and approach phases were noteworthy as they also included fatal accidents. By contrast, accidents involving rotary-wing aircraft were more evenly spread among four phases of flight: take-off, cruise, manoeuvring, and landing. Together, accidents in these phases accounted for 76 per cent of rotary-wing accidents. Fatal rotary-wing accidents were recorded only against the cruise and manoeuvring phases.

While differences between the two aircraft types were apparent when analysed by phase of flight, the pattern was more similar when accidents were examined according to the type of accident. Around two-thirds of all accidents involved operational factors, with the remaining third associated with mechanical factors. The most common accident types for fixed-wing and rotary-wing aircraft were associated with collisions, loss of aircraft control, airframe, and powerplants. Collision accidents and those involving a loss of aircraft control were also more commonly associated with fatal accidents for both aircraft types.

ABBREVIATIONS

ATSB	Australian Transport Safety Bureau
BTRE	Bureau of Transport and Regional Economics
CASA	Civil Aviation Safety Authority
n	Number of records
MTOW	Maximum take-off weight
PIC	Pilot in command
PPL	Private pilot licence
PPLA	Private pilot (aeroplane) licence
PPLH	Private pilot (helicopter) licence
RPT	Regular public transport

1 INTRODUCTION

1.1 Background to the report

Earlier this year the Australian Transport Safety Bureau (ATSB) released the inaugural edition of *Australian Aviation Safety in Review* (ATSB, 2007), providing an overview of accident and fatal accident data across a range of operational categories. That report showed private aircraft operations having an accident rate among the highest of all categories, and typically second only to aerial agriculture operations (Figure 1). Moreover, private operations had the highest rate of fatal accidents within general aviation (Figure 2) and the highest rate of fatalities (a measure of the total number of people receiving fatal injuries from accidents).

Figure 1: General aviation accident rate per 100,000 hours flown, 2001 to 2005

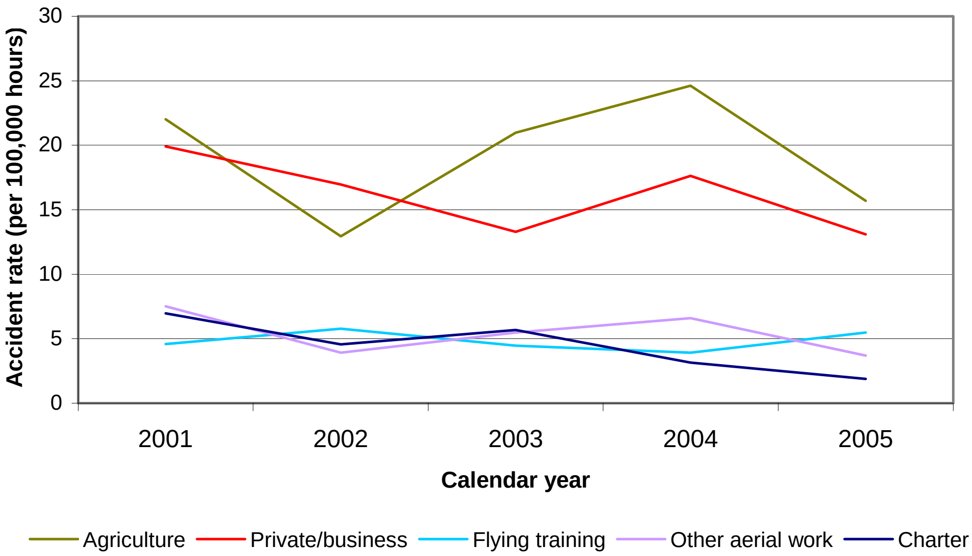
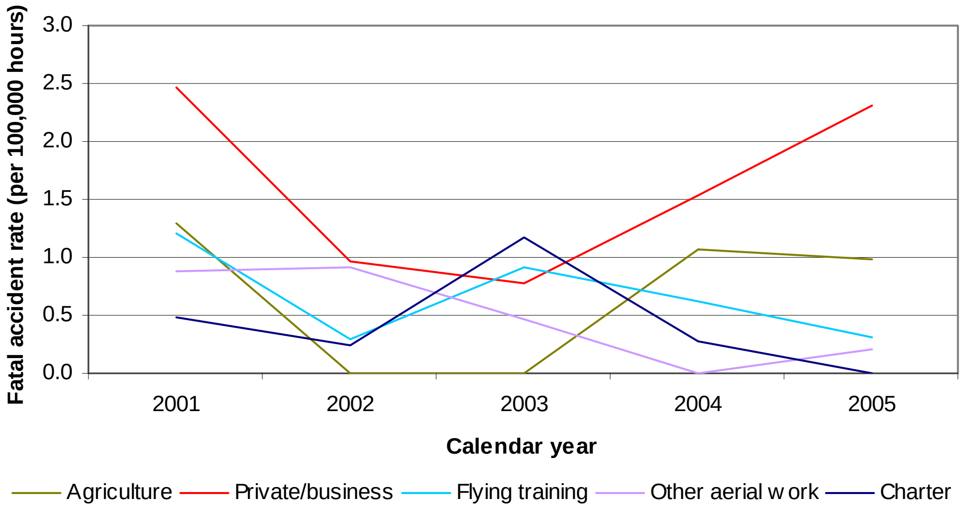


Figure 2: General aviation fatal accident rate per 100,000 hours flown, 2001 to 2005



The ATSB report also noted the increasing number of rotary-wing aircraft registered in Australia, and corresponding to that, a growing number of licence holders for rotary-wing aircraft. Hence, it was considered timely to take a closer look at private operations involving rotary-wing aircraft to better understand the nature of accidents in this type of aircraft. In doing so, this report considers similarities and differences between accidents involving fixed-wing and rotary-wing aircraft conducting private operations.

Accident rates for all of general aviation also indicate that rotary-wing aircraft have a higher accident rate than fixed-wing aircraft. However, the difference in accident rates between the two aircraft types is less obvious for private operations, indicating accidents involving fixed-wing aircraft are two to three times more common in private operations than for general aviation overall (Figure 3 and Figure 4).

Figure 3: General aviation accident rate per 100,000 hours flown by aircraft type, 2001 to 2005

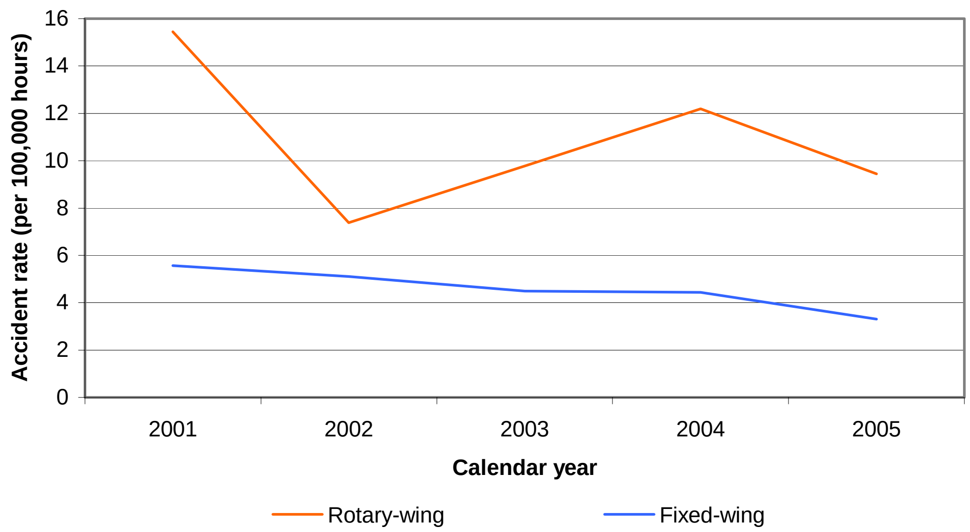
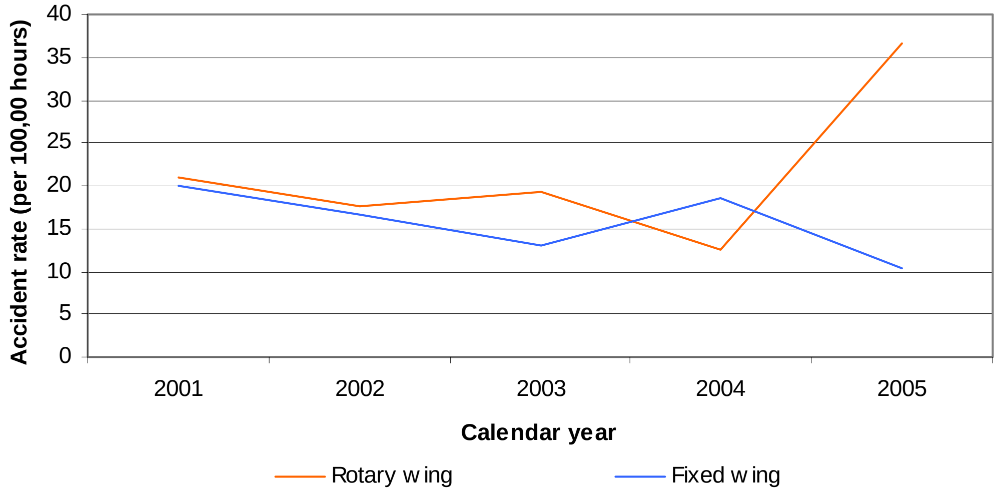


Figure 4: Private operations accident rate per 100,000 hours flown by aircraft type, 2001 to 2005



1.2 Objectives

The purpose of this report was to examine fixed-wing and rotary-wing accidents involving private operations for the period 2001 to 2005. Specifically, the objectives were to:

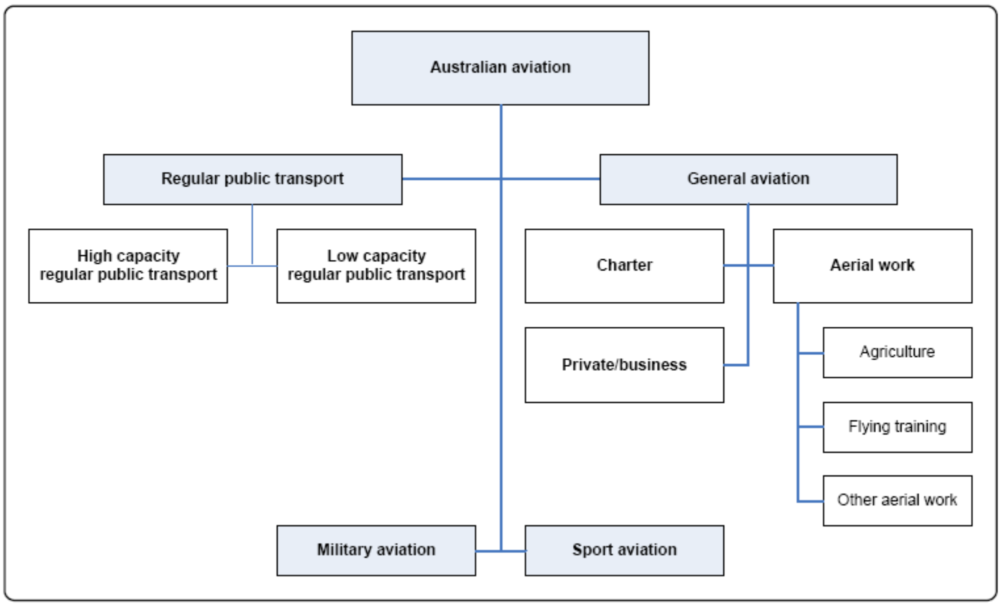
- provide an overview of accident and fatal accident rates; and
- examine accidents by phase of flight and event type.

1.3 The Australian aviation industry

The ATSB is responsible for the independent investigation of accidents and incidents involving civil aircraft in Australia. For recording and statistical purposes, the ATSB divides the Australian aviation industry into four main categories. These are regular public transport (RPT), general aviation, sport aviation and military aviation. The ATSB's aviation accident and incident database captures data predominantly involving RPT and general aviation aircraft. As shown in Figure 5, RPT is divided into high capacity and low capacity operations. General aviation is divided into charter, flying training, agriculture, other aerial work, and private/business operations.

Some data on sport and military operations are included in the database, but investigations into accidents involving sport operations (eg ultralights, microlights/trike, gyroplanes, gliders and hang gliders) will only be conducted if it benefits future safety, and sufficient resources are available (ICAO, 2003). Military operations are normally overseen by military safety authorities.

Figure 5: The Australian aviation industry



The purpose of this report was to examine accidents involving private operations. Generally, private flying refers to flying conducted for the purposes of recreation or personal transport. Within private flying there is a sub-category of operations referred to as business flying. This is associated with flying operations in support of a non-flying business or profession, whereby the flight does not generate revenue directly. Business flying is analogous to the use of a company car. The following are regarded as private operations (CASA, 2007):

i. the personal transportation of the owner of the aircraft;

ii. aerial spotting where no remuneration is received by the pilot or the owner of the aircraft or by any person or organisation on whose behalf the spotting is conducted;

iii. agricultural operations on land owned and occupied by the owner of the aircraft;

iv. aerial photography where no remuneration is received by the pilot or the owner of the aircraft or by any person or organisation on whose behalf the photography is conducted;

v. the carriage of persons or the carriage of goods without a charge for the carriage being made other than the carriage, for the purposes of trade, of goods being the property of the pilot, the owner or the hirer of the aircraft;

vi. the carriage of persons, but not in accordance with a fixed schedule between terminals, provided that:

- public notice of the flight has not been given by any form of public advertisement or announcement;
- the number of persons on the flight, including the operating crew, does not exceed six;
- no payment is made for the services of the operating crew;
- the persons on the flight, including the operating crew, share equally in the costs of the flight; and
- no payment is required for a person on the flight other than the cost sharing payment above.

vii. the carriage of goods otherwise than for the purposes of trade;

viii. conversion training for the purpose of endorsement of an additional type or category of aircraft in a pilot licence; or

ix. any other activity of a kind substantially similar to any of those specified in subparagraphs (i) to (viii) (inclusive).

1.4 The private pilot licence

The private pilot licence (PPL) is the most common licence type in Australia[1], accounting for around half of all current pilot licences. It is from within this category that some pilots will undertake advanced training to gain commercial or other higher level licences. The *Civil Aviation Regulations (1998)* set out the minimum experience required to obtain a PPL[2]. However, most trainees take more than the minimum hours specified to reach the appropriate standard.

Private pilot (aeroplane) licence (PPLA)

Prior to undertaking the PPLA flight test a student must meet the following training requirements and possess the following minimum aeronautical experience:

40 hours total flight time which includes:

- 5 hours general flight time as pilot-in-command (PIC);
- 5 hours cross country flight time as PIC;
- 2 hours instrument flying;
- pass the PPLA written examination;
- hold or be qualified to hold a Flight Radio Telephone Operator Certificate; and
- be recommended by the Chief Flying Instructor.

Prerequisite experience for a rotary-wing licence is similar to that for fixed-wing. However, if the candidate for a PPL (helicopter) holds an aeroplane or gyrocopter licence, the student will require 25 per cent additional flight time, compared to the PPLA requirements, before meeting the minimum experience criteria.

Private pilot (helicopter) licence (PPLH)

A person's aeronautical experience must consist of:

(a) if the person holds an aeroplane pilot licence or a gyroplane pilot licence—at least 38 hours of flight time as a pilot of a helicopter that includes:

(i) at least 35 hours of general flight time; and

(ii) at least 3 hours of cross-country flight time; or

(b) in any other case—at least 50 hours of flight time as a pilot of a helicopter that includes:

(i) at least 35 hours of general flight time; and

(ii) at least 15 hours of cross-country flight time.

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1 There were 15,999 private pilot licence holders as of 31 December 2005.

2 The PPL uses the terms aeroplane and helicopter. However, the remainder of the report refers to aeroplanes as fixed-wing aircraft, and helicopters as rotary-wing aircraft.

A minimum of a Class 2 medical certificate[3] is required to hold a PPL. A medical clearance remains valid for a period of 4 years, or for 2 years after the age of 40. Once a pilot is granted a PPL, without any additional endorsements, he or she can:

- fly solo anywhere in Australia[4];
- carry passengers, but not for hire or reward; and
- fly by day under the visual flight rules.

The holder of a PPL also needs to meet certain currency requirements in order to exercise the privileges of the licence. These include, having carried out three take-offs and landings within the previous 90 days (if carrying passengers), and having satisfactorily completed a flight review, or passed a flight test for the issue or renewal of a rating within the 2 years immediately prior to the proposed flight.

Additional training for a variety of advanced endorsements and ratings can be undertaken, including:

- private instrument flight rules rating;
- night visual flight rules rating;
- instrument rating;
- manual propeller pitch control endorsement; and
- retractable undercarriage endorsement.

Private pilots are not limited by the flight time restrictions imposed on commercial aircrew. However, as private pilots generally fly very few hours each year, the risk of fatigue related to flying activity is very low. This is not to say that private pilots are not subject to fatigue for other reasons. Private pilots need to monitor their fatigue closely to be confident that they are fit to fly.

1.5 Activity data for private operations

Fixed-wing aircraft

Fixed-wing aircraft comprise the majority of aircraft registered in Australia. They are also the most common aircraft type used in private operations. Fixed-wing hours were relatively consistent over the study period, accounting for 90.2 per cent of all private hours (Table 1).

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3 There are three types of medical certificates issued by the Civil Aviation Safety Authority (CASA), relating to varying types of licences held. These are: Class 1, applicable to airline and commercial pilots, flight engineers and flight navigators; Class 2, applicable to student and private pilots, and commercial balloon pilots; and Class 3, applicable to air traffic controllers and flight service officers. These medicals are conducted by Designated Aviation Medical Examiners.

4 Specific training is required prior to flight in controlled airspace (Civil Aviation Order 40.0 subsection 3).

Fixed-wing aircraft used in private operations vary by size, age, engine type, and number of engines. In 2005, fixed-wing piston engine aircraft accounted for 93.0 per cent of general aviation hours flown. For the same year, the average age of piston engine aircraft was about 30 years. Table 1 provides some activity data for fixed-wing operations[5].

Table 1: Fixed-wing activity data

	2001	2002	2003	2004	2005	% change
Hours flown (private)	364,152	378,673	347,035	351,146	348,647	-4.3
Number of aircraft on the register (MTOW[6] below 5,700kg)	8,762	8,792	8,934	9,071	9,218	5.2
PPLA	Not available	16,519	16,330	15,079	15,612	-5.5

Note: Licence holder statistics are shown by financial year; other statistics are by calendar year.

Rotary-wing aircraft

Since 2002, the overall activity for rotary-wing aircraft has generally grown, with the number of hours flown and number of aircraft on the register increasing. The number of rotary-wing licences has remained fairly stable over this period (Table 2).

Table 2: Rotary-wing activity data

	2001	2002	2003	2004	2005	% change
Hours flown (private)	42,800	33,936	36,485	40,009	41,019	-4.2[7]
Number of aircraft on the register (MTOW below 5,700kg)	967	1,034	1,123	1,196	1,291	7.9
PPLH	Not available	391	393	385	387	4.3

Note: Licence holder statistics are shown by financial year; other statistics are by calendar year.

Piston engine rotary-wing aircraft accounted for 60.6 per cent of the hours flown for rotary-wing aircraft in 2005, while the remaining 39.4 per cent were attributed to rotary-wing aircraft powered by turbo-shaft engines (also referred to as turbine engines). In the same year, the average age of piston engine rotary-wing aircraft was 16 years, which is considerably lower than the average age of fixed-wing aircraft (ATSB, 2006).

5 Hours flown activity data was provided by the Bureau of Transport and Regional Economics; PPL numbers and aircraft registration data were sourced from the Civil Aviation Safety Authority.

6 MTOW: Maximum take-off weight.

7 Since 2002, there has been a 20.9 per cent change in the number of hours flown for private operations.

The hours flown data provided by the Bureau of Transport and Regional Economics (BTRE) indicates a decrease in rotary-wing activity involved in private operations in 2002, compared with 2001. However, when compared with the activity data for 2000 (30,034 hours flown), 2001 data appears to be unusually high. A further examination of the data for that year was unable to identify the reason for the apparent increase in activity. Consequently, while there appears to be a decrease in activity between 2001 and 2005, a comparison between 2000 and 2005 shows an increase of 36.6 per cent in activity for rotary-wing private operations.

The average time flown by private pilots was low. In 2005 the combined rate was 24.4 hours per year: 22.3 hours per year for fixed-wing pilots and 106.0 hours for rotary-wing pilots. Generally, a pilot licence does not have an expiry date. However, the authority to use the licence depends on the person holding a valid medical certificate, and meeting recency requirements and appropriate ratings. This means that while the licence is considered to be current, pilots may be inactive. For this reason the average number of hours flown by private pilots is not necessarily a particularly accurate measure of actual annual flying experience of pilots within this category of operations. However, the average number of flying hours provides a general indication of activity among private pilots.

2 METHODOLOGY

2.1 Data sources

The accident data used within this report was extracted from the ATSB's aviation safety accident and incident database. Hours flown activity data was provided by the BTRE.

For statistical purposes, the ATSB records private operations involving aerial spotting, aerial agriculture and aerial photography activities (as outlined in Section 1.3) against the type of activity being conducted rather than the operation type. Hence, private operations involving aerial spotting, aerial agriculture and aerial photography are not included in this study.

2.2 Method of analysis

The ATSB aviation database was searched to identify those accidents involving Australian civil registered aircraft (VH-) operating within and outside Australian territory for the period 2001 to 2005 that were conducting private operations. This dataset included information on the event type and phase of flight. Of the private operations accidents identified, two accidents involved more than one aircraft. For statistical purposes, each of these accidents was counted only once.

Accident rate data was calculated using the hours flown data to enable an equivalent comparison of accident involvement between fixed-wing and rotary-wing aircraft. Rates used in this report are based on 100,000 hours flown.

3 RESULTS AND DISCUSSION

3.1 Accident numbers

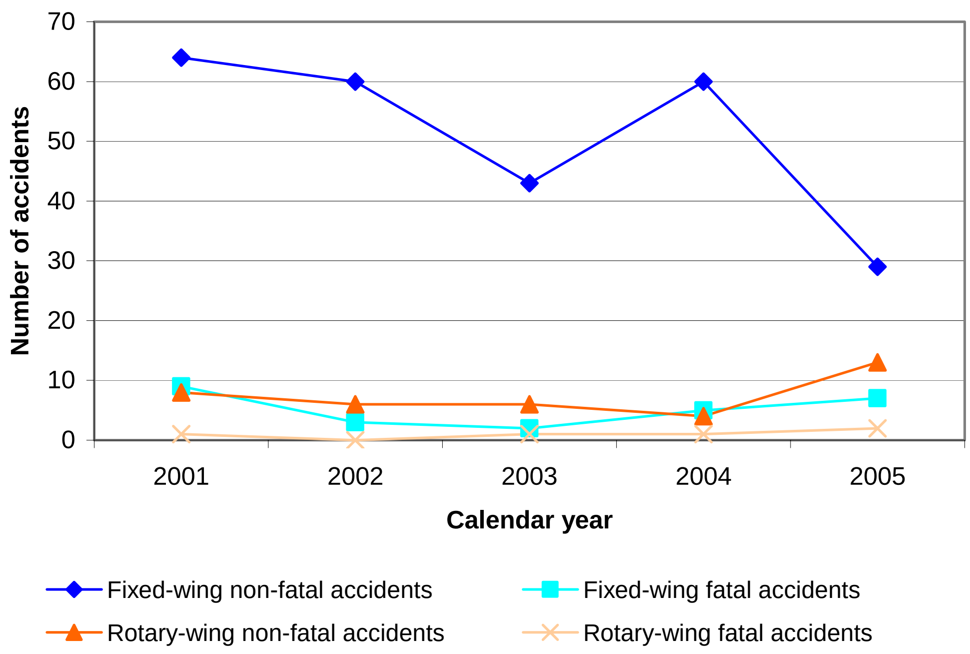
A search of the ATSB's aviation safety database identified a total of 324 private and business aircraft accidents between 2001 and 2005. In line with activity data, the majority of these accidents involved fixed-wing aircraft, accounting for 87.0 per cent (n = 282). Rotary-wing aircraft accounted for the remaining 13 per cent (n = 42).

Of the 282 accidents involving fixed-wing aircraft, 90.8 per cent were non-fatal (n = 256), while 9.2 per cent were fatal accidents (n = 26). For rotary-wing aircraft, 88.1 per cent of accidents were non-fatal (n = 37), while 11.9 per cent were fatal (n = 5).

As shown in Figure 6, the number of non-fatal accidents involving fixed-wing aircraft in 2005 was considerably lower than in previous years, and less than half the number recorded in 3 of the previous 4 years. Fatal accidents over the period were relatively low each year, ranging from nine in 2001 to two in 2003. Fatal accidents as a proportion of all fixed-wing accidents varied with the change in the number of non-fatal accidents. In 2003, fatal accidents accounted for 4.4 per cent of all fixed-wing accidents, but in 2005 they accounted for 19.4 per cent of fixed-wing accidents in private operations (Table 3).

The number of accidents involving rotary-wing aircraft conducting private operations generally declined between 2001 and 2004, but increased in 2005 (Figure 6 and Table 3).

Figure 6: Number of accidents in private operations, 2001 to 2005



3.2 Accident rates

Fixed-wing aircraft accounted for 90.2 per cent of private operations flying hours, but only 87.0 per cent of private accidents. Rotary-wing aircraft, on the other hand, accounted for 9.8 per cent of private operations flying hours, but 13.0 per cent of accidents. Hence, rotary-wing aircraft were involved in proportionally more accidents than fixed-wing aircraft (Table 3).

Table 3: Accident numbers and rates for private aircraft operations, 2001 to 2005

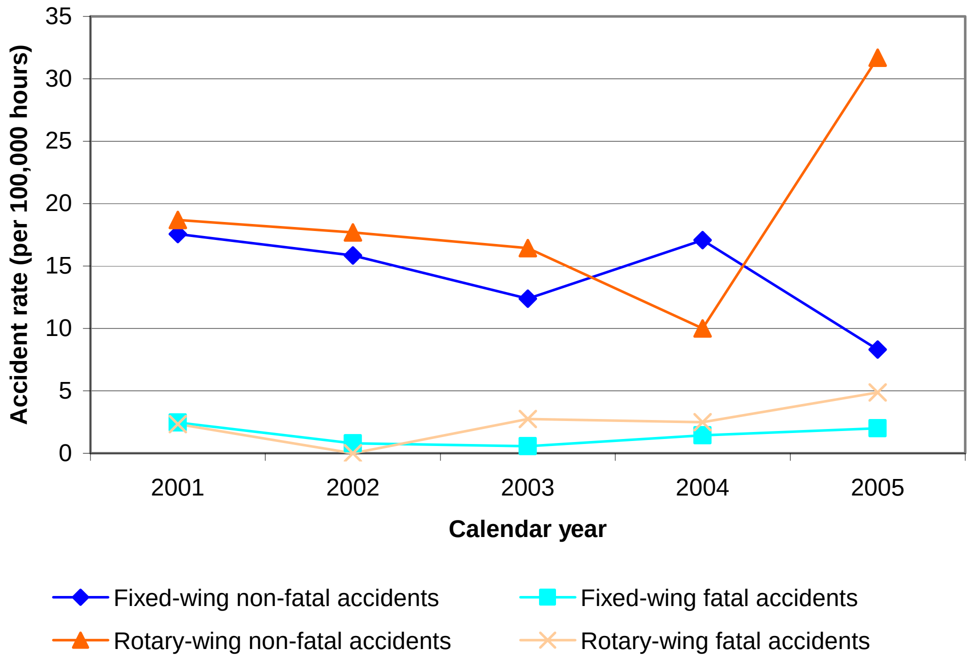
Fixed-wing accidents						
	Non-fatal			Fatal		
	No.	Rate	% of total fixed-wing	No.	Rate	% of total fixed-wing
2001	64	17.6	87.7	9	2.5	12.3
2002	60	15.8	95.2	3	0.8	4.8
2003	43	12.4	95.6	2	0.6	4.4
2004	60	17.1	92.3	5	1.4	7.7
2005	29	8.3	80.6	7	2.0	19.4
Total	***256***	***14.3***	***90.8***	***26***	***1.5***	***9.2***

Rotary-wing accidents						
	Non-fatal			Fatal		
	No.	Rate	% of total rotary-wing	No.	Rate	% of total rotary-wing
2001	8	18.7	88.9	1	2.3	11.1
2002	6	17.7	100.0	0	0.0	0.0
2003	6	16.4	85.7	1	2.7	14.3
2004	4	10.0	80.0	1	2.5	20.0
2005	13	31.7	86.7	2	4.9	13.3
Total	***37***	***19.0***	***88.1***	***5***	***2.6***	***11.9***

The non-fatal accident rate for fixed-wing aircraft reduced from 17.6 per 100,000 hours flown in 2001, to 8.3 per 100,000 hours in 2005, with some variability in the intervening years. The fatal accident rate reduced from 2.5 per 100,000 hours in 2001 to a low of 0.6 per 100,000 hours in 2003, before increasing to 2.0 per 100,000 hours in 2005 (Figure 7).

The non-fatal accident rate for rotary-wing aircraft declined between 2001 and 2004, but increased considerably in 2005. The fatal accident rate was reasonably steady until 2005, when it increased to 4.9 per 100,000 hours. However, meaningful trends cannot be identified due to the very small number of fatal accidents involving rotary-wing aircraft (Figure 7).

Figure 7: Accident rates per 100,000 hours flown in private operations, 2001 to 2005



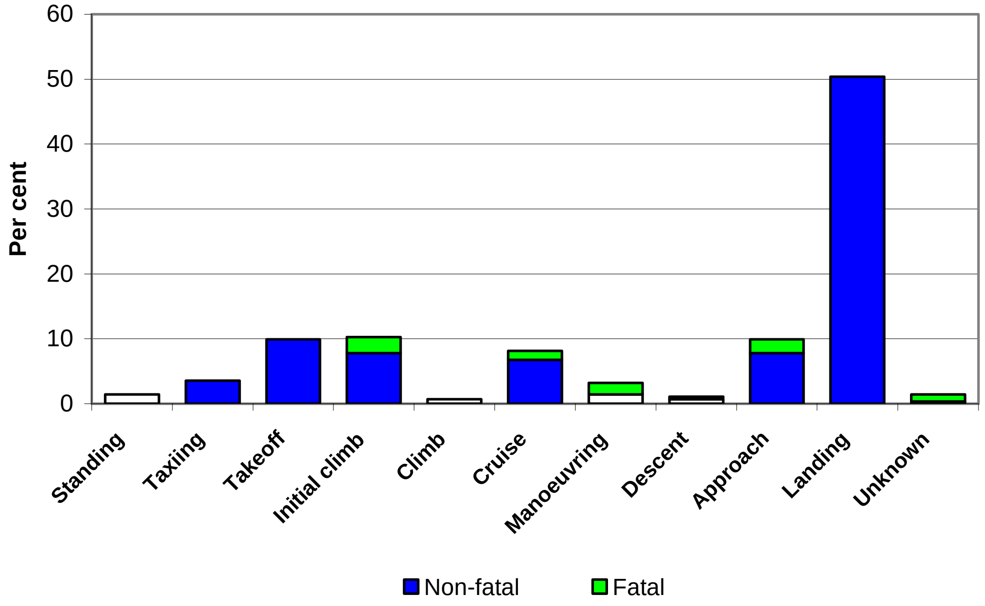
3.3 Phase of flight

An analysis was conducted using the phase of flight in which the accident occurred. This analysis enabled identification of the stages of flight where accidents are most prevalent, and also, the phases of flight most commonly associated with fatal accidents.

Landing was the most prominent phase of flight for accidents involving fixed-wing aircraft, accounting for half (50.4 per cent) of all accidents between 2001 and 2005. Other phases of flight each accounted for around 10 per cent of accidents or less, and were reasonably equally distributed among take-off, initial climb, cruise and approach. The initial climb and approach phases recorded an equal proportion of non-fatal accidents (7.8 per cent each) and similar fatal accident rates (2.1 per cent and 2.5 per cent respectively). There were no fatal accidents during the take-off or landing phases for fixed-wing private operations, but fatal accidents were recorded against the approach, manoeuvring, cruise, and initial climb phases of flight. In four accidents, the phase of flight was unknown (Figure 8).

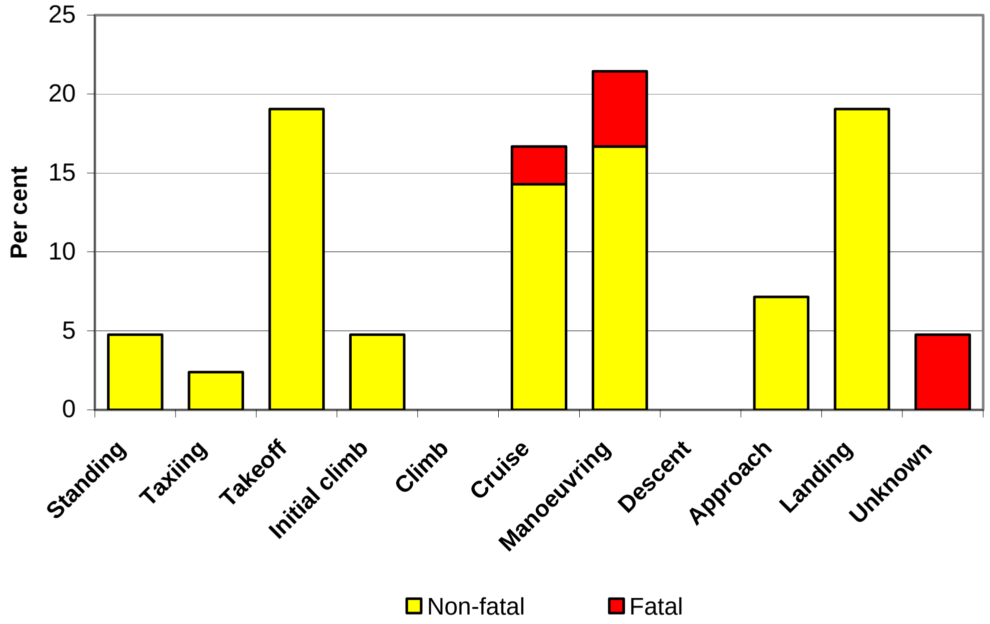
As a proportion of time spent in each phase of flight, fixed-wing accidents were over-represented in initial climb, take off, approach, and landing, which normally account for only a small proportion of flight time. Accidents during the approach and initial climb phases are particularly dangerous as the aircraft is operated nearer to the aerodynamic stall speed and at a height from which recovery may not be possible should control be lost.

Figure 8: Fixed-wing accidents by phase of flight for private operations, 2001 to 2005



Rotary-wing accidents are common in the landing phase, but to a much lesser extent than for fixed-wing aircraft (19.1 per cent compared with 50.4 per cent). Instead, accidents are more evenly distributed across four phases of flight (manoeuvring, landing, take-off and cruise) that together accounted for 76.2 per cent of all accidents. Like fixed-wing accidents, fatalities were recorded against the manoeuvring and cruise phases of flight (4.8 per cent and 2.4 per cent respectively); however, none were recorded against the initial climb or approach phases. The phase of flight for two fatal rotary-wing accidents could not be established, so these are listed here as unknown (Figure 9).

Figure 9: Rotary-wing accidents by phase of flight for private operations, 2001 to 2005



Overall, fixed-wing accidents were distributed across all phases of flight, whereas no rotary-wing accidents occurred in the descent or climb phases. Landing accidents were the most common accident by phase for fixed-wing aircraft, but were less common for rotary-wing aircraft. Rotary-wing aircraft recorded the highest proportion of accidents during manoeuvring, but for fixed-wing aircraft, this phase accounted for only 3.2 per cent of accidents. Despite these differences, manoeuvring had the highest proportion of fatal accidents.

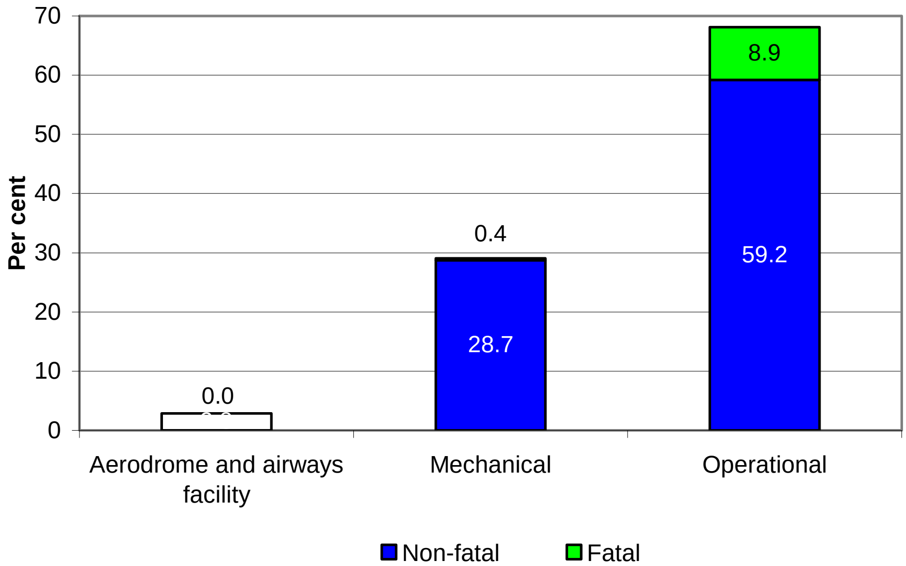
3.4 Event type analysis

Consistent with the presentation in the *Australian Aviation Safety in Review*, the accidents involving private operations examined in this report have been classified into three key event types: aerodrome and airways facility, operational, and mechanical. This classification provides a broad overview of the type of accidents experienced in private operations. These categories are further divided into more descriptive event types, referred to here as the primary event (refer to Appendix A).

3.4.1 Aerodrome and airways facility, operational, and mechanical factors

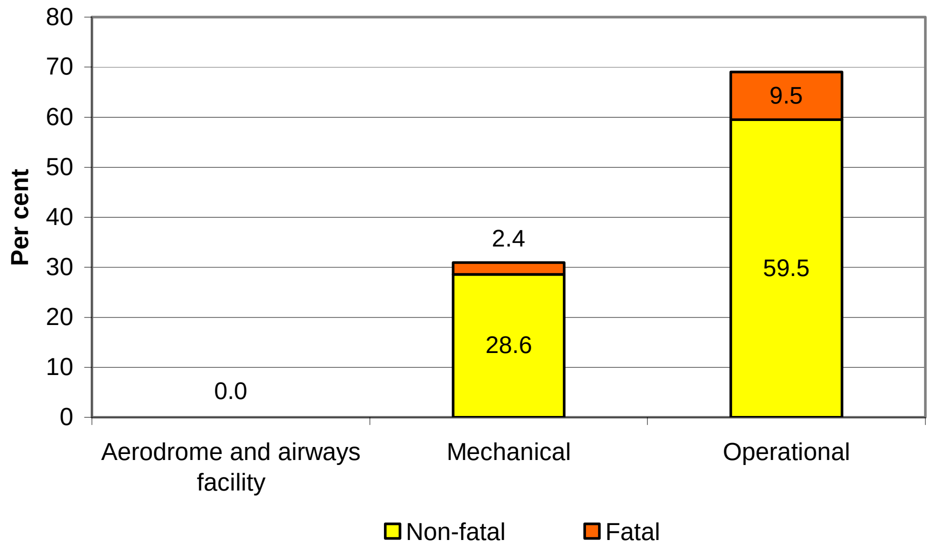
Of the three event classification types, the greatest proportion of accidents involving private operations were attributed to operational factors, accounting for 68.1 per cent of fixed-wing accidents. Operational factors were also associated with the largest proportion of fatal accidents (8.9 per cent). This was followed by mechanical factors, totalling 29.1 per cent, of which the majority were non-fatal accidents (only one fatal accident). The lowest proportion of accidents involved aerodrome and airways facilities, which accounted for 2.8 per cent of the total accidents and recorded no fatal accidents (Figure 10).

Figure 10: Classification of private operation fixed-wing accidents, 2001 to 2005



Operational factors were also identified as the most prominent event type in rotary-wing accidents, and at a rate similar to those involving fixed-wing aircraft (69.0 per cent). Fatal accidents in this category accounted for 9.5 per cent of all rotary-wing accidents, which again, was similar to fixed-wing accidents. Mechanical factors accounted for 31.0 per cent of accidents, of which 28.6 per cent were non-fatal and 2.4 per cent were fatal. No rotary-wing accidents were recorded against aerodrome and airways facilities (Figure 11).

Figure 11: Classification of private operation rotary-wing accidents, 2001 to 2005



An operational factor was the most common event type for both fixed-wing and rotary-wing aircraft involved in private operations, accounting for just over two-thirds of all accidents, and the majority of fatal accidents. Mechanical accidents accounted for just under a third of accidents.

3.4.2 Primary event analysis

The three broad event types were examined further to provide more detail about these accidents.

Private accidents involving fixed-wing aircraft were recorded against the majority of event types, but were most common in five categories (Figure 12). The highest proportion of accidents involved aircraft control[8] (18.8 per cent), which also recorded the highest proportion of fatal accidents (4.6 per cent). This was followed by collisions[9], which accounted for 16.7 per cent of accidents and 2.8 per cent of fatal accidents. Other accidents involved powerplant/propulsion systems and airframe problems. Hard landings were also common, although no fatal injuries resulted from this type of accident. Inflight breakup and medical/injury related only recorded two accidents each, all resulting in fatalities.

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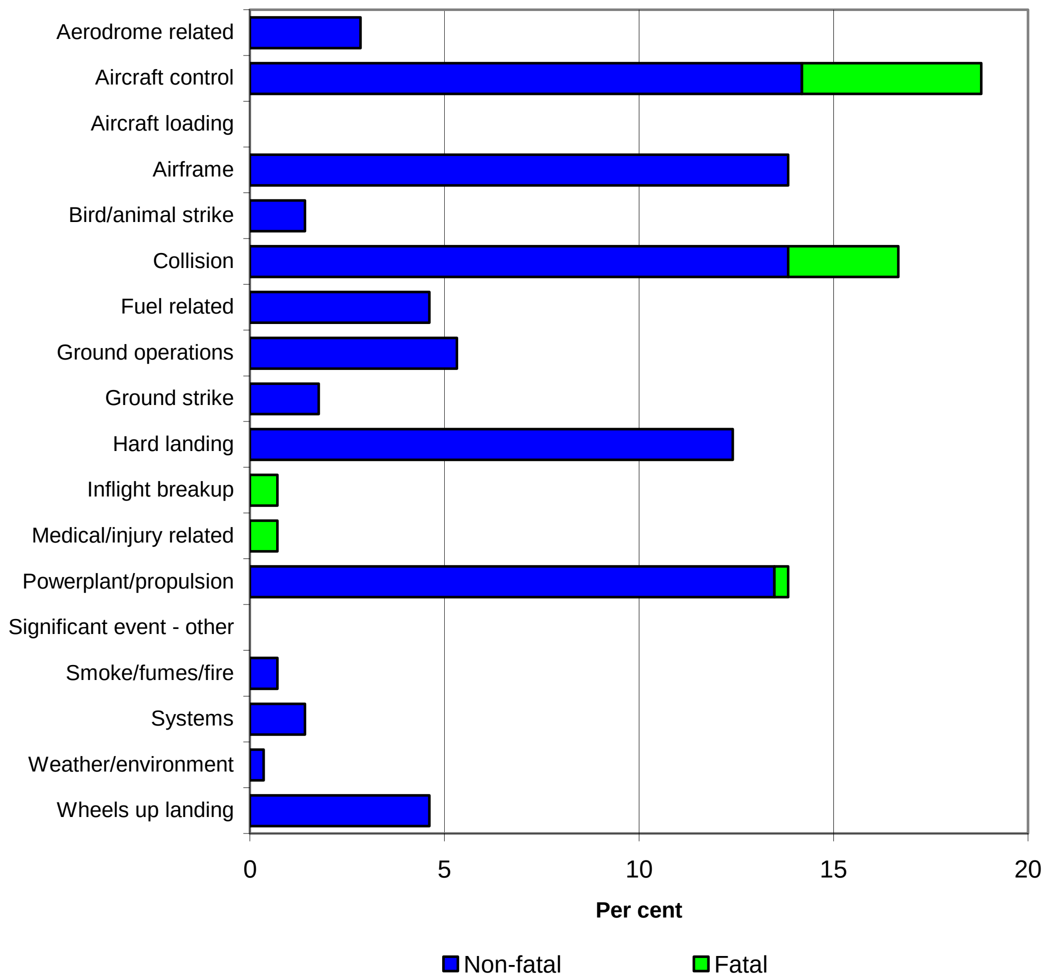
8 Aircraft control accidents refer to those accidents involving the loss of control of the aircraft either in the air or on the ground.

9 Collision events include mid-air collisions, collisions with terrain, controlled flight into terrain, wirestrikes and collisions on ground. The two most common types of collision were collision with terrain and collision on ground.

Other event types were each cited in about 5 per cent or less of the 282 fixed-wing accidents recorded between 2001 and 2005.

Figure 12: Primary event analysis of private operation fixed-wing aircraft accidents, 2001 to 2005

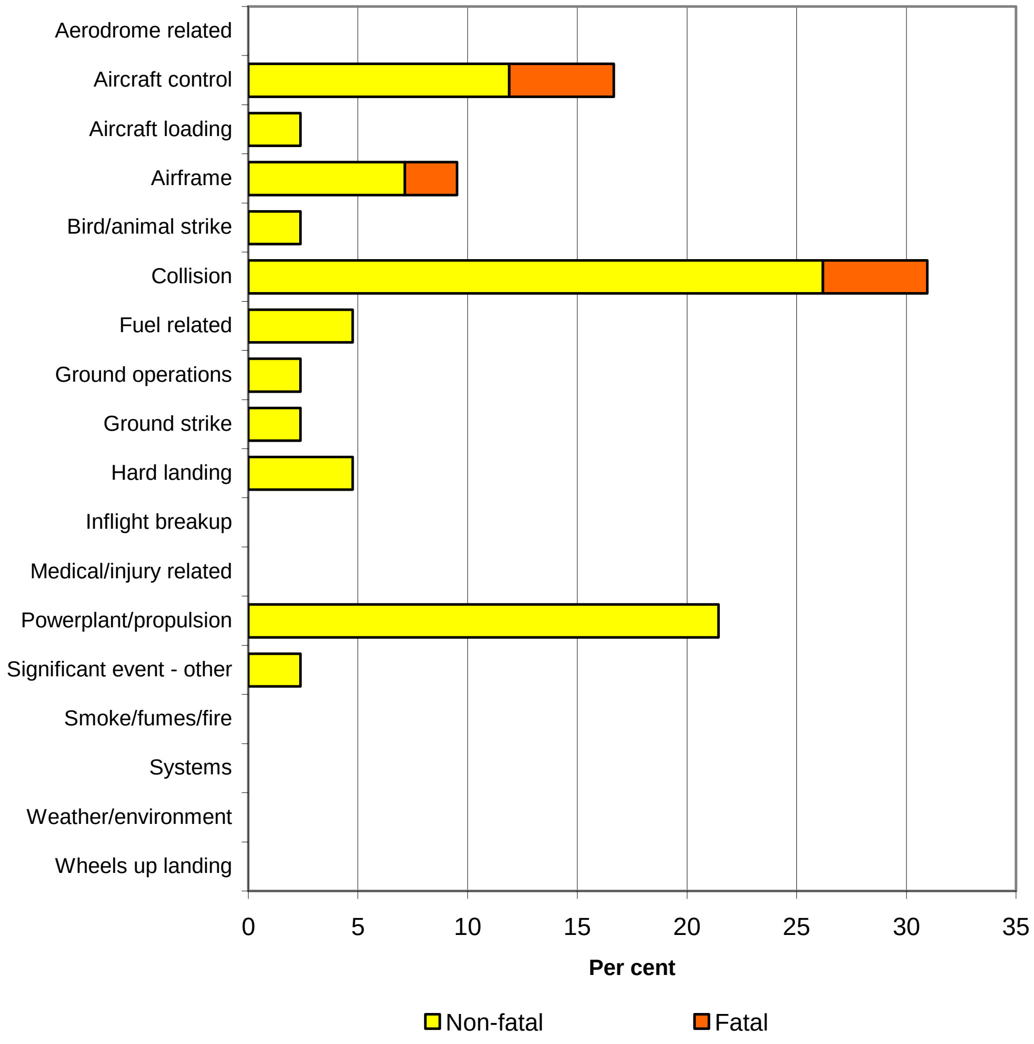


Like fixed-wing aircraft accidents, the majority of accidents for rotary-wing aircraft involved only a few event sub-types. Collisions were the most common event affecting rotary-wing aircraft (31.0 per cent), of which 4.8 per cent resulted in fatalities. Powerplant/propulsion factors were also common, accounting for 21.4 per cent of accidents, although none of these were fatal. Aircraft control was identified in 16.7 per cent of accidents, of which 4.8 per cent had a fatal outcome. Accidents involving the airframe accounted for 9.5 per cent of accidents, and mostly involved problems associated with the main or tail rotor[10]. One of these accidents resulted in fatal injuries (Figure 13).

Most other event types were rare. This analysis involved only 42 rotary-wing occurrences over 5 years – over a longer period, other occurrence types might become apparent. Nevertheless, a pattern is emerging that indicates the most common types of accidents, and it is possible to compare these with the much larger pool of data involving fixed-wing aircraft.

10 The ATSB classifies events where the main or tail rotor has failed as airframe occurrences.

Figure 13: Primary event analysis of private operation rotary-wing aircraft accidents, 2001 to 2005



4 CONCLUSION

Private operations typically account for around 400,000 flying hours per year, or around one-quarter of general aviation activity. In recent years, rotary-wing activity has increased, and now contributes about 10 per cent of all private hours flown.

The accident rate for private operations has generally declined over the 5 years examined in this report, although this decline has not been consistent. Fatal accidents for fixed-wing aircraft and for rotary-wing aircraft have remained low, but the fatal accident rate for rotary-wing activity appears to be climbing gradually. As the number of rotary-wing aircraft involved in private operations is still reasonably low, it is not clear whether the apparent upward trend in fatal accident rates is real, or just the result of small annual variations that are more pronounced because small numbers are involved.

Overall, the pattern of event types for fixed-wing and rotary-wing accidents share a good deal of similarity. Most accidents can be attributed to a small number of common event types: collisions, aircraft control, airframe and powerplant issues. Moreover, collision and aircraft control accidents are the most frequent accidents that result in fatalities. Hard landings are more prominent for fixed-wing aircraft, reflecting the different flying characteristics of fixed-wing and rotary-wing aircraft, but in any case, these are not typically associated with fatal injuries.

Differences between fixed-wing and rotary-wing aircraft are more apparent when accidents are examined by phase of flight. The landing phase accounts for more than half of all fixed-wing accidents, but less than one-fifth of rotary-wing accidents. For rotary-wing, take-off accidents are about as common as landing accidents, which is not the case for fixed-wing. Manoeuvring and cruise are among the most common phases of flight for accidents involving rotary-wing aircraft, and are also associated with fatal accidents. While fatal accidents involving fixed-wing aircraft are found in these two phases of flight, fatalities are also associated with accidents in the initial climb and approach phases

With approximately 16,000 licensed private pilots in Australia, the average flying activity for the individual pilot is relatively low. This appears to be particularly true for pilots of fixed-wing aircraft. Opportunities to improve flying skills, especially in the approach and landing phases where accidents are most frequent, are therefore limited. More important, however, are the collision and aircraft control accidents, which tend to be associated with fatal accidents for pilots of both rotary-wing and fixed-wing aircraft.

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6 APPENDIX: EVENT TYPE ANALYSIS

AERODROME AND AIRWAYS FACILITY

Aerodrome related

MECHANICAL

Airframe

Powerplant/propulsion

Systems

OPERATIONAL

Aircraft control

Aircraft loading

Bird/animal strike

Collision

Fuel related

Ground operations

Ground strike

Hard landing

Inflight breakup

Medical/injury related

Significant event - other

Smoke/fumes/fire

Weather/environment

Wheels up landing

An analysis of fixed-wing and rotary-wing aircraft accidents involving private operations, 2001 to 2005