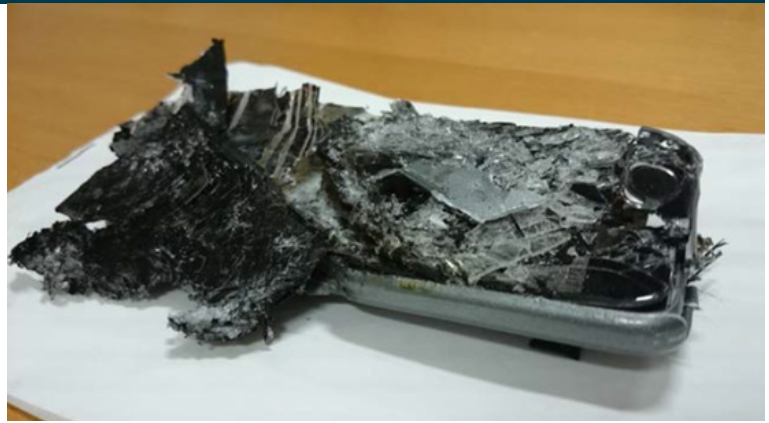




Australian Government
Australian Transport Safety Bureau

Aviation Occurrence Statistics

2007 to 2016



Research

ATSB Transport Safety Report

Aviation Research
AR-2017-104
Final – 15 January 2018

Publishing information

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

© Commonwealth of Australia 2018



Ownership of intellectual property rights in this publication

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

Creative Commons licence

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

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

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

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

Addendum

| Page | Change | Date |
|------|--------|------|
| | | |
| | | |

Safety summary

The purpose of this report

Each year, thousands of safety occurrences involving Australian and foreign-registered aircraft are reported to the Australian Transport Safety Bureau (ATSB) by individuals and organisations in Australia's aviation industry and by members of the general public.

This report is part of a series that aims to provide information to the aviation industry, manufacturers and policy makers, as well as to the travelling and general public, about these aviation safety occurrences. In particular, what can be learned to improve transport safety in the aviation sector.

The study uses information over the ten-year period from 2007-2016 to provide an insight into the current and possible future trends in aviation safety, and takes a detailed look at the accidents and incidents in 2016 for each type of aircraft operation.

What the ATSB found

The majority of air transport operations in Australia each year proceed without incident.

In 2016, nearly 230 aircraft were involved in accidents in Australia, with another 291 aircraft involved in a serious incident (an incident with a high probability of an accident). There were 21 fatalities in the aviation sector in 2016, which was fewer than any previous year recorded by the ATSB. There were no fatalities in either high or low capacity regular public transport (RPT) operations, which has been the case since 1975 and 2010 respectively.

Commercial air transport operations experienced one fatality from 15 accidents; general aviation experienced 10 fatalities from 119 accidents; and recreational aviation had 10 fatalities from 63 accidents.

Collision with terrain was the most common accident or serious incident for general aviation aircraft, recreational aviation and remotely piloted aircraft in 2016. Aircraft control was the most common cause of an accident or serious incident for air transport operators.

Wildlife strikes, including birdstrikes, were again the most common types of incident involving air transport and general aviation operations, with runway events the most common type of incident for recreational aviation.

The accident and fatal accident rates for general and recreational aviation reflect the higher-risk operational activity when compared to air transport operations. They also reflect the significant growth in recreational aviation activity over the last ten years and this sector's increased reporting culture.

General aviation accounts for one-third of the total hours flown by Australian-registered aircraft and over half of all aircraft movements across Australia.

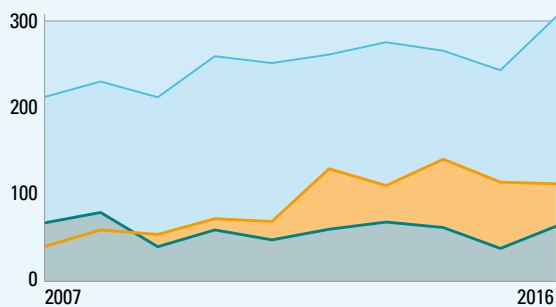
The total accident rate, per hours flown, indicates general aviation operations are 10 times more likely to have an accident than commercial operations, with recreational aircraft around twice as likely to experience an accident than general aviation.

The fatal accident rate, per hours flown, indicates general aviation operations are around 20 times more likely to experience a fatal accident than commercial air transport, and recreational operations are almost 40 times more likely to experience a fatal accident than air transport.

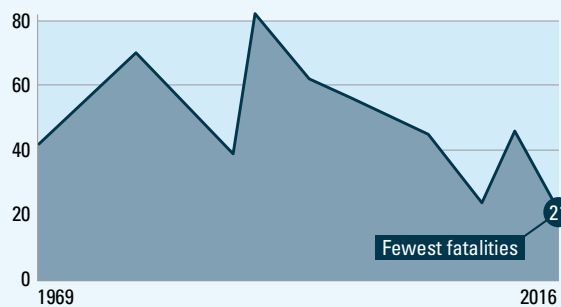
OCCURRENCES BY OPERATION TYPE

Commercial air transport General aviation Recreational aviation

Serious incidents and accidents 2016 65 305 113

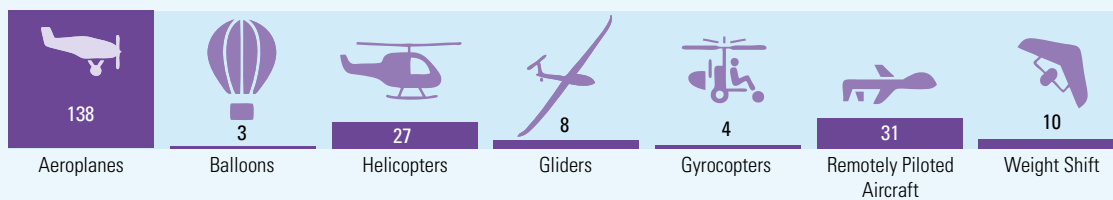


Serious incidence and accidents 2007–2016

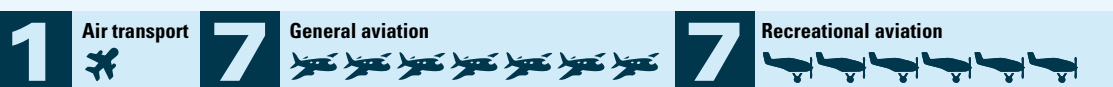


Total fatalities since recording commenced in 1969

2016 ACCIDENTS BY AIRCRAFT TYPE



2016 FATAL ACCIDENTS BY OPERATION TYPE

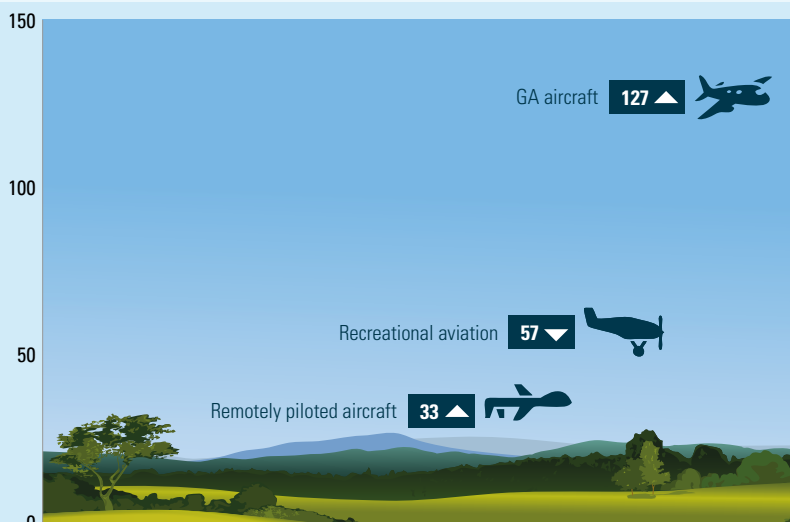


2016 OCCURRENCE TYPES: WHAT HAPPENED

▲ Trend increase ▼ Trend decrease



The most common incident involving air transport operations was **wildlife strikes**.



The most common accident and serious incident involving GA aircraft, recreational aviation and remotely piloted aircraft systems was **terrain collisions**.

Recreational gyrocopters experienced the highest fatal accident rate for any aircraft or operation type, whereas recreational balloon operations had the highest total accident rate; almost four times as high as any other aircraft operation type. There were no fatal accidents involving recreational balloons reported during the study period.

Aeroplanes remain the most common aircraft type flown which is reflected in their involvement in accidents. In 2016, nine of the 15 fatal accidents involved aeroplanes—three helicopters and two powered weight shift aircraft were also involved in fatal accidents.

In 2016, the increased availability and use of remotely piloted aircraft (RPA) saw them surpass helicopters as the second highest aircraft type for reported accidents; however, there were no collisions with other aircraft, fatalities or serious injuries relating to RPA reported to the ATSB that year. While the consequences of an accident involving an RPA have been low to date, their increased use, and possible interactions with traditional aviation, is an emerging trend in transport safety that will continue to be monitored closely by the ATSB.

Safety message

This report highlights the importance of effective and timely reporting of all aviation safety occurrences, not just for the potential of initiating an investigation, but to allow further study and analysis of aviation transport safety.

While there has been an increase in accident and incident reporting, the limited detail provided for most occurrences, especially by recreational flyers, remains a challenge for the industry and ATSB. This report also highlights the need for improvements in the reporting rates for some areas in general aviation.

By comparing accident and occurrence data across aviation operations types, the ATSB is able to develop a complete picture of the aviation industry to identify emerging trends in aviation transport safety, identify further areas for research and recommend pre-emptive safety actions.

Contents

| | |
|--|-----------|
| Context | 1 |
| Activity data | 2 |
| Departures | 2 |
| Hours flown | 4 |
| Occurrences by operation type | 9 |
| Commercial air transport | 12 |
| High capacity RPT and charter (VH- registered) | 13 |
| Low capacity RPT (VH- registered) | 16 |
| Charter (VH- registered), low capacity | 18 |
| Medical transport | 22 |
| Foreign-registered air transport | 23 |
| General aviation | 24 |
| Aerial work | 27 |
| Flying training | 34 |
| Private/business/sports aviation | 36 |
| Foreign general aviation | 40 |
| Other general aviation | 40 |
| Recreational aviation | 41 |
| Gyrocopters | 43 |
| Recreational aeroplanes | 45 |
| Weight shift | 46 |
| Remotely piloted aircraft systems | 48 |
| Occurrences by aircraft type | 50 |
| Differences in accidents between operation groups and aircraft type | 50 |
| Differences in accidents between specific operation types and aircraft types | 52 |
| Charter | 53 |
| Aerial work | 54 |
| Flying training | 54 |
| Private/business | 54 |
| Recreational aviation | 54 |
| Occurrence types: what happened | 56 |
| Commercial air transport | 56 |
| Accidents and serious incidents | 56 |
| Incidents | 58 |
| General aviation | 60 |
| Accidents and serious incidents | 60 |
| Incidents | 62 |
| Recreational aviation | 64 |
| Accidents and serious incidents | 64 |
| Incidents | 66 |
| Remotely piloted aircraft systems | 68 |
| Accidents and serious incidents | 68 |
| Incidents | 69 |
| Data sources and submissions | 70 |
| Sources of information | 70 |

| | |
|---|-----------|
| Appendices | 71 |
| Appendix A – Explanatory notes | 71 |
| Analysis methodology | 71 |
| Operation types | 72 |
| Occurrence types and events | 73 |
| Appendix B – ATSB occurrence type taxonomy | 74 |
| Australian Transport Safety Bureau | 77 |
| Purpose of safety investigations | 77 |
| Developing safety action | 77 |
| Glossary..... | 78 |

Context

Each year, the Australian Transport Safety Bureau (ATSB) receives accident and incident notifications from pilots, airline operators, air traffic control, maintenance personnel, aerodrome operators, emergency services authorities, and 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 of accidents and incidents, and the analysis of data to identify emerging trends and identify issues before they lead to accidents.

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 RRM, visit the [ATSB's website](#).¹

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

See *Appendix A – Explanatory notes* for definitions of aircraft operation types and a general explanation of the analysis approach. Definitions of occurrence categories appear in the *Glossary*.

NOTE 1:

In this edition of *Aviation occurrence statistics*, *Medical transport* operations are grouped with *Commercial air transport* operations. While consistent with the 2015 and 2016 editions of this publication, previous editions grouped *emergency medical services* under *General Aviation – Aerial work*. This change is consistent with the Civil Aviation Safety Authority's Notice of Proposed Rule Making (NPRM) 1304OS, July 2013. The NPRM outlined that Medical transport flights will operate under the requirements of an Air Transport Air Operator's Certificate (issued under CASR Part 119) and the applicable operational rule set (CASR Part 133 for helicopter operations and either Part 121 or 135 for aeroplane operations).

Consistent with the 2015 and 2016 editions, this edition also combines occurrences involving mustering activities classified within *Private* operations with *Aerial work – Mustering*.

NOTE 2:

Although comparable with the previous edition of *Aviation Occurrence Statistics*, fewer incidents are reported in this edition than earlier (pre-2014) editions due to a change of ATSB policy. Events involving operational non-compliance with air traffic control verbal or published instructions, airspace infringement, and breakdowns of co-ordination between air navigation service providers, when they occur without any other occurrence event, have not been included as incidents in these statistics since the 2014 edition. See *Appendix A – Explanatory notes* for more detail.

¹ www.atsb.gov.au/about_atsb/legislation.aspx

Activity data

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

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

Table 1 and Table 2 display activity data used to calculate rates in this report. The data is rounded to the nearest thousand hours (or thousand departures) to present the size or magnitude of the data in general terms. Specific activity data for movements of non-Australian (foreign) registered aircraft is limited, but tabulated where available.

Aviation activity is grouped into the following operational types:

- **Commercial air transport.** High capacity regular public transport (RPT) flights, low capacity RPT flights, charter flights and medical transport flights.
- **General aviation.** Aerial work operations (including aerial agriculture, aerial mustering, search and rescue, and aerial survey), flying training, and private, business and sports (including gliding) aviation (VH or foreign-registered).
- **Recreational aviation.** Aircraft used for recreational flying registered by a recreational aviation administration organisation (RAAO).

Departures

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

Departure data is not available for individual operation types within general aviation (GA) prior to 2014 and for any recreational aviation operational type. The combined totals also do not include medical transport (commercial air transport) or gliding (general aviation). At the time of publication, departures were only available to 2015 for most operation types, and to 2016 for some types of air transport (high and low capacity RPT, charter and foreign RPT).

Table 1: Departures (thousands), 2007 to 2016²

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| All commercial air transport (excl. medical transport) | 1,318 | 1,311 | 1,278 | 1,382 | 1,405 | 1,475 | 1,443 | 1,335 | 1,269 | N/A |
| High capacity RPT charter (VH- registered) | 439 | 491 | 493 | 537 | 559 | 612 | 621 | 622 | 630 | 638 |
| Low capacity RPT (VH- registered) | 168 | 141 | 128 | 133 | 143 | 154 | 146 | 128 | 128 | 136 |
| Low capacity charter (VH- registered, estimated) ³ | 667 | 633 | 609 | 662 | 651 | 655 | 618 | 524 | 452 | N/A |
| Foreign-registered | 62 | 63 | 64 | 69 | 73 | 75 | 63 | 62 | 70 | 86 |
| All VH- registered general aviation (excluding gliding) | 1,784 | 1,949 | 1,833 | 1,985 | 1,853 | 1,760 | 1,812 | 2,187 | 2,032 | N/A |

Commercial air transport operations and general aviation departures have remained relatively constant over the last 10 years (Figure 1).

Within air transport, high capacity regular public transport (RPT)⁴ departures steadily increased from 2007 to 2012 by around 30,000 departures per year. Since then they have increased at a much slower rate of 6,000 extra departures per year. The trend in low capacity RPT departures has remained relatively flat since 2008, while charter departures have decreased significantly in the last three years⁵ (Figure 2).

² Departures are not available for medical transport, recreational aviation or gliding.

³ Charter operations in high capacity aircraft is combined with regular public transport (RPT). Charter operations on low capacity aircraft is reported to BITRE through the *General Aviation Activity Survey*. Low capacity charter departures prior to 2014 were estimated because departures were not recorded separately for different types of operations in the BITRE *General Aviation Activity Survey*. The estimation model calculated the rate of departures per hour flown for aircraft that only perform charter operations. The ratio is then used to estimate the number of charter-related departures for all aircraft based on the number of charter hours flown. Ratios were specific to aircraft type (aeroplane or helicopter) and number of engines (single or multi-engine). From 2014 low capacity charter departures are collected in the BITRE *General Aviation Activity Survey*.

⁴ Within this report, when high capacity RPT operations is referenced it also includes the small number of high capacity charter operation departures or hours.

⁵ In 2014, BITRE started a major reclassification of operation types in their *General Aviation Activity Survey*, including the specific collection of charter departures (which were previously estimated), and the specific collection of new operation types that previously would have been counted within charter. However, the current publication corrected for the latter change and used 2014 and 2015 charter departures that were the equivalent of what of their pre-2014 estimate.

Figure 1: Departures by operation type 2007 to 2015

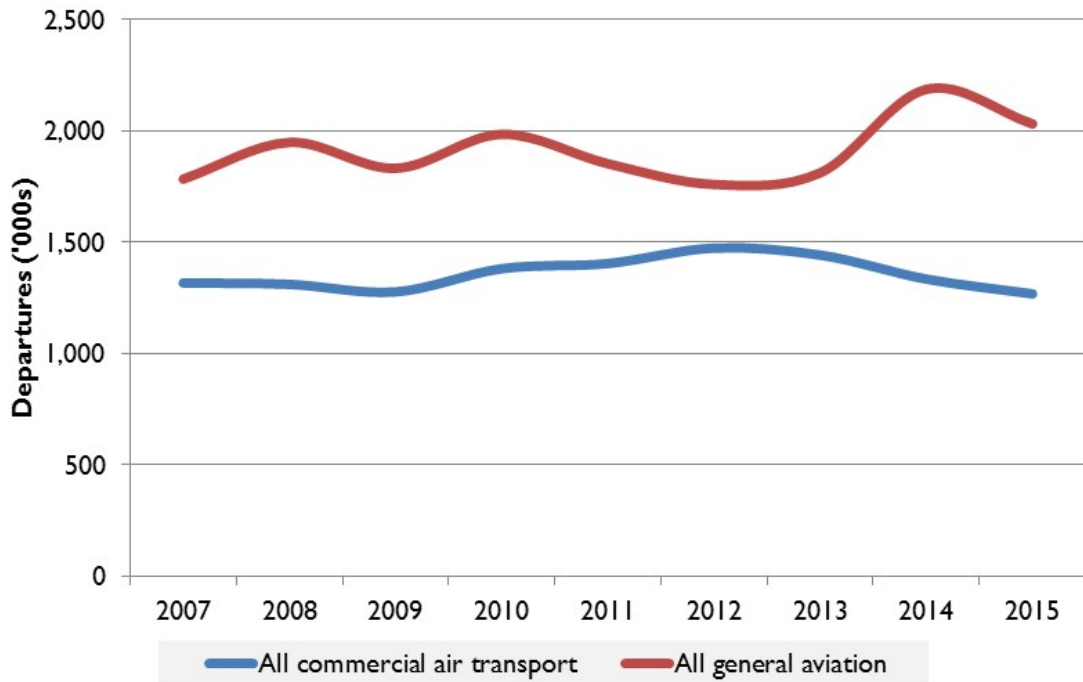
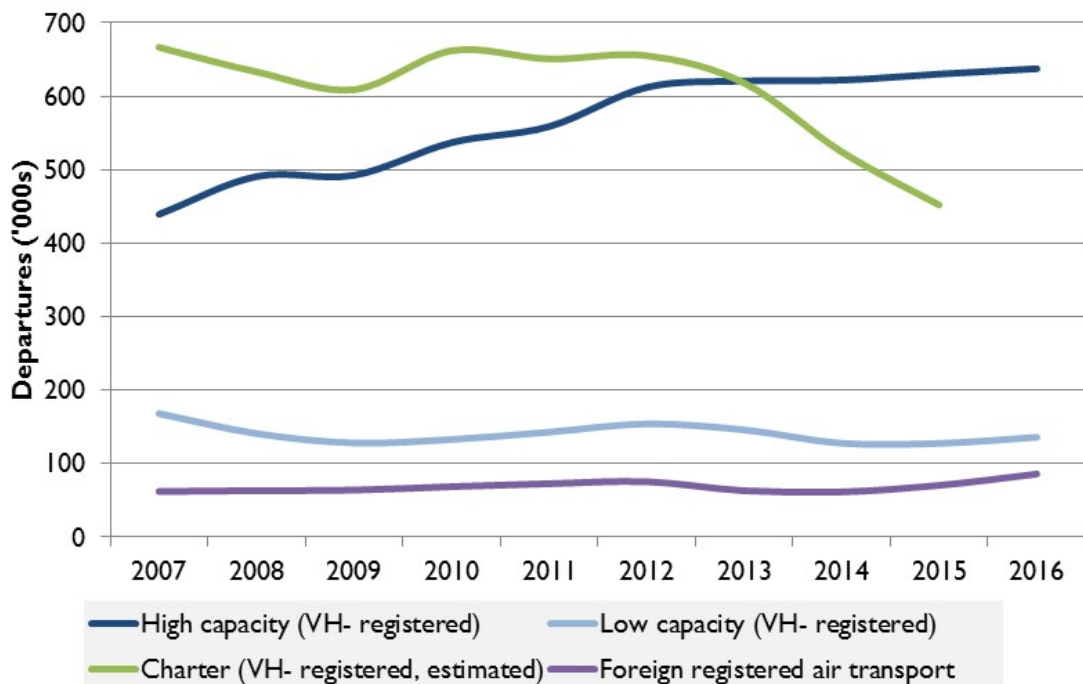


Figure 2: Departures in commercial air transport 2007 to 2016



Hours flown

While departures are generally used as a measure of exposure for commercial air transport operations, flying hours are a more useful measure of exposure for general aviation because of the higher risk of an accident outside of approach and landing and take-off phases of flight. For

example, agricultural and search and rescue aircraft performing low flying as part of normal operations.

Table 2 records thousands of hours flown by operation type⁶ for Australian (VH-) registered aircraft, and for recreational aircraft registered by a recreational aviation administration organisation (RAAO). At the time of publication, reliable hours flown data was only available to the end of 2015 for most operation types.

Table 2: Hours flown (thousands), Australian-registered, 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| All commercial air transport (VH- registered) | 1,720 | 1,816 | 1,858 | 1,798 | 1,947 | 2,011 | 2,145 | 2,098 | 1,928 | N/A |
| High capacity RPT & charter | 1,027 | 1,122 | 1,134 | 1,231 | 1,296 | 1,387 | 1,362 | 1,368 | 1,407 | 1,442 |
| Low capacity RPT | 167 | 133 | 111 | 117 | 139 | 156 | 147 | 125 | 123 | 131 |
| Low capacity charter | 547 | 521 | 471 | 509 | 487 | 504 | 488 | 403 | 359 | N/A |
| Medical transport | 75 | 82 | 81 | 90 | 88 | 97 | 100 | 75 | 104 | N/A |
| All general aviation (VH- registered) | 1,467 | 1,439 | 1,468 | 1,426 | 1,355 | 1,280 | 1,289 | 1,206 | 1,192 | N/A |
| All aerial work | 370 | 382 | 364 | 424 | 421 | 373 | 405 | 482 | 461 | N/A |
| <i>Aerial agriculture</i> | 62 | 78 | 73 | 104 | 100 | 89 | 80 | 76 | 78 | N/A |
| <i>Aerial mustering</i> | 113 | 113 | 106 | 118 | 126 | 113 | 125 | 139 | 149 | N/A |
| <i>Aerial search & rescue</i> | 9 | 9 | 7 | 6 | 7 | 6 | 6 | 10 | 10 | N/A |
| <i>Aerial survey</i> | 54 | 64 | 38 | 58 | 68 | 48 | 50 | 39 | 34 | N/A |
| Flying training | 461 | 490 | 501 | 440 | 391 | 365 | 384 | 332 | 311 | N/A |
| Private/Business/Sport ⁷ | 379 | 382 | 390 | 384 | 384 | 365 | 365 | 279 | 304 | N/A |
| <i>Gliding</i> | 257 | 184 | 214 | 178 | 159 | 176 | 135 | 113 | 115 | N/A |
| Recreational aviation (Non-VH/RAAO- registered) | 259 | 281 | 311 | 345 | 348 | 343 | 309 | 325 | 320 | N/A |
| Gyrocopters ⁸ | 29 | 33 | 40 | 47 | 48 | 46 | 42 | 41 | 44 | N/A |
| Recreational aeroplanes ⁹ | 129 | 145 | 163 | 180 | 180 | 175 | 139 | 159 | 156 | N/A |
| Weight Shift ¹⁰ | 100 | 103 | 109 | 119 | 120 | 122 | 128 | 124 | 120 | N/A |

⁶ Hours flown are not recorded individually for all types of aerial work that are reported on in these statistics (such as fire control) prior to 2014. Hours flown for several categories of aerial work were not collected by the BITRE prior to 2014, so hours flown for 'all aerial work' includes additional types of aerial work categories to those shown in Table 2. Similarly, for private/business/sport, only gliding flying activity is recorded separately.

The *General Aviation Activity Survey* collects test and ferry hours as a separate category. In Table 2, test and ferry hours are distributed across charter, aerial work, flying training and private/business/sport operations, based on the expected proportion of test and ferry flights in those categories. Private/business/sport is assigned 11 per cent, flying training 11 per cent, charter 21 per cent, and aerial work is assigned the remaining proportion.

⁷ Gliding hours are not included in these Private/Business/Sport hours

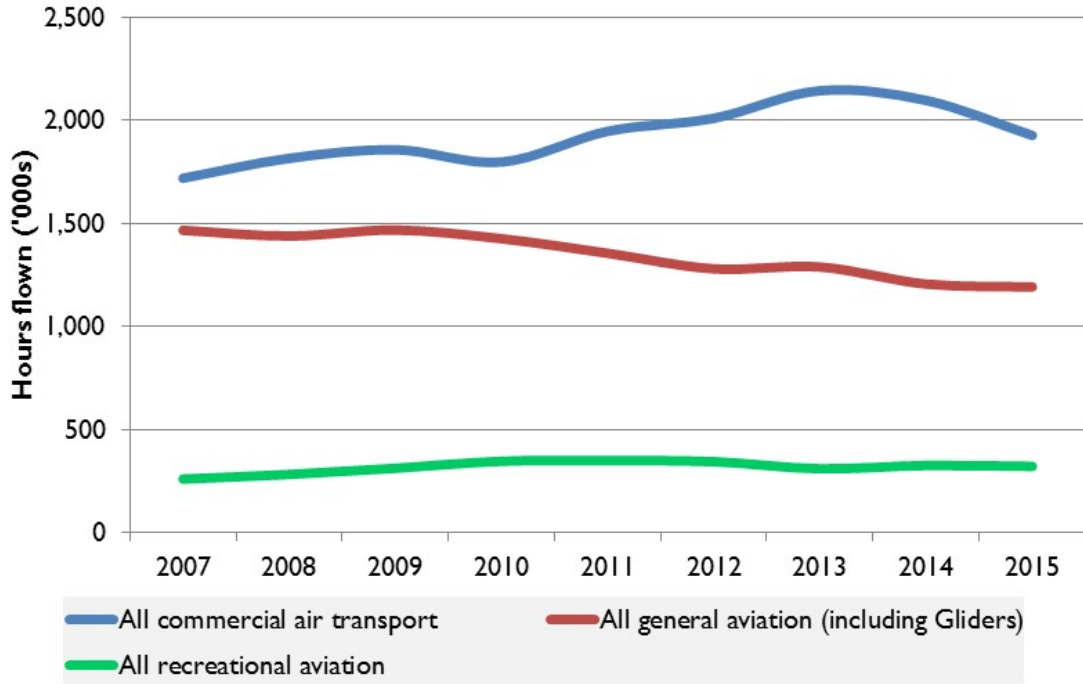
⁸ Australian Sport Rotorcraft Association (ASRA) registers and collects all activity data for gyrocopters. Data sourced from BITRE.

⁹ Recreational Aviation Australia (RAAus) register and collect activity data for recreational (light sport) aeroplanes, including ultralights and some motorised gliders. Data sourced from BITRE.

¹⁰ Both the Hang Gliding Federation of Australia (HGFA) and RAAus register and collect activity data for weight shift aircraft, including hang gliders (HGFA only), paragliders (HGFA only), powered parachutes, and weight-shift microlights/trikes. Data sourced from BITRE.

Air transport hours significantly increased from 2007 through 2013, but has since decreased slightly. In contrast, general aviation steadily decreased, with a levelling out over the last two years of the decade (Figure 3). Recreational hours have remained relatively steady since 2009. In 2015, commercial air transport had 1.6 times more hours flown than general aviation. In turn, general aviation had nearly four times more hours flown than recreational aviation operational types.

Figure 3: Hours flown by operation type, Australian-registered 2007 to 2015



The majority of commercial air transport flying in Australia is high capacity RPT, and its proportion of total air transport hours flown increased from 60 per cent to 73 per cent between 2007 and 2015. In contrast, the 2015 low capacity RPT hours flown were significantly less than 2007. Charter¹¹ hours remained relatively static before decreasing significantly in 2014 and 2015.¹² Further, medical transport hours flown increased by approximately 40 per cent from 2007 to 2015 (Figure 4).

¹¹ Within this report, charter refers to low capacity charter operations.

¹² In 2014, BITRE started a major reclassification of operation types in their *General Aviation Activity Survey*, including the specific collection of new operation types that previously counted within charter activity. However, the current publication corrected for this change and used 2014 charter hours that were the equivalent of pre-2014.

Figure 4: Hours flown in VH-registered commercial air transport 2007 to 2016

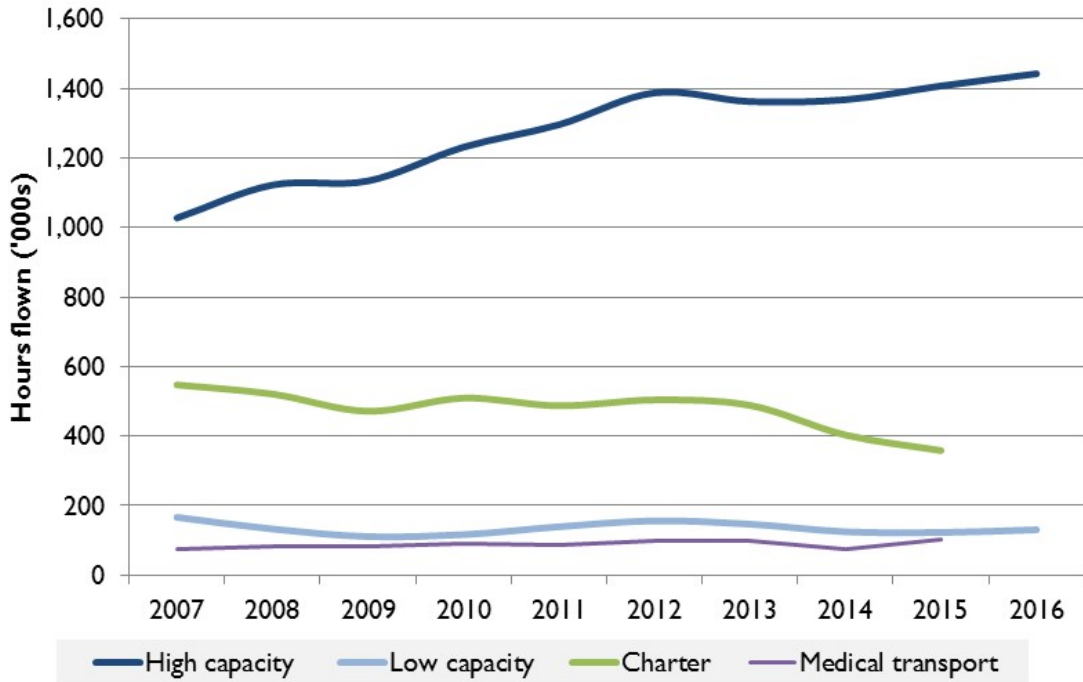


Figure 5 shows a comparison of flying activity across general aviation. Flying training has fallen by more than one-third since its peak in 2009. Private/business and sport activity has steadily reduced over the 10 years by about 20 per cent because of a decrease in gliding activity by around 45 per cent. Excluding gliding, private/business and sport activity has been steady across the 10 years. All aerial work and aerial agriculture activity increased by around 25 per cent and aerial mustering by around 30 per cent. Aerial survey hours reduced by almost 40 per cent, possibly due to an increase in remotely piloted aircraft use.

Aerial work makes up around one-third of all general aviation flying hours.

Figure 5: Hours flown in general aviation 2007 to 2015

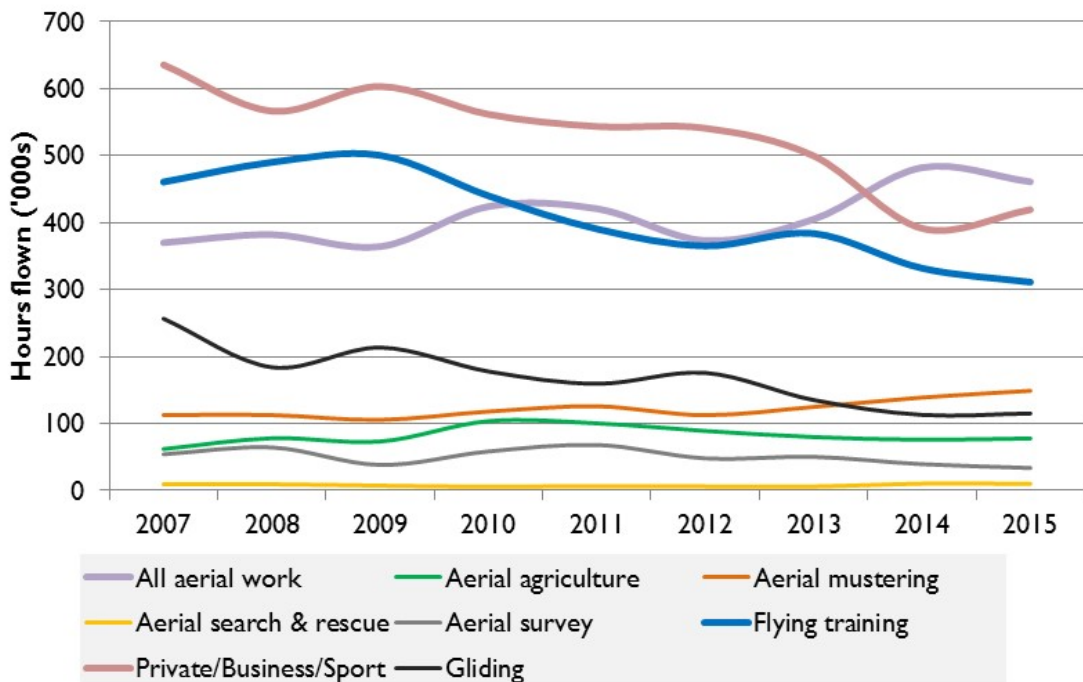
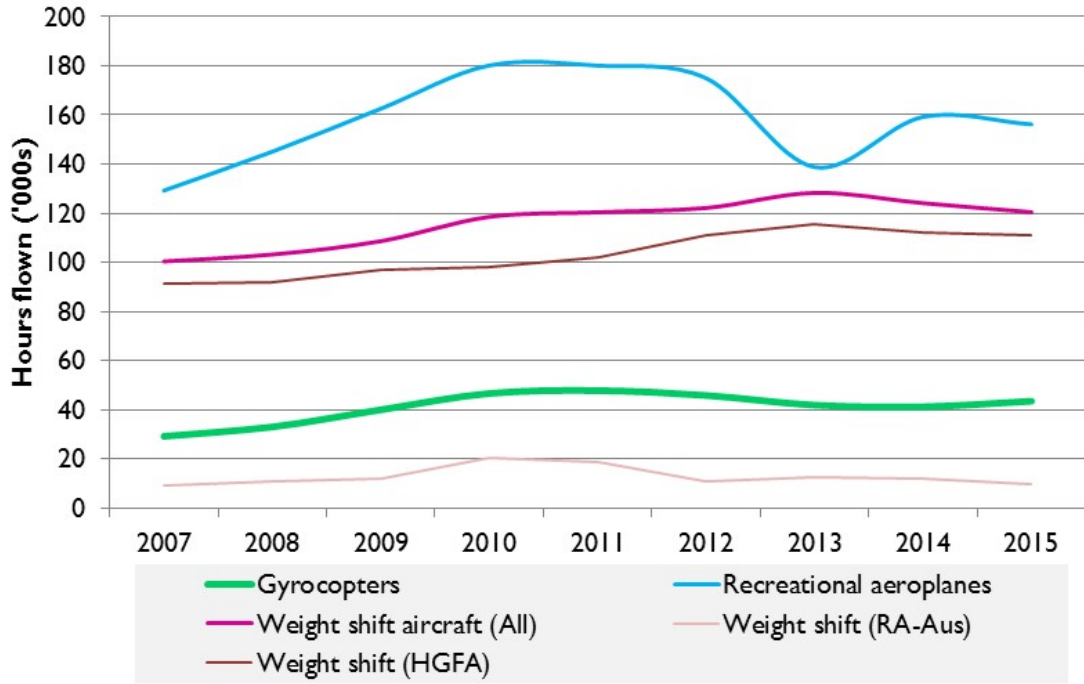


Figure 6 shows a comparison of flying activity for Australian (non-VH) recreational aviation across different types of RAAO, as reported by each RAAO to the BITRE. Flying hours of RAAUs, registered recreational aeroplanes increased significantly up to 2012, but has declined since then. Although representing only 13 per cent of recreational aviation activity, gyrocopters have had the most significant increase, within the recreational operational type, of around 50 per cent.

Figure 6: Hours flown in recreational aviation 2007 to 2015



Additional aviation activity statistics are available from the [BITRE website](http://www.bitre.gov.au).¹³

¹³ www.bitre.gov.au

Occurrences by operation type

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

- **Commercial air transport.** High capacity regular public transport (RPT) flights, low capacity RPT flights, charter and medical transport flights.
- **General aviation.** Aerial work operations, flying training, and private, business and sports (including gliding) aviation (VH or foreign-registered).
- **Recreational aviation.** Aircraft used for recreational flying registered by a recreational aviation administration organisation (RAAO).
- **Remotely piloted aircraft operations.** All operations using remotely piloted aircraft (RPA) approved by the Civil Aviation Safety Authority.

Aircraft involved in these occurrences include both Australian civil registered aircraft (both VH-aircraft, and aircraft registered by recreational aviation organisations) operating within or outside of Australian territory,¹⁴ and foreign registered aircraft operating within Australian territory. For further information on how the statistics in this report were treated, and how these operational types are defined by the ATSB, see *Appendix A – Explanatory notes*.

Table 3 compares the number of fatal accidents and fatalities for commercial air transport, general aviation, and recreational aviation, and each of their subtypes. Fatal accidents in some aircraft operations are more likely to have a greater number of associated fatalities than in other operation types. For example, aircraft used for agricultural operations usually have a single pilot on board and, as a result, the number of fatal accidents was the same as the number of fatalities over the last 10 years. In contrast, survey or photography aircraft generally have a pilot, in addition to a camera operator or navigator on board, resulting in more fatalities than fatal accidents, in the same period.

¹⁴ 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 NM limit.

Table 3: Fatal accidents and fatalities by operation type (Australian-registered unless specified) 2007 to 2016¹⁵

| Operation type | Number of aircraft associated with a fatality | Number of fatalities |
|---|--|-----------------------------|
| Commercial air transport | 13 | 18 |
| High capacity RPT | 0 | 0 |
| Low capacity RPT | 1 | 2 |
| Charter | 12 | 16 |
| Medical transport | 0 | 0 |
| Foreign registered air transport | 0 | 0 |
| General aviation | 142 | 207 |
| Aerial work | 48 | 55 |
| <i>Agriculture</i> | 18 | 18 |
| <i>Mustering</i> | 14 | 15 |
| <i>Search & rescue</i> | 2 | 2 |
| <i>Fire control</i> | 2 | 2 |
| <i>Survey and photography</i> | 6 | 9 |
| <i>Other</i> | 6 | 9 |
| Flying training | 8 | 11 |
| Private/Business/Sport | 84 | 139 |
| <i>Private/Business</i> | 70 | 122 |
| <i>Sport aviation (excluding gliding)</i> | 4 | 5 |
| <i>Gliding¹⁶</i> | 10 | 12 |
| Foreign registered general aviation | 1 | 1 |
| Recreational aviation | 94 | 116 |
| Gyrocopters | 15 | 17 |
| Aeroplanes | 46 | 59 |
| Weight Shift | 32 | 39 |
| Total | 249 | 341 |

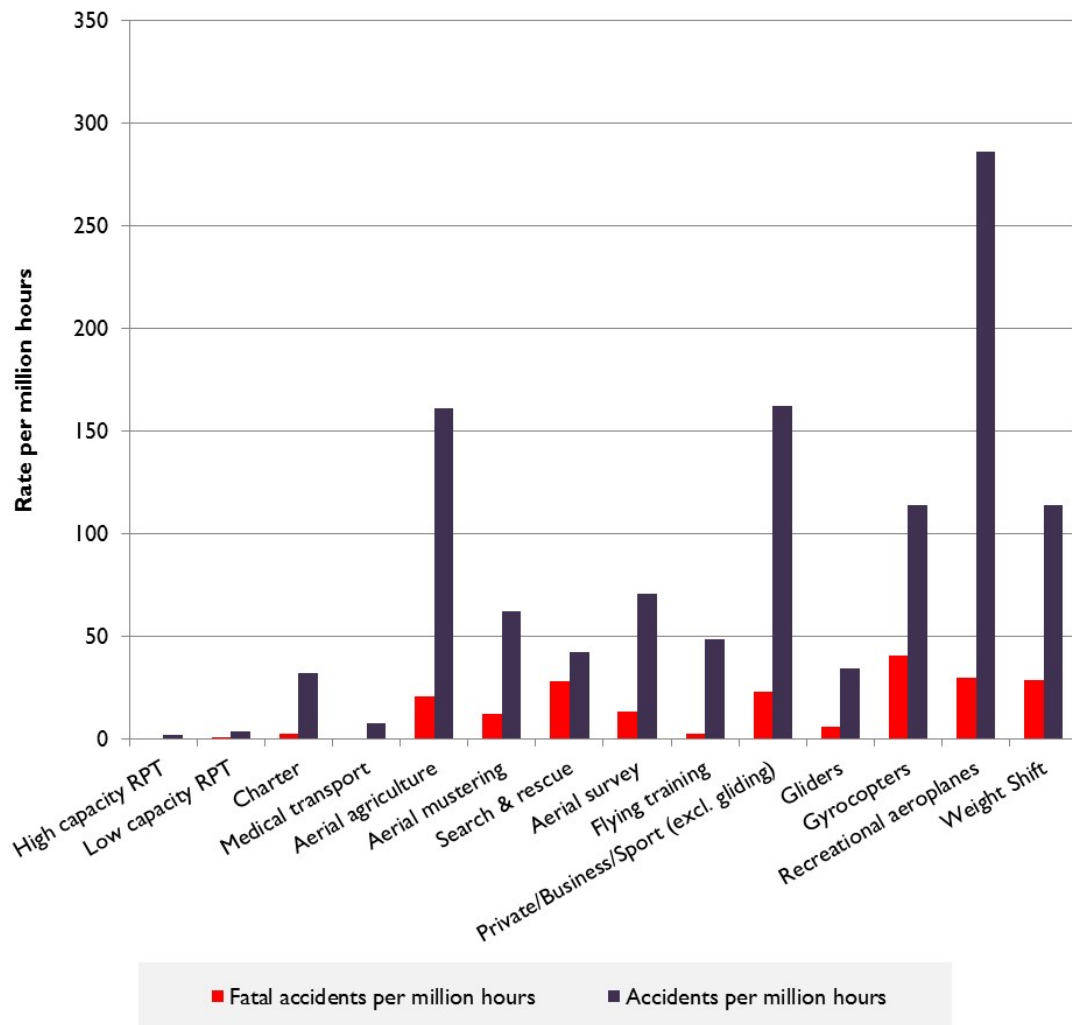
¹⁵ Totals (bold values) also contain occurrences where the operation subtype was unknown. Hence, totals can contain more aircraft or fatalities than the sum of the operation subtype values.

¹⁶ Includes two motorised gliders.

Figure 7 shows the rate of accidents and fatal accidents for each of the specific operation types¹⁷ over this period per million hours flown. Recreational aviation operation types had notably higher accident rates when compared to general aviation or air transport operations. While RAAus-registered aeroplanes had the highest accident rate, general aviation, aerial agriculture and private/business and sport flights had higher accident rates than recreational gyrocopters and weight shift aircraft.

Recreational aircraft, private/business and sport, and aerial agriculture operation types were among the most likely to result in a fatal accident when considering the amount of flying activity. However, two-thirds of all search and rescue accidents were fatal and almost 40 per cent of all gyrocopters accidents were fatal. Gyrocopters also had the worst fatal accident rate per million hours flown. Almost one quarter of both low capacity RPT and weight shift aircraft accidents were fatal. More information on accident rates for each operation type is provided in the following sections of this report.

Figure 7: Rate of accidents and fatal accidents (Australian-registered aircraft only) by operation type 2007 to 2015¹⁷



¹⁷ Activity data for each operation type was provided by BITRE, except for the following: Fire control, Other/unknown GA, Foreign-registered GA. Accident and fatal accident rates are based on those accidents from 2006 to 2014 only, as activity data was not yet available for 2015 at the time of writing. Private/Business/Sport excludes gliding.

Commercial air transport

The number of reported safety incidents in commercial air transport increased over the last 10 years (Table 4). This is an indication of the increase in flying activity in most types of air transport, and operators' greater awareness of their ATSB reporting requirements. Around 35 per cent of all commercial air transport incidents reported to the ATSB involved birdstrikes.

Serious incidents are indicators of events that almost led to accidents. They represent occurrences that could have resulted in consequences that were more serious. The number of serious incidents in 2016 in commercial air transport was consistent with the 10-year average.

There were 15 commercial air transport aircraft involved in 14 accidents in 2016. This was consistent with the 10-year average. The majority (11) involved one or more aircraft conducting charter operations, two conducting medical transport and one involving high capacity operations.

There was one fatal accident in 2016 involving an aircraft conducting charter operations and one serious injury accident. These numbers were low in comparison to other types of aviation.

Table 4: All commercial air transport occurrences (VH- and foreign registered aircraft) 2007 to 2016

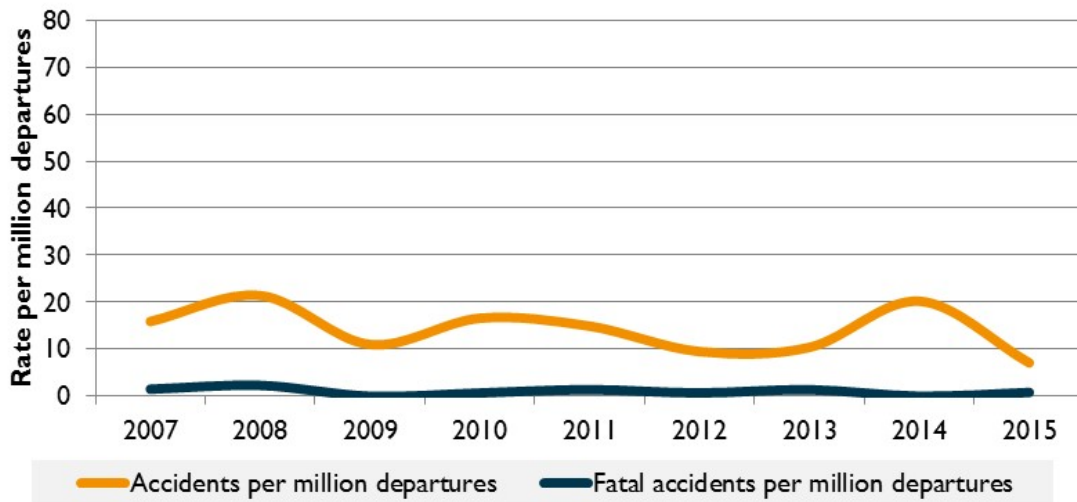
| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 3,152 | 3,337 | 3,162 | 3,477 | 4,002 | 4,226 | 4,404 | 4,318 | 3,837 | 3,901 |
| Serious incidents | 47 | 52 | 27 | 37 | 28 | 47 | 54 | 36 | 30 | 50 |
| Serious injury accidents | 1 | 3 | 4 | 2 | 2 | 2 | 2 | 6 | 4 | 1 |
| Fatal accidents | 2 | 3 | 0 | 1 | 2 | 1 | 2 | 0 | 1 | 1 |
| Total accidents | 21 | 28 | 14 | 23 | 21 | 14 | 15 | 27 | 9 | 15 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 1 | 15 | 6 | 2 | 2 | 2 | 4 | 8 | 5 | 2 |
| Fatalities | 2 | 6 | 0 | 2 | 2 | 1 | 3 | 0 | 1 | 1 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million departures | 15.9 | 21.4 | 11 | 16.6 | 14.9 | 9.5 | 10.4 | 20.2 | 7.1 | N/A |
| Fatal accidents per million departures | 1.5 | 2.3 | 0 | 0.7 | 1.4 | 0.7 | 1.4 | 0 | 0.8 | N/A |

Figure 8: Commercial air transport occurrence and injuries 2007 to 2016





Figure 9: Commercial air transport accident and fatal accident rate (per million departures) 2007 to 2015



High capacity RPT and charter (VH- registered)

The number of incidents reported to the ATSB involving VH- registered high capacity RPT has risen by around 40 per cent in the last 10 years. This is consistent with the increase in the rate of departures, also 40 per cent. The incident to departures ratio has remained relatively constant. Provided these trends remain constant, the number of reported incidents would double every 17 years, with departures doubling every 18 years.

In 2016, birdstrikes were the most commonly reported safety incident to the ATSB involving aircraft conducting high capacity RPT operations.

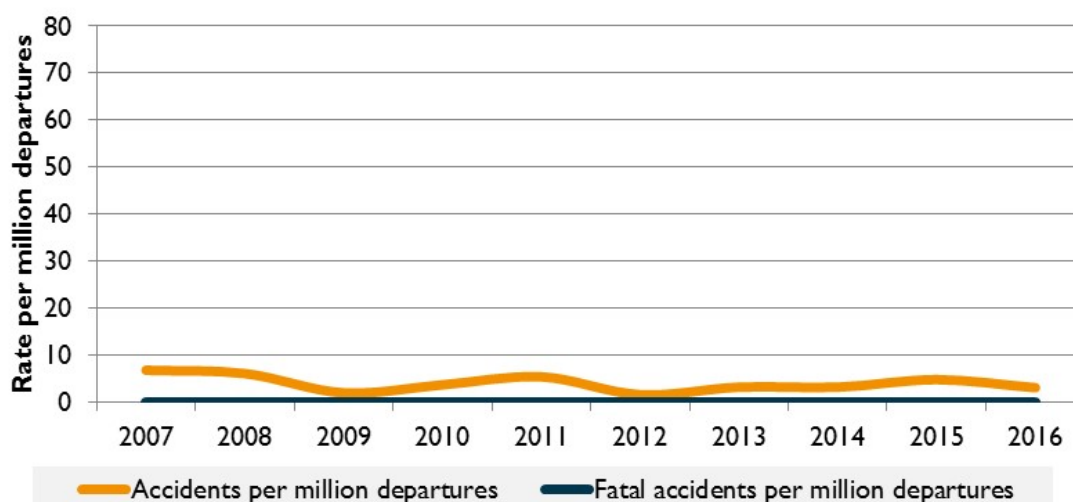
The number of aircraft involved in an accident and serious incident in 2016 was consistent with the 10-year average.

No fatalities involving VH- registered high capacity RPT aircraft have occurred since 1975.

Table 5: High capacity RPT (VH- registered aircraft) occurrences 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 1,916 | 2,130 | 2,016 | 2,428 | 2,853 | 3,108 | 3,282 | 3,220 | 2,736 | 2,760 |
| Serious incidents | 16 | 20 | 10 | 13 | 13 | 12 | 23 | 13 | 4 | 14 |
| Serious injury accidents | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 2 | 2 | 0 |
| Fatal accidents | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total accidents | 3 | 3 | 1 | 2 | 3 | 1 | 2 | 2 | 3 | 2 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 1 | 12 | 1 | 2 | 1 | 0 | 1 | 2 | 2 | 0 |
| Fatalities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million departures | 6.8 | 6.1 | 2 | 3.7 | 5.4 | 1.6 | 3.2 | 3.2 | 4.8 | 3.1 |
| Fatal accidents per million departures | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Accidents per million hours | 2.9 | 2.7 | 0.9 | 1.6 | 2.3 | 0.7 | 1.5 | 1.5 | 2.1 | 1.4 |
| Fatal accidents per million hours | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

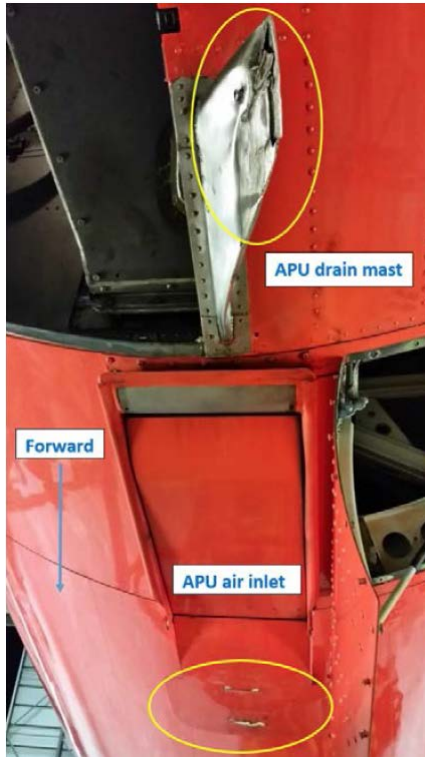
Figure 10: Accident rate for high capacity RPT aircraft (VH- registered) (per million departures) 2007 to 2016



In 2016, there was one accident involving two high capacity RPT VH-registered aircraft and a further 14 aircraft involved in 13 serious incidents as outlined below:

- Two Boeing 737s received substantial damaged following a taxiing collision at Hobart Airport, Tasmania, when the left wingtip of one aircraft collided with the horizontal stabiliser of the other. There were no injuries reported ([ATSB investigation AO-2016-167](#)).
- While taxiing for departure at Sydney Airport, New South Wales, the crew of a de Havilland Aircraft DHC-8 braked heavily to avoid a collision with a catering truck crossing the taxiway. There were no injuries or aircraft damage reported (ATSB occurrence 201600909).
- At Brisbane Airport, a British Aerospace BAe 146 did not taxi in accordance with air traffic control instructions and came into close proximity with a taxiing Boeing 737. There were no injuries or aircraft damage reported (ATSB occurrence 201605398).

- There was a pod strike on the right engine of a Boeing 737 following a ground strike in heavy rain and gusting winds at Faleolo International Airport (Samoa). There were no injuries reported and the investigation is continuing ([ATSB investigation AO-2016-042](#)).
- The tail of an Airbus A320 struck the surface of the runway during take-off at Melbourne Airport, Victoria. Following this, the crew elected to return to Melbourne. This was the cadet pilot's first take-off as the pilot flying. No injuries were reported ([ATSB investigation AO-2016-046](#)).



Tail strike of an Airbus A320 at Melbourne Airport on 11 May 2016 (ATSB investigation AO-2016046).
 Note: access doors are open for inspection. Source: Operator — annotated by ATSB

- En route from Sydney to Dallas-Fort Worth (United States) the cabin crew of an Airbus A380 were alerted to the presence of smoke in the cabin. The source was located as a crushed personal electronic device wedge in a seat mechanism. No injuries were reported ([ATSB investigation AO-2016-051](#)).
- En route from Los Angeles to New York (United States), on board a Boeing 747, a personal electronic device ignited after being crushing by a seat mechanism. No injuries were reported ([ATSB investigation AO-2016-066](#)).



Crushed personal electronic device. Source: Operator

- The captain of a Bombardier DHC-8 received minor injuries on approach into Canberra Airport, Australian Capital Territory, caused by an encounter with severe turbulence. It is likely the captain, was not sufficiently restrained, due to slackness of the seat harness's crotch strap ([ATSB investigation AO-2016-132](#)).
- Landing at Darwin Airport, Northern Territory, a Boeing 737 encountered gusty wind conditions and veered off the runway resulting in minor damage to the aircraft. There were no reported injuries. The investigation is continuing ([ATSB investigation AO-2016-166](#)).
- There were also five serious incidents involving crew incapacitation.

Low capacity RPT (VH- registered)

In contrast to other types of commercial air transport, the number of incidents reported to the ATSB involving low capacity RPT aircraft has significantly decreased over the last 10 years. This is primarily due to the decline in flying activity, both in term of hours and departures. This decline is a combined result of Australia's changing requirements to support mining activity, with larger aircraft needed to move more people to regional cities and mining communities and regional airlines using aircraft with larger seating capacities. This has moved many former low capacity flights into the high capacity type of operation with the additional regional travel options provided by high capacity RPT operators.

The most commonly reported incidents involving low capacity RPT aircraft in 2016 were birdstrikes.

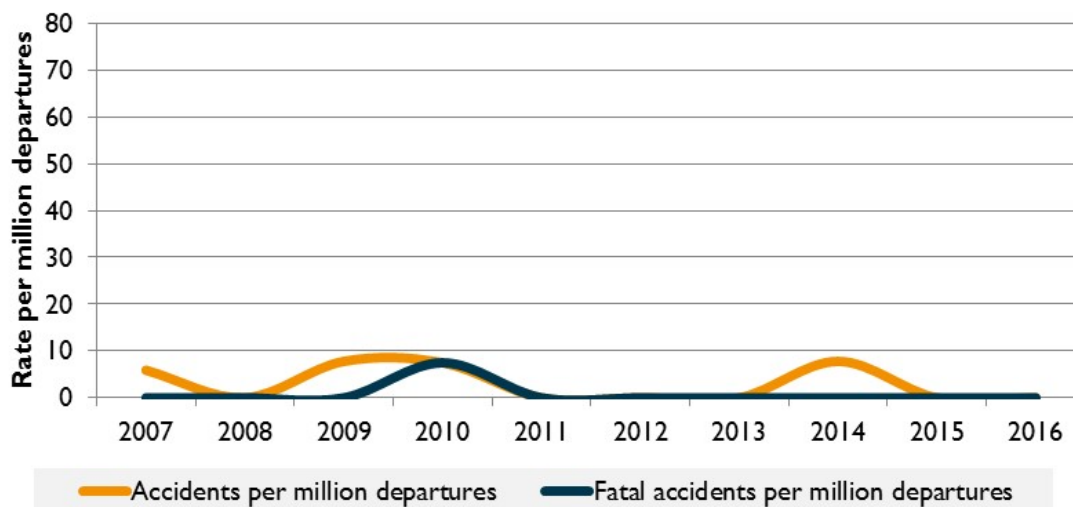
The number of serious incidents, four in 2016 was consistent with the 10-year average of around five per year. There were no accidents in 2016 involving low capacity air transport aircraft.

No fatalities involving VH- registered low capacity RPT aircraft have occurred since 2010.

Table 6: Low capacity RPT (VH- registered aircraft) occurrences 2006 to 2015

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 481 | 393 | 405 | 432 | 453 | 394 | 374 | 376 | 361 | 372 |
| Serious incidents | 8 | 11 | 4 | 6 | 2 | 5 | 3 | 1 | 5 | 4 |
| Serious injury accidents | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fatal accidents | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total accidents | 1 | 0 | 1 | 1 | 0 | 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 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million departures | 5.9 | 0 | 7.8 | 7.5 | 0 | 0 | 0 | 7.8 | 0 | 0 |
| Fatal accidents per million departures | 0 | 0 | 0 | 7.5 | 0 | 0 | 0 | 0 | 0 | 0 |
| Accidents per million hours | 6 | 0 | 9 | 8.6 | 0 | 0 | 0 | 8 | 0 | 0 |
| Fatal accidents per million hours | 0 | 0 | 0 | 8.6 | 0 | 0 | 0 | 0 | 0 | 0 |

Figure 11: Accident rate for low capacity RPT aircraft (VH- registered) (per million departures) 2007 to 2016



There were four serious incidents reported in 2016 involving low capacity RPT operations as outlined below:

- A SAAB 340, at Charleville aerodrome, Queensland, sustained minor damage from an electrical fire originating from an incorrectly assembled generator connection (ATSB occurrence 201604325).
- En route from Orange, New South Wales, to Sydney, a SAAB 340 operating as a low capacity RPT flight had a near collision with a Glaser-Dirks DG-800B glider. The aircraft passed about 100-200 m below the glider ([ATSB investigation AO-2016-015](#)).
- En route from Essendon Airport, Victoria, to King Island aerodrome, Tasmania, a Fairchild SA227 conducting low capacity RPT operations had a near collision with a Cessna 150

operating as a private or business flight. The aircraft passed within 100 ft. in altitude and laterally 200-300 m ([ATSB investigation AO-2016-017](#)).

- En route from Perth Airport to Shark Bay, Western Australia, the aircrew of a de Havilland DHC-8 conducted an emergency descent following a cabin pressure warning. The crew diverted the aircraft back to Perth Airport and landed without further incident. No injuries or damage to the aircraft was reported ([ATSB investigation AO-2016-093](#)).

Charter (VH- registered), low capacity

The number of incidents reported to the ATSB involving Australian-registered low capacity aircraft conducting charter work has been relatively stable since 2011. Of all commercial air transport operations, charter transport operations generally experience the highest number and rates of accidents and fatal accidents.

The number of accidents reported to the ATSB in 2015 involving charter aircraft decreased significantly to three from 23 in 2014. The number in 2016 increased to 11, in line with the 10-year average. The reason for the reduction in 2015 is unknown. There was one fatal accident involving a charter aircraft in 2016.

Over the 10 years, the average accident and fatal accident rate per million hours was higher than for departures, reflecting the short duration of most charter flights and their greater exposure to approach and landing accidents due to more departures per each hour flown.

The most commonly safety incidents reported to the ATSB in 2016 involving charter aircraft were birdstrikes, at around 47 per cent.

The number of serious incidents in 2016 was the highest in the 10-year period. There was one serious injury accident in 2016.

Table 7: Charter (VH- registered aircraft) occurrences 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 521 | 553 | 492 | 357 | 401 | 398 | 398 | 395 | 446 | 393 |
| Serious incidents | 16 | 13 | 9 | 14 | 11 | 20 | 22 | 18 | 19 | 24 |
| Serious injury accidents | 0 | 2 | 1 | 0 | 1 | 2 | 1 | 4 | 0 | 1 |
| Fatal accidents | 2 | 3 | 0 | 0 | 2 | 1 | 2 | 0 | 1 | 1 |
| Total accidents | 16 | 25 | 8 | 20 | 18 | 12 | 12 | 23 | 3 | 11 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 0 | 3 | 2 | 0 | 1 | 2 | 3 | 6 | 1 | 2 |
| Fatalities | 2 | 6 | 0 | 0 | 2 | 1 | 3 | 0 | 1 | 1 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million departures | 24 | 39.5 | 13.1 | 30.2 | 27.7 | 18.3 | 19.4 | 43.9 | 6.6 | N/A |
| Fatal accidents per million departures | 3 | 4.7 | 0 | 0 | 3.1 | 1.5 | 3.2 | 0 | 2.2 | N/A |
| Accidents per million hours | 29.2 | 48 | 17 | 39.3 | 36.9 | 23.8 | 24.6 | 57 | 8.4 | N/A |
| Fatal accidents per million hours | 3.7 | 5.8 | 0 | 0 | 4.1 | 2 | 4.1 | 0 | 2.8 | N/A |

Figure 12: Accident rate for charter aircraft (VH- registered) (per million departures) 2007 to 2015

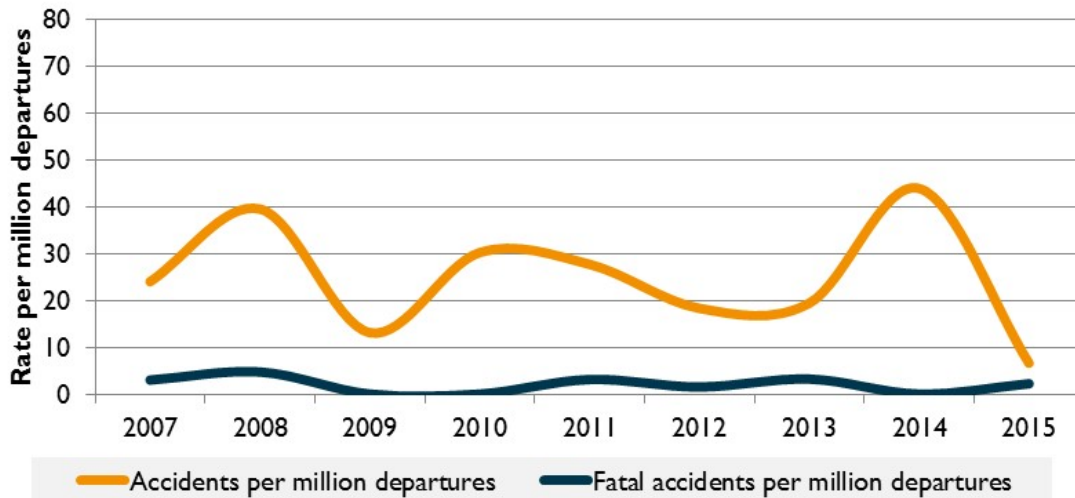
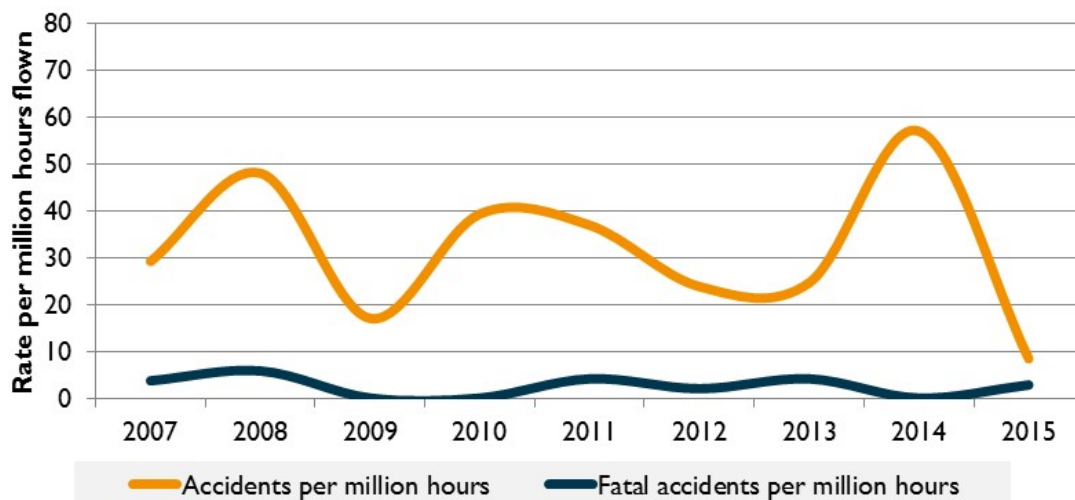


Figure 13: Accident rate for charter aircraft (VH- registered) (per million hours flown) 2007 to 2015



In 2016, there was one fatal accident involving a VH- registered aircraft conducting charter work with 11 accidents involving VH- registered aircraft. They are outlined below:

- The only passenger of a Robinson R44 helicopter was fatally injured and the pilot seriously injured, when impact forces and a post-impact fire following an in-flight break-up 41 km south-west of Mossman, Queensland, destroyed the aircraft. The ATSB investigation is continuing ([ATSB investigation AO-2016-156](#)).
- The pilot of a Kavanagh Balloons E-300 sustained serious injuries, and a passenger sustained minor injuries, during a hard landing near York, Western Australia. The pilot was ejected on impact with the balloon subsequently dragging over the pilot ([ATSB investigation AO-2016-080](#)).
- A Cessna 172 received substantial damage from a collision while taxiing, with several portable tie-down bollards at Wilpena Pound, South Australia. No injuries were reported (ATSB occurrence 201600659).
- A Classic Aircraft Corporation YMF, conducting charter work, received minor damage from a collision with a recreational Aeroprakt A22LS Foxbat while taxiing at the Caloundra aerodrome, Queensland. No injuries were reported (ATSB occurrence 201603532).

- The single passenger of a Cessna 208 seaplane sustained minor injuries when it bounced on the water on approach and subsequently struck trees, near Hamilton Island, Queensland. The aircraft received substantial damage from the accident. The ATSB investigation is continuing ([ATSB investigation AO-2016-007](#)).
- A collision with terrain during landing at Redcliffe Airport, Queensland by a de Havilland DH-82A resulted in substantial damage to the aircraft. No injuries were reported ([ATSB investigation AO-2016-030](#)).



Collision with terrain of a de Havilland DH-82A. Source: Ron Ennis — modified by the ATSB

- Two passengers received minor injuries during an emergency disembarkation, due to fire in the neck of a Kavanagh Balloon B-400, after landing near Cessnock aerodrome, New South Wales. ([ATSB investigation AO-2016-039](#)).
- A Cessna 206 collided with terrain following a loss of control on take-off at Southport Broadwater, Queensland, resulted in substantial damage. No injuries were reported ([ATSB investigation AO-2016-055](#)).
- The passenger of a de Havilland DH-82A sustained minor injuries from a collision with terrain following a forced or precautionary landing due to the aircraft not producing thrust near Funnel Bay, Queensland. During the joy-flight, the pilot and passenger heard a loud bang. A post landing inspection by the pilot revealed the propeller was missing ([ATSB investigation AO-2016-071](#)).



Collision with terrain of a de Havilland DH-82A. Source: Aircraft owner — modified by the ATSB

- A Beechcraft B58 aircraft sustained substantial damage when the aeroplane conducted a wheels-up landing at Gove aerodrome, Northern Territory. During the flight, the pilot observed the landing gear unsafe light was illuminated. Over a two-hour period, the pilot used various methods to retract the landing gear including multiple attempts of the emergency landing gear extension procedure. No injuries were reported ([ATSB investigation AO-2016-089](#)).



Wheels up landing of a Beech 58. Source: Pilot

- A Robinson R44 received substantial damage when the helicopter's main rotor, followed by the horizontal stabiliser, struck a rock near Sleisbeck, Northern Territory. No injuries were reported ([ATSB investigation AO-2016-0158](#)).



Ground strike of a Robinson R44. Source: Operator

Medical transport

The number of incidents involving medical transport aircraft reported to the ATSB in 2016 was high compared to the 10-year average, however, it was consistent with the current average starting in 2012 (Table 8). Birdstrikes were the most commonly reported incident, at around 31 per cent.

Table 8: Medical transport aircraft occurrences 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 92 | 121 | 123 | 100 | 114 | 149 | 136 | 159 | 141 | 150 |
| Serious incidents | 2 | 5 | 3 | 3 | 1 | 7 | 5 | 2 | 2 | 4 |
| Serious injury accidents | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Fatal accidents | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total accidents | 1 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Fatalities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million hours | 13.4 | 0 | 36.8 | 0 | 0 | 0 | 10 | 0 | 9.6 | N/A |
| Fatal accidents per million hours | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | N/A |

In 2016, there were two accidents and four serious incidents involving medical transport aircraft as outline below:

- A Beechcraft B200 received substantial damage from a collision with terrain at Moomba Airport, South Australia. No injuries were reported ([ATSB investigation AO-2016-170](#)).



Collision with terrain of a Beech B200. Source: operator

- A Raytheon B200 received substantial damage when the right main landing gear collapsed on landing at Essendon Airport, Victoria. Prior to landing, the crew detected an unsafe landing gear indication and conducted multiple fly-by inspections. No injuries were reported (ATSB occurrence 201605209).

Foreign-registered air transport

In 2016 incidents reported to the ATSB involving foreign-registered air transport operations increased significantly, compared to the 10-year average. No foreign aircraft operating as air transport in Australia have been involved in fatal accidents in the last 10 years (Table 9).

Birdstrikes were the most commonly reported incident, at around 23 per cent.

Table 9: Occurrences involving foreign-registered air transport aircraft in Australia 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 137 | 131 | 120 | 143 | 159 | 159 | 188 | 162 | 146 | 215 |
| Serious incidents | 5 | 3 | 1 | 1 | 1 | 3 | 1 | 2 | 0 | 4 |
| Serious injury accidents | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Fatal accidents | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total accidents | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 0 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Fatalities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

There were four serious incidents and no accidents involving foreign-registered air transport aircraft reported to the ATSB in 2016. The serious incident investigated by the ATSB is outlined below:

- At Perth Airport, Western Australia, an Airbus A320, on a night instrument approach, descended below the altitude profile. Air traffic control issued a low altitude alert and instructed the crew to conduct a missed approach. The crew complied and the aircraft landed without further incident. The ATSB investigation is continuing ([ATSB investigation AO-2016-012](#)).

General aviation

General aviation is considered to be all flying activities of VH- registered aircraft outside of commercial air transport (scheduled (RPT) and non-scheduled (charter and medical transport) passenger and freight operations. It excludes recreational aircraft that are administered by recreational aviation administration organisations (RAAOs) and do not have an Australian civil (VH-) registration, such as recreational aeroplanes up to 600 kg, weight shift hang gliders, paragliders, powered parachutes, trikes, and gyrocopters. Recreational aircraft statistics are reported separately on page 41 in *Recreational aviation*. General aviation also excludes all remotely piloted aircraft operations, which are reported separately on page 48 in *Remotely piloted aircraft*.

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

General aviation also accounts for over half of all aircraft movements across Australia (see Figure 1 on page 4). General aviation aircraft also comprise about one-third of the total hours flown by Australian-registered aircraft (as shown in Figure 3 on page 6).

Despite the larger size of general aviation compared to air transport in both fleet size and number of departures, but not in hours, there are comparatively few occurrence reports sent to the ATSB. In 2016, there were 1,652 general aviation occurrences reported (Table 10). Although there is a less comprehensive reporting requirement under the Transport Safety Investigation Regulations than for aircraft not engaged in commercial air transport, the reporting rate is small when compared to the 3,966 occurrences involving commercial air transport aircraft reported to in 2016.

The most commonly reported safety incident to the ATSB concerning general aviation in 2016 was birdstrikes.

Table 10: All general aviation occurrences (VH- and foreign registered aircraft) 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 1,595 | 1,607 | 1,795 | 1,550 | 1,502 | 1,400 | 1,393 | 1,258 | 1,295 | 1,347 |
| Serious incidents | 93 | 102 | 95 | 132 | 137 | 158 | 185 | 117 | 113 | 186 |
| Serious injury accidents | 7 | 16 | 8 | 15 | 12 | 8 | 6 | 14 | 10 | 17 |
| Fatal accidents | 12 | 22 | 16 | 13 | 16 | 20 | 15 | 11 | 10 | 7 |
| Total accidents | 119 | 128 | 117 | 127 | 114 | 103 | 90 | 148 | 130 | 119 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 9 | 23 | 10 | 19 | 21 | 10 | 8 | 19 | 12 | 20 |
| Fatalities | 21 | 34 | 16 | 16 | 28 | 29 | 24 | 17 | 12 | 10 |
| Rate of aircraft involved¹⁸ | | | | | | | | | | |
| Accidents per million departures | 66.7 | 65.7 | 63.8 | 64 | 61.5 | 58.5 | 49.7 | 67.7 | 64 | N/A |
| Fatal accidents per million departures | 6.7 | 11.3 | 8.7 | 6.5 | 8.6 | 11.4 | 8.3 | 5 | 4.9 | N/A |
| Accidents per million hours | 98.4 | 102 | 93.3 | 101.8 | 95.3 | 93.3 | 78 | 135.4 | 120.8 | N/A |
| Fatal accidents per million hours | 9.9 | 17.5 | 12.8 | 10.4 | 13.4 | 18.1 | 13 | 10.1 | 9.3 | N/A |

¹⁸ Foreign registered general aviation departures and hours are unknown. VH- registered aircraft hours is the proxy denominator for all general aviation departures and hours. The real rate per departure or hour will be slightly smaller than the figures presented in this table.

The lower level of awareness in the general aviation community of the requirement to report safety matters, and what constitutes a reportable transport safety matter continues to be a major challenge for the ATSB. Future amendments to the Transport Safety Investigation Regulations will clarify what the industry needs to report, in order to make reporting clearer and less onerous for pilots and operators.

Flying training had the highest number of general aviation occurrences reported to the ATSB over the 10-year period. The number of private/business and sports aviation operations occurrences was about 86 per cent of the number of reported flying training occurrences. While this could suggest that certain general aviation operations involve a greater level of risk, it is more likely that the reporting cultures and safety management systems of the operators involved in these types of flying is stronger than in other areas of general aviation.

Between 2007 and 2015, the type of flying the aircraft was conducting during an incident, was not reported to the ATSB for about 62 per cent of general aviation reported incidents. However, in 2016, this ratio dropped to 47 per cent indicating that more accurate information regarding these aircraft, was provided to the ATSB. In these occurrences, usually someone other than the pilot(s) involved notified the ATSB (such as air traffic control, the public, pilots of nearby aircraft or aerodrome-base staff). A review of 'unknown' general aviation occurrences found that most were associated with either:

- runway events, primarily runway incursions
- bird and animal strikes
- communications failure or
- operational non-compliance.

The number of general aviation aircraft, per year, involved in incidents reported to the ATSB has decreased significantly since 2009 and levelled-off in the last three years of the 10-year period. At 186, the number of serious incidents in 2016 involving general aviation aircraft was the highest reported to the ATSB over the 10 years. This was a significant increase from the low of 113 in 2015. Further, 2016 saw 119 accidents, consistent with the 10-year average of 119.6. The number of fatal accidents and fatalities for 2016, at seven and 10 respectively was the lowest over the reporting period.

Since 2012, each year has seen fewer fatal accidents and fatalities involving general aviation aircraft. Without evidence of a corresponding fall in the number of flying hours or departures until 2015, and the data remaining relatively constant, this indicates that the risk of a fatal accident in general aviation is decreasing each year. However, the trend in the number of serious injuries remained relatively stable.

Figure 14: General aviation occurrences and injuries (VH- and foreign registered aircraft) 2007 to 2016

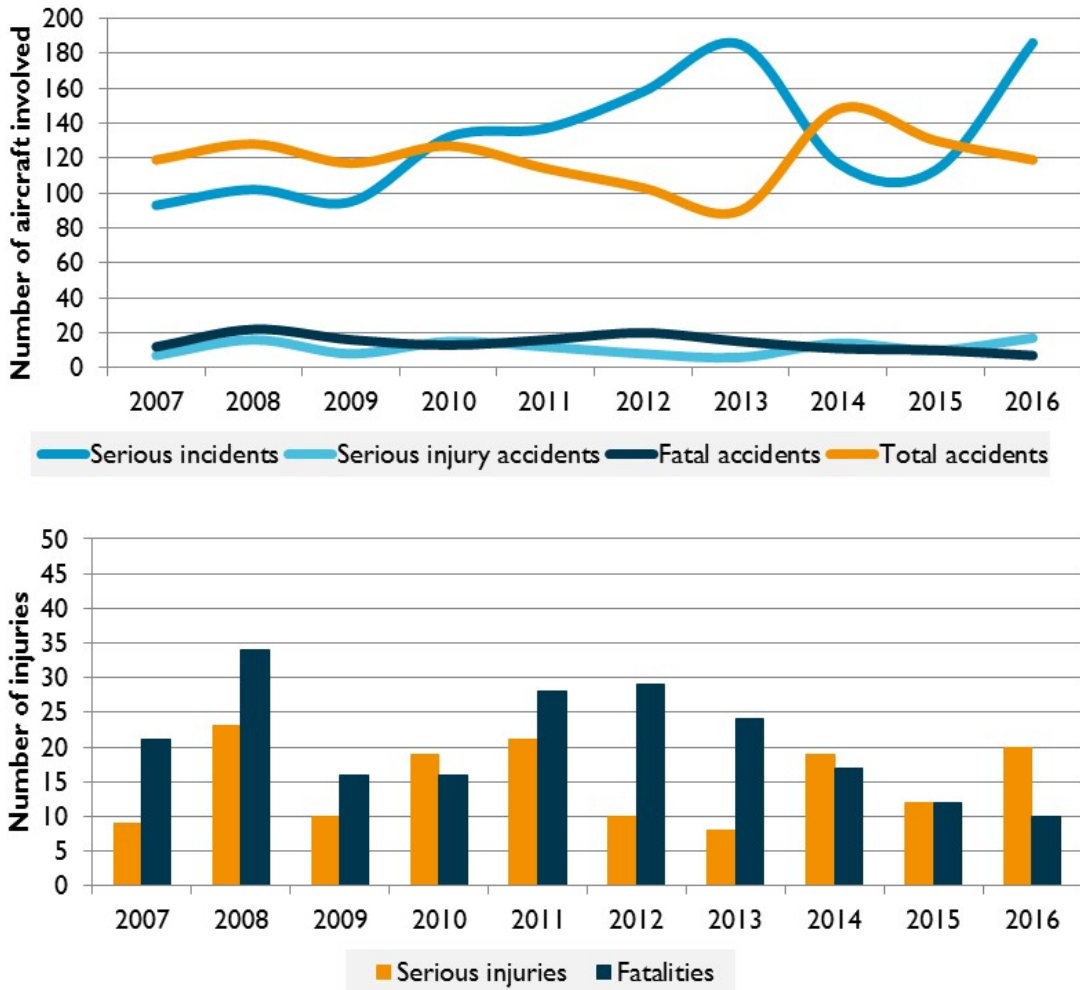
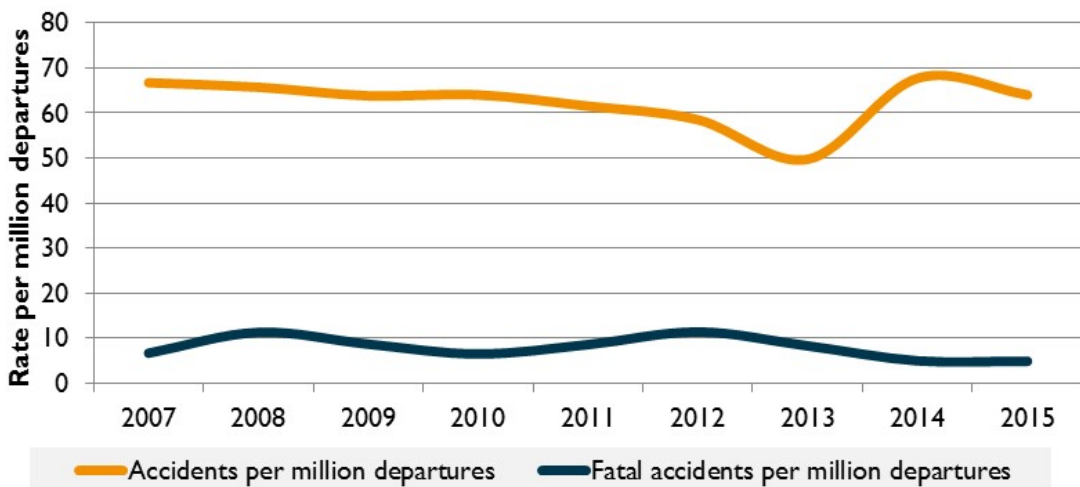


Figure 15: General aviation accident and fatal accident rate (per million departures, VH-registered aircraft only) 2007 to 2015



Of the 1,195 general aviation aircraft involved in accidents over the last 10 years, approximately 12 per cent, or 142 accidents were fatal, involving 207 fatalities. In 2015, the last year with available general aviation departure information, the accidents rate was nine times that of commercial air transport and the fatal accidents rate was six times greater. The accident rate in

2015 was consistent with the average over the study period. The fatal accident rate was the lowest over the same period.

Accident types and severity varied across the different types of general aviation flying, as some types of operations involve a greater level of accepted operational risk including low flying in aerial agriculture and mustering. Over the 2007 to 2015 period, the different types of general aviation, per million hours flown showed the following accident rates:

- Private/business and sports had the highest average rate of reported accidents (162.1 per million hours flown) and the second average highest fatal accident rate (22.6 per million hours flown).
- Aerial agriculture had the second highest average rate of accidents (160.7 per million hours flown) and the third lowest average fatal accident rate (20.3 per million hours flown).
- Search and rescue had the lowest average rate of reported accidents (42.1 per million hours flown) but the highest average fatal accident rate (28.1 per million hours flown).
- Flying training had the second lowest average rate of reported accidents (48.2 per million hours flown) and the lowest average fatal accident rate (2.2 per million hours flown).

Aerial work

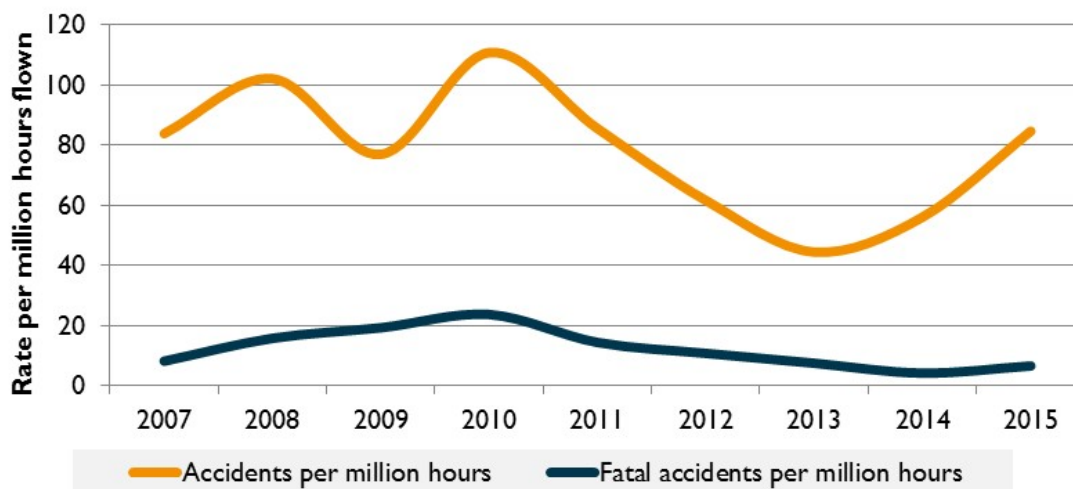
Aerial work includes a number of different commercial activities, including aerial agriculture, mustering, surveying and photography, search and rescue, and aerial fire control. These activities often require aircraft to operate in conditions with inherent risks, such as manoeuvring at low level for crop spraying and aerial mustering. This is a significant factor to take into account when comparing aerial work occurrence data with other operation types.

In 2016, the number of incidents reported to the ATSB involving general aviation aircraft conducting aerial work was the second highest in the 10-year period. The number of aircraft involved in serious incidents (41) was significantly greater than the 10-year average. The number of accidents (38) was consistent with the 10-year average

Table 11: Aerial work (VH- registered aircraft) occurrences 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|-------|------|-------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 102 | 91 | 117 | 110 | 126 | 106 | 129 | 134 | 144 | 142 |
| Serious incidents | 12 | 13 | 13 | 28 | 23 | 31 | 44 | 18 | 20 | 41 |
| Serious injury accidents | 2 | 7 | 1 | 5 | 5 | 2 | 1 | 3 | 6 | 9 |
| Fatal accidents | 3 | 6 | 7 | 10 | 6 | 4 | 3 | 2 | 3 | 4 |
| Total accidents | 31 | 39 | 28 | 47 | 36 | 23 | 18 | 27 | 39 | 38 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 2 | 9 | 2 | 6 | 8 | 2 | 1 | 3 | 6 | 11 |
| Fatalities | 3 | 7 | 7 | 12 | 9 | 4 | 3 | 3 | 3 | 4 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million hours | 83.8 | 102.1 | 76.9 | 110.8 | 85.5 | 61.6 | 44.4 | 56 | 84.6 | N/A |
| Fatal accidents per million hours | 8.1 | 15.7 | 19.2 | 23.6 | 14.3 | 10.7 | 7.4 | 4.1 | 6.5 | N/A |

Figure 16: Accident rate for aircraft (VH- registered) involved in aerial work (per million hours flown) 2007 to 2015



The year 2015 had the second lowest reported fatal accident rate in the years from 2007. The accident rate was consistent with the previous eight years (Figure 16).

The following sections explore the accidents, serious incidents and injuries that occurred in 2016 in the different types of aerial work.

Aerial agriculture

The number of accidents, incidents and serious incidents involving aircraft conducting aerial agricultural spraying and spreading activities was the highest number in the study period, however very few incidents, relative to serious incidents and accidents were reported. There were three fatal accidents in 2016.

Wire strike was the most commonly reported occurrence involving aircraft conducting aerial agriculture operations in 2016, followed by collision with terrain, engine failure or malfunction and loss of control.

Table 12: Occurrences involving general aviation aircraft conducting aerial agriculture 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|-------|-------|-------|-------|-------|-------|------|-------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 4 | 5 | 5 | 2 | 7 | 6 | 9 | 7 | 7 | 15 |
| Serious incidents | 5 | 7 | 5 | 17 | 13 | 15 | 27 | 7 | 11 | 25 |
| Serious injury accidents | 1 | 4 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 5 |
| Fatal accidents | 0 | 3 | 3 | 4 | 1 | 2 | 1 | 0 | 1 | 3 |
| Total accidents | 10 | 18 | 10 | 16 | 18 | 10 | 8 | 12 | 17 | 21 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 1 | 4 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 5 |
| Fatalities | 0 | 3 | 3 | 4 | 1 | 2 | 1 | 0 | 1 | 3 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million hours | 161 | 230.2 | 136.5 | 154.2 | 179.3 | 112.3 | 100.2 | 158 | 218.6 | N/A |
| Fatal accidents per million hours | 0 | 38.4 | 40.9 | 38.5 | 10 | 22.5 | 12.5 | 0 | 12.9 | N/A |

In 2016, there were 21 accidents, including three fatal accidents, involving aerial agriculture. Some of these accidents are outlined below:

- The pilot of a Bell 206B received fatal injuries when the helicopter was destroyed by a collision with terrain and post-impact fire, 5 km south-west of Carmila, Queensland. The aircraft was spraying cane fields at the time of the accident, and struck a powerline causing the tail rotor and vertical stabiliser assembly to separate from the helicopter ([ATSB investigation AO-2016-027](#)). In 2016, there were three more wire strike accidents, including two serious injury accidents, involving aircraft conducting aerial agriculture operations; one of these was also investigated ([ATSB investigation AO-2016-081](#)).
- The pilot of an Air Tractor AT-502 received fatal injuries when the aeroplane was destroyed by a collision with terrain near Walgett, New South Wales. The ATSB investigation is continuing ([ATSB investigation AO-2016-146](#)).
- The pilot of an Air Tractor AT-802A was fatally injured and the aeroplane destroyed by a collision with terrain and post-impact fire 33 km west of Narromine, New South Wales. The ATSB investigation is continuing ([ATSB investigation AO-2016-157](#)).
- A Cessna A188B sustained substantial damage in a collision with terrain near Hay aerodrome, New South Wales. The pilot was not injured ([ATSB investigation AO-2016-099](#)).



Collision with terrain of a Cessna A188B. Source: Aircraft owner

Aerial mustering

Similar to aerial agriculture, the number of aerial mustering incidents reported to the ATSB each year, relative to the number of accidents and serious incidents is low. There were as many incidents reported to the ATSB in 2016 as in the previous nine years, possibly indicating the reporting culture for aerial mustering operators is slowly improving.

In 2016, the most commonly reported occurrence involving aerial mustering aircraft was collision with terrain.

Table 13: Occurrences involving general aviation aircraft conducting aerial mustering 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|-------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 4 |
| Serious incidents | 0 | 1 | 0 | 2 | 1 | 0 | 2 | 2 | 0 | 3 |
| Serious injury accidents | 1 | 1 | 0 | 4 | 1 | 1 | 0 | 2 | 3 | 1 |
| Fatal accidents | 1 | 0 | 3 | 4 | 1 | 2 | 0 | 0 | 2 | 1 |
| Total accidents | 9 | 3 | 6 | 19 | 6 | 9 | 1 | 4 | 11 | 6 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 1 | 1 | 0 | 4 | 1 | 1 | 0 | 2 | 3 | 1 |
| Fatalities | 1 | 0 | 3 | 5 | 1 | 2 | 0 | 0 | 2 | 1 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million hours | 79.8 | 26.6 | 56.8 | 160.9 | 47.7 | 80 | 8 | 28.8 | 73.8 | N/A |
| Fatal accidents per million hours | 8.9 | 0 | 28.4 | 33.9 | 7.9 | 17.8 | 0 | 0 | 13.4 | N/A |

Six aerial mustering aircraft accidents were reported to the ATSB in 2016, including one fatal accident. Some of these accidents are outlined below:

- The pilot of a Cessna 150 was fatally injured when the aeroplane collided with terrain caused by a loss of control at New Crown Station, Northern Territory. The aircraft was substantially damaged ([ATSB investigation AO-2016-074](#)).



Collision with terrain of a Cessna 150. Source: South Australia police

- The pilot of a Robinson R22 helicopter was seriously injured when the helicopter collided with terrain following a wire strike while conducting cattle mustering on a property 88 km north-east of Roma, Queensland. The aircraft was substantially damaged ([ATSB investigation AO-2016-013](#)).



Collision with terrain of a Robinson R22. Source: Queensland Police

- The pilot of a Robinson R22 helicopter sustained minor injuries when it collided with terrain 15 km south of Coen, Queensland. A cow, with long horns, charged and reared up at the helicopter causing the accident. The cow's horn went over the right skid of the helicopter, trapping the skid. The pilot attempted to free the helicopter but it rolled to the right. The main rotor struck the ground and the helicopter collided with the ground, sliding around 10 m and catching fire. The pilot exited the aircraft before it was destroyed. No injuries to the cow were reported ([ATSB investigation AO-2016-120](#)).



Collision with terrain and subsequent fire destruction of a Robinson R22. Source: Queensland Police

- A Robinson R22 helicopter was destroyed by a grass fire, which ignited when the pilot conducted a precautionary landing in long grass after detecting a severe tail vibration. It was subsequently determined that the vibrations were caused when a large bush turkey collided with the tail rotor. No injuries were reported to the ATSB (ATSB occurrence 201600288).

Search and rescue

Occurrences involving search and rescue aircraft, are very rarely reported to the ATSB. This is likely due to the very small amount of search and rescue flying activity in Australia, relative to other types of general aviation.

In 2016, there were nine reported incidents involving aircraft conducting search and rescue operations including two birdstrikes, one loss of separation and a near encounter with a remotely piloted aircraft.

Table 14: Occurrences involving general aviation aircraft conducting search and rescue operations 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 7 | 3 | 4 | 4 | 7 | 7 | 9 | 12 | 5 | 9 |
| Serious incidents | 0 | 1 | 0 | 3 | 0 | 3 | 2 | 1 | 0 | 1 |
| Serious injury accidents | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fatal accidents | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| Total accidents | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fatalities | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |

In 2016, there were no accidents and one serious incident involving search and rescue aircraft reported to the ATSB. The serious incident is outlined below:

- An Agusta SPA AW139 sustained minor damaged during winching operations when the helicopters main rotor blades contacted foliage. No injuries were reported (ATSB occurrence 201604008).

Fire control

Despite the potential hazards associated with reduced visibility, spatial disorientation, low-level manoeuvring, and high operating weight, few accidents and serious incidents involving fire control operations are reported to the ATSB.

There were two incidents reported to the ATSB in 2016, including a near encounter with a remotely piloted aircraft.

Table 15: Occurrences involving general aviation aircraft conducting fire control operations 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 3 | 1 | 6 | 1 | 0 | 3 | 3 | 4 | 3 | 2 |
| Serious incidents | 1 | 1 | 3 | 0 | 0 | 1 | 1 | 1 | 1 | 3 |
| Serious injury accidents | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fatal accidents | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Total accidents | 1 | 0 | 4 | 0 | 0 | 0 | 2 | 2 | 1 | 0 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fatalities | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

In 2016, two serious incidents, involving three aircraft conducting aerial fire control, were reported to the ATSB. There were no reported accidents. The serious incidents are outline below:

- A Bell 212 sustained minor damage when the helicopter collided with terrain following the aircraft's blades striking a tree near Bann River, Victoria (ATSB occurrence 201600147).
- An Aerospatiale AS350BA and an Airbus AS350B3 had a near collision when the bucket on one of the helicopters crossed in close proximity to the other near Merricumbene, New South Wales (ATSB occurrence 201604394).

Survey and photography

Survey and photography aerial work results in around half the number of fatalities per year as aerial agriculture and mustering. However, survey and photography has a much higher proportion of reported incidents to all occurrence, accidents, incidents and serious incident. This is probably an indication of a stronger reporting culture, relative to other types of aerial work.

In 2016, the most commonly reported incidents for survey and photography operations to the ATSB were birdstrikes, followed by loss of separation.

Table 16: Occurrences involving general aviation aircraft conducting survey and photography operations 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|-------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 15 | 17 | 24 | 29 | 27 | 17 | 26 | 27 | 36 | 24 |
| Serious incidents | 1 | 1 | 2 | 3 | 3 | 7 | 4 | 2 | 2 | 2 |
| Serious injury accidents | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| Fatal accidents | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 |
| Total accidents | 4 | 8 | 3 | 5 | 4 | 0 | 5 | 2 | 1 | 3 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 0 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 3 |
| Fatalities | 1 | 2 | 0 | 0 | 4 | 0 | 0 | 2 | 0 | 0 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million hours | 73.8 | 124.2 | 78.2 | 85.5 | 58.7 | 0 | 99.3 | 50.7 | 29.7 | N/A |
| Fatal accidents per million hours | 18.4 | 31 | 0 | 0 | 29.4 | 0 | 0 | 25.4 | 0 | N/A |

In 2016, there were three accidents involving aircraft conducting survey and photography operations and a further two aircraft involved in two serious incidents. The three accidents are outlined below:

- Two passengers and pilot of a McDonnell Douglas 369D, sustained serious injuries when the helicopter collided with terrain following engine power loss. The investigation is continuing ([ATSB investigation AO-2016-078](#)).
- A Robinson R22 received substantial damage when, after landing, the helicopter slipped sideways on uneven ground and rolled over at Adelaide River Station, Northern Territory. No injuries were reported (ATSB occurrence 201604231).
- A Cessna 210M received substantial damage from a wheels-up landing at Menindee aeroplane landing area, New South Wales. A post-flight inspection revealed the landing gear lever was not fully engaged. No injuries were reported (ATSB occurrence 201600916).

Flying training

2016 saw the second highest number of incidents and the highest number of serious incidents involving flying training in the last 10 years. However, the number of accidents was consistent with the 10-year average.

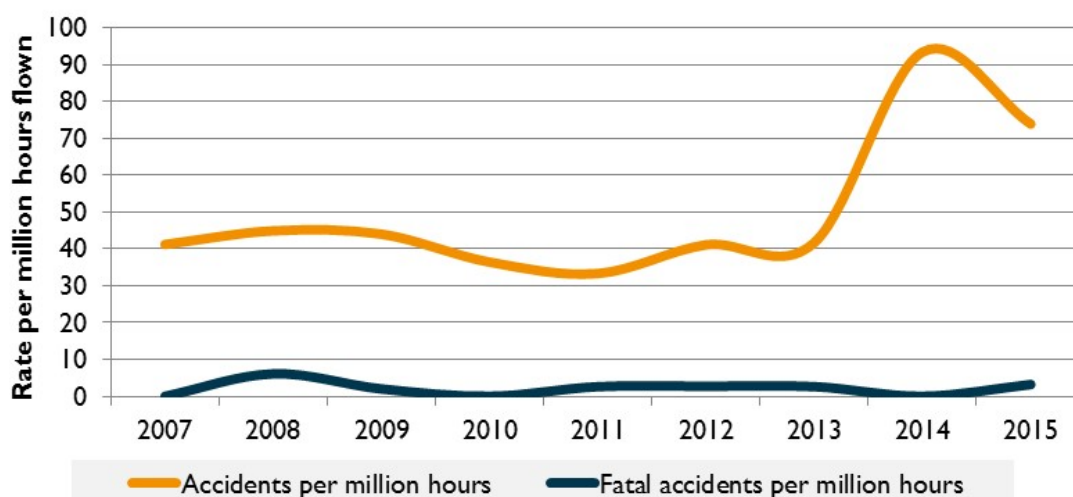
In 2015, the flying training accident rate was high compared to the years 2007 to 2013, though less than 2014.

In 2016, the most common reported incidents involving flying training included aircraft separation issues, followed by birdstrikes. Near collision was the most commonly reported accident or serious incident.

Table 17: Flying training (VH- registered) aircraft occurrences 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 265 | 210 | 226 | 213 | 210 | 222 | 296 | 288 | 379 | 378 |
| Serious incidents | 18 | 18 | 24 | 30 | 22 | 45 | 48 | 42 | 30 | 65 |
| Serious injury accidents | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 2 | 1 | 0 |
| Fatal accidents | 0 | 3 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| Total accidents | 19 | 22 | 22 | 16 | 13 | 15 | 16 | 31 | 23 | 16 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 0 | 0 | 1 | 3 | 1 | 1 | 0 | 2 | 1 | 0 |
| Fatalities | 0 | 4 | 1 | 0 | 2 | 2 | 1 | 0 | 1 | 0 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million hours | 41.2 | 44.9 | 44 | 36.4 | 33.3 | 41.1 | 41.7 | 93.4 | 73.9 | N/A |
| Fatal accidents per million hours | 0 | 6.1 | 2 | 0 | 2.6 | 2.7 | 2.6 | 0 | 3.2 | N/A |

Figure 17: Accident rate for aircraft (VH- registered) involved in flying training (per million hours flown) 2007 to 2015



In 2016, there were 16 accidents, but no fatal accidents, involving flying training. Some of these accidents are outlined below:

- During circuit training at Parafield Airport, South Australia, the pilot of a Sia Marchetti F.260 landed with the undercarriage retracted resulting in substantial damage to the aeroplane. No injuries were reported (ATSB occurrence 201600003).
- During a touch-and-go landing at Murray Field aerodrome, Western Australia, a Cessna 172R struck a kangaroo resulting in substantial damage to the aircraft and a rejected take-off. No injuries were reported (ATSB occurrence 201600149).
- The pilot of an amateur built EXEC 162FA sustained minor injuries when the aircraft collided with terrain after the pilot lost directional control at Lismore Airport, New South Wales. The aircraft received substantial damage in the accident (ATSB occurrence 201600405).
- During simulated engine failure training at Sunshine Coast Airport, Queensland, a Bell 206B landed hard with the tail striking the ground. As the crew was attempting to control the nose down attitude, the main rotor blade struck the tail severing it from the tail boom. The helicopter received substantial damage but no injuries were reported (ATSB occurrence 201600601).

- A Cessna 152 received substantial damage when the crew conducted a forced landing in a paddock precipitated by an engine failure due to fuel exhaustion near the Gold Coast Airport, Queensland. No injuries were reported (ATSB occurrence 201604151).
- While taxiing at Quairading aerodrome landing area, Western Australia, the crew of a Cessna 172R manoeuvred the aeroplane to avoid birds and collided with a patio pole resulting in substantial damaged to the aircraft. No injuries were reported (ATSB occurrence 201605424).
- During landing at Merredin aerodrome landing area, Western Australia, the solo student pilot of a Grob G-115C2 sustained minor injuries when the aeroplane collided with terrain. The aircraft received substantial damage (ATSB occurrence 201602988).

Private/business and sports aviation

Private/business and sports aviation generally describes aircraft that operated for pleasure or recreation, or for a business or professional need. It is often difficult to distinguish between business and private operations; as a result, they have been aggregated for the purpose of this report.

It is important to note that this section only includes aircraft conducting this type of operation that are registered on the Australian civil aircraft (VH-) register. Sports and recreational aircraft registered under RAOs are considered separately in the *Recreational* section of this report.

In 2016, with 61 accidents, private/business and sports aviation operations had the largest number of reported accidents of any general aviation operation type. However, this operation type had the equal lowest number of fatalities, five from two accidents, in the last 10 years.

In 2015, the accident rate for private/business and sports aviation was the second highest in the nine-year period to 2015.

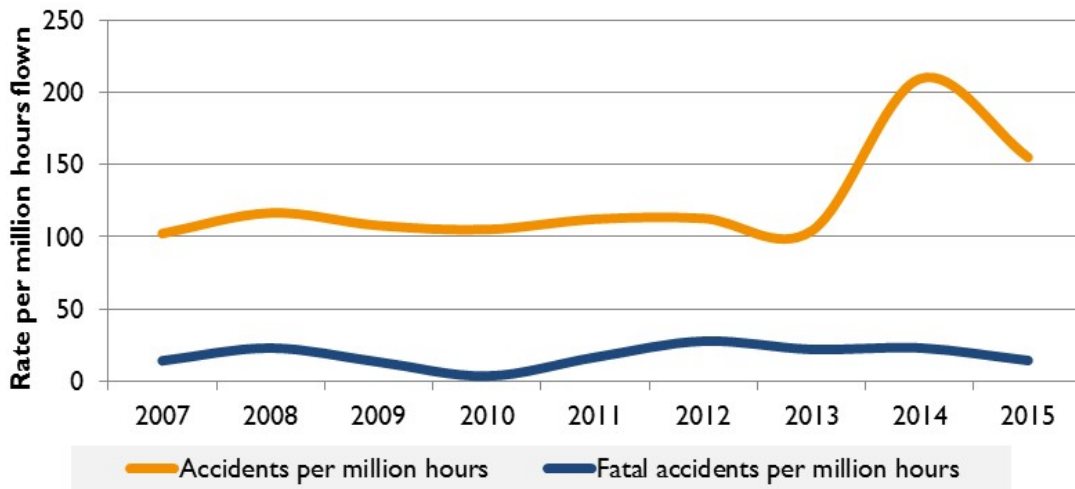
The most common incidents reported to the ATSB in 2016 concerning private/business and sports aircraft were landing gear indications and engine failure or malfunction. The most common accidents were collision with terrain and loss of control. The most common serious incidents were near collisions and forced or precautionary landings.

The number of occurrences in the private/business operation type is significantly greater than those occurrences in sports aviation.

Table 18: Private/business and sports aviation (VH-registered) aircraft occurrences (including gliding) 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 212 | 185 | 201 | 160 | 191 | 168 | 136 | 187 | 173 | 181 |
| Serious incidents | 24 | 16 | 21 | 21 | 38 | 43 | 45 | 28 | 35 | 54 |
| Serious injury accidents | 5 | 9 | 6 | 8 | 7 | 3 | 4 | 9 | 3 | 8 |
| Fatal accidents | 9 | 13 | 8 | 2 | 9 | 15 | 11 | 9 | 6 | 2 |
| Total accidents | 65 | 66 | 65 | 59 | 61 | 61 | 52 | 82 | 65 | 61 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 7 | 14 | 7 | 10 | 12 | 5 | 6 | 14 | 5 | 9 |
| Fatalities | 18 | 23 | 8 | 3 | 17 | 23 | 20 | 14 | 8 | 5 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million hours | 102.3 | 116.5 | 107.7 | 105.0 | 112.2 | 112.8 | 104.1 | 209.4 | 155.0 | N/A |
| Fatal accidents per million hours | 14.2 | 22.9 | 13.3 | 3.6 | 16.6 | 27.7 | 22.0 | 23.0 | 14.3 | N/A |

Figure 18: Accident rate for aircraft (VH- registered) involved in private/business/sport (including gliding) (per million hours flown) 2007 to 2015



Private/business

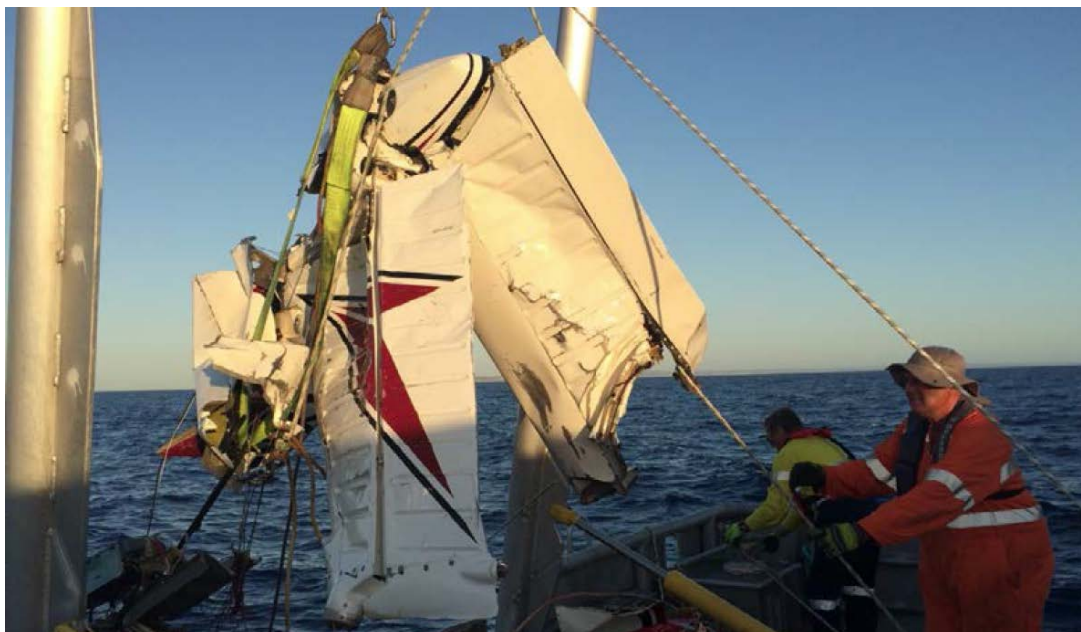
Over 2,300 aircraft being used for private or business flying in the last 10 years were involved in incidents, serious incidents, or accidents that were reported to the ATSB. The number of incidents reported to the ATSB in 2016 (145) was consistent with the 10-yearly average of 158 per year. The number of accidents and serious incidents were also consistent with their 10-year averages. Fatalities were significantly less than average.

Table 19: Occurrences involving general aviation aircraft conducting private and business operations 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 196 | 162 | 184 | 135 | 165 | 146 | 117 | 163 | 150 | 145 |
| Serious incidents | 19 | 13 | 17 | 14 | 27 | 34 | 28 | 22 | 28 | 39 |
| Serious injury accidents | 4 | 7 | 3 | 5 | 4 | 1 | 3 | 7 | 3 | 2 |
| Fatal accidents | 7 | 11 | 5 | 2 | 8 | 12 | 10 | 8 | 5 | 2 |
| Total accidents | 57 | 59 | 56 | 52 | 43 | 47 | 43 | 69 | 56 | 51 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 6 | 12 | 3 | 6 | 9 | 2 | 4 | 12 | 5 | 3 |
| Fatalities | 15 | 20 | 5 | 3 | 16 | 19 | 19 | 13 | 7 | 5 |

In 2016, 51 VH- registered aircraft conducting private or business operations were involved in an accident. There were five fatalities from two fatal accidents, and two accidents resulted in serious injuries. The fatal and serious injury accidents are described below:

- All four occupants of a Piper PA-28 were fatally injured when the aeroplane impacted water in low visibility conditions near Barwon Heads, Victoria. The pilot likely experienced spatial disorientation and a subsequent loss of control. The aircraft was destroyed in the accident ([ATSB investigation AO-2016-006](#)).



Recovery by Victoria Police of a Piper PA-28's fin and left horizontal stabiliser. Source: Victoria Police

- The pilot of a Cessna 172 was fatally injured, at Parafield Airport, South Australia, either by being struck by the aircraft or in a fall as a result of the aeroplane taxiing away following a hand start with no one at the aircraft controls and without it being adequately secured. The uncontrolled aircraft taxied a short distance before colliding with a Piper PA-32. The pilot's dog was unsecured in the aircraft. The aircraft was destroyed in the accident ([ATSB investigation AO-2016-115](#)).



Taxiing collision between Cessna 172 and Piper PA-32. Source: ATSB

- One of the pilots of an amateur built Europa Aircraft Classic, operating in the experimental category, was seriously injured during a forced landing at a paddock nearby Bridport aerodrome, Tasmania. Shortly after take-off, while conducting touch-and-go circuits, the engine spluttered for a short time before stopping completely, leading to forced landing. The aircraft sustained substantial damage in the accident ([ATSB investigation AO-2016-077](#)).



Forced landing of an amateur built Europa. Source: Tasmanian Police

- The passenger and pilot of a Cessna 182B sustained serious injuries when the aircraft collided with terrain near Melawondi Cattle Station, Queensland. The aircraft sustained substantial damage in the accident (ATSB occurrence 201600858).

Sports aviation

Sports aviation includes gliding, parachute operations, private balloon operations and aerobatics in VH-registered aircraft. In 2016, the number of aircraft involved in incidents and serious incidents was significantly above the 10-year average. Alternatively, the number of aircraft involved in accidents was consistent with the average, these data are a possible indication that the reporting culture within sports aviation is improving.

The most commonly reported occurrence, accident, incident or serious incident, was collision with terrain (30) followed by loss of control (18) and runway excursions (12).

Table 20: Occurrences involving general aviation aircraft conducting sports aviation 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 16 | 23 | 17 | 25 | 26 | 22 | 19 | 24 | 23 | 36 |
| Serious incidents | 5 | 3 | 4 | 7 | 11 | 9 | 17 | 6 | 7 | 15 |
| Serious injury accidents | 1 | 2 | 3 | 3 | 3 | 2 | 1 | 2 | 0 | 6 |
| Fatal accidents | 2 | 2 | 3 | 0 | 1 | 3 | 1 | 1 | 1 | 0 |
| Total accidents | 8 | 7 | 9 | 7 | 18 | 14 | 9 | 13 | 9 | 10 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 1 | 2 | 4 | 4 | 3 | 3 | 2 | 2 | 0 | 6 |
| Fatalities | 3 | 3 | 3 | 0 | 1 | 4 | 1 | 1 | 1 | 0 |

In 2016, there were 10 accidents, with no fatal accidents involving sports aviation, as well as 15 serious incidents, involving six serious injuries. Some of these accidents are described below:

- During an aero-tow glider launch of a PZL-Swidnik PW-5 at Beverley aerodrome landing area, Western Australia, the glider pilot encountered control issues and released from the tow aircraft. The glider landed hard resulting in the pilot receiving serious injuries and substantial damage to the glider (ATSB occurrence 201600246).

- During the approach to Waikerie aerodrome, South Australia, the pilot of an Alexander Schleicher Segelflugzeugbau ASW-27-18E lost control and the glider collided with terrain. The pilot was seriously injured and the glider was destroyed (ATSB occurrence 201600268).
- After landing near Cessnock Airport, New South Wales, the ground crew of a Kavanagh B-425 mishandled the crown line and the balloon basket tipped over. The pilot fell from the basket and was struck by the burner receiving serious injuries (ATSB occurrence 201600589).
- During the glider launch of a Glasflugel LIBELLE 201B at Balaklava, South Australia, authorised landing area, South Australia, the aircraft over ran the rope and the cable back-released and flicked up into the main wheel becoming trapped in the landing gear. The glider subsequently nosed over and collided with terrain. The glider sustained substantial damage and the pilot was seriously injured (ATSB occurrence 201604749).
- During approach near Narromine aerodrome, New South Wales, a Schempp-Hirth Flugzeugbau GmbH VENTUS C struck a wire and collided with terrain. The glider sustained substantial damage and the pilot received serious injuries (ATSB occurrence 201604832).
- During cruise, an Alexander Schleicher Segelflugzeugbau ASH-26E glider experienced consistent sink. The pilot was unable to deploy the motor and conducted a forced landing, subsequently colliding with vegetation. The glider sustained substantial damage and the pilot sustained minor injuries (ATSB occurrence 201605162).

Foreign general aviation

There are a small number of foreign general aviation accidents and serious incidents reported each year. In 2016, 18 foreign general aviation aircraft incidents were reported to the ATSB. This is consistent with the 10-year average.

Table 21: Foreign registered general aviation aircraft occurrences 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 18 | 26 | 14 | 12 | 14 | 18 | 16 | 25 | 18 | 18 |
| Serious incidents | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 2 | 2 |
| Serious injury accidents | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Fatal accidents | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total accidents | 1 | 1 | 0 | 2 | 0 | 2 | 0 | 2 | 1 | 0 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Fatalities | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

In 2016, there were no accidents and two serious incidents reported to the ATSB. These are described below:

- During cruise 185 km south-east of Broome, the pilot of a Cessna 172B was reported to be partially incapacitated due to illness. No injuries were reported (ATSB occurrence 201600523).
- During approach to Kingaroy aerodrome, Queensland, the pilot of a Jonker JSC-1 glider observed a departing North American AT-6A pass in close proximity. No injuries were reported (ATSB occurrence 201600736).

Other general aviation

Between 2007 and 2016, over 6,400 aviation safety occurrences, involving over 6,800 aircraft, were reported to the ATSB for Australian-registered general aviation aircraft, but no information was provided on the type of flying operation for these occurrences. In many occurrences involving a general aviation aircraft where the type of flying operation is not known, the ATSB was notified

by someone other than the pilot of the aircraft involved, such as through air traffic control, the public, pilots of nearby aircraft, or aerodrome-based staff.

The number of occurrences involving ‘unknown’ general aviation aircraft has decreased by over 50 per cent since its peak in 2009. This is probably due to improvements in reporting detail and in data collection methods. 2016 had the second lowest number of ‘unknown’ general aviation occurrences in the last 10 years. The large number of ‘unknown’ general aviation aircraft involved in reportable occurrences has been, in part, related to the abolition of mandatory flight plans for all aircraft since the mid 1990’s, which is reflected in most of these occurrences being airspace-related including, airspace infringements, aircraft proximity issues, non-compliance with published information, air traffic control instructions, or standard operating procedures. Other reasons that an operation type might not be recorded for an occurrence include no aircraft being affected, such as some ground operation-related occurrences, or where aerodrome officers have located dead wildlife on an aerodrome from a suspected animal or bird strike.

Recreational aviation

Recreational aviation covers a very diverse range of aircraft types, including factory and amateur-built fixed-wing aeroplanes and motorised gliders, weight shift hang-gliders, trikes, paragliders and powered parachutes, and gyrocopters. Aircraft involved in recreational aviation, as defined by the ATSB, are those aircraft types registered by an RAAO with an Australian non-VH- registration.

Over the last 10 years, reporting of safety incidents to the ATSB by recreational aviation pilots and organisations has more than doubled, due to both the growth in recreational flying, and improving awareness among RAAOs and pilots of the need to report safety matters to the ATSB. As a result, some of the relatively low numbers of occurrences at the beginning of the 10-year reporting period are accounted for by the under-reporting of accidents and incidents.

In 2016, the number of incidents and serious incidents involving recreational aircraft reported to the ATSB was consistent with the previous four years. However, there were fewer accidents than in the previous four years. The ATSB does not usually investigate accidents involving recreational aircraft, but the RAAO may conduct its own investigation.

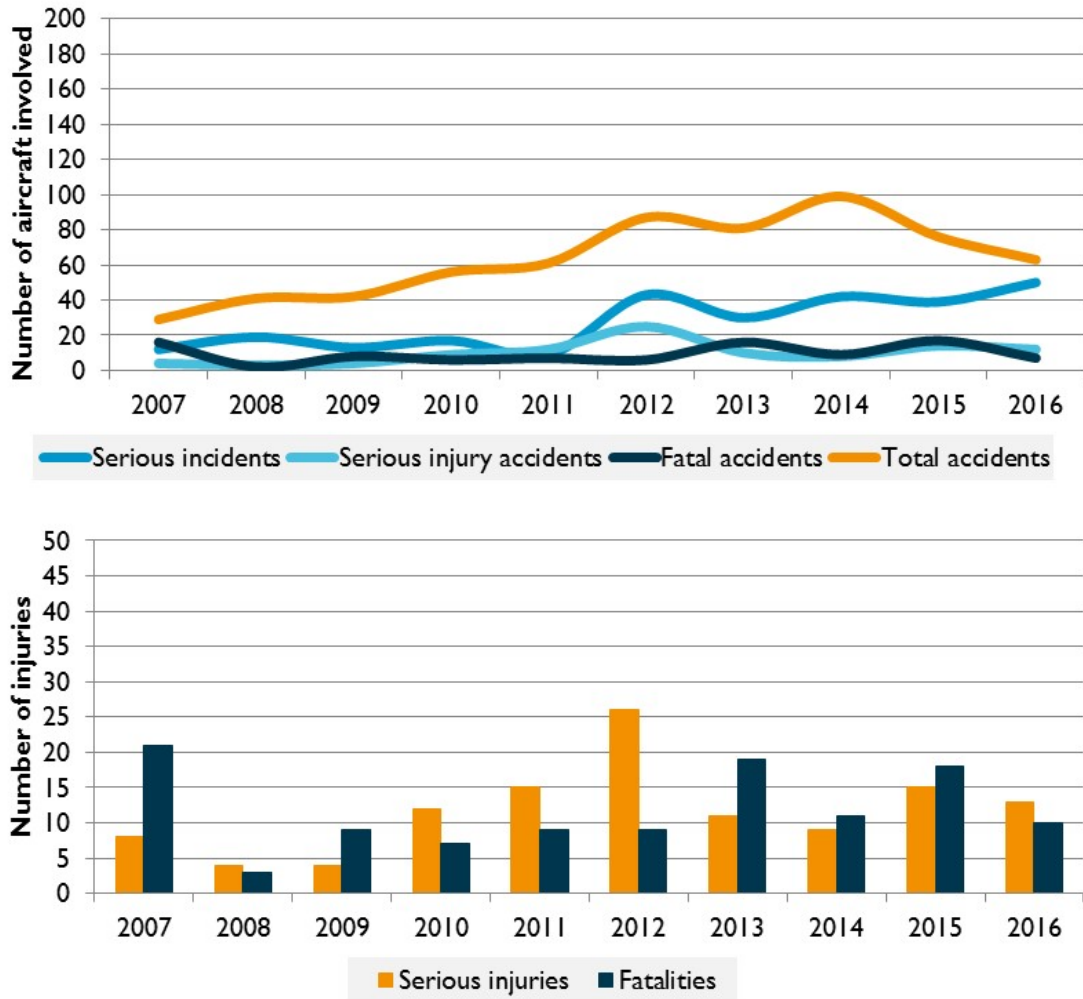
Table 22: Recreational aviation (non-VH registered) aircraft occurrences 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 48 | 66 | 45 | 72 | 88 | 113 | 114 | 139 | 92 | 122 |
| Serious incidents | 12 | 19 | 13 | 17 | 9 | 43 | 30 | 42 | 39 | 50 |
| Serious injury accidents | 4 | 3 | 4 | 9 | 12 | 25 | 10 | 8 | 14 | 12 |
| Fatal accidents | 16 | 2 | 8 | 6 | 7 | 6 | 16 | 9 | 17 | 7 |
| Total accidents | 29 | 41 | 42 | 56 | 61 | 87 | 81 | 99 | 76 | 63 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 8 | 4 | 4 | 12 | 15 | 26 | 11 | 9 | 15 | 13 |
| Fatalities | 21 | 3 | 9 | 7 | 9 | 9 | 19 | 11 | 18 | 10 |
| Rate of aircraft involved¹⁹ | | | | | | | | | | |
| Accidents per million hours | 112.0 | 145.7 | 134.9 | 162.1 | 175.1 | 253.7 | 262.1 | 305.0 | 237.3 | N/A |
| Fatal accidents per million hours | 61.8 | 7.1 | 25.7 | 17.4 | 20.1 | 17.5 | 51.8 | 27.7 | 53.1 | N/A |

There were seven fatal accidents involving recreational aircraft in 2016, resulting in 10 fatalities, and a further 12 accidents where the occupants were seriously injured.

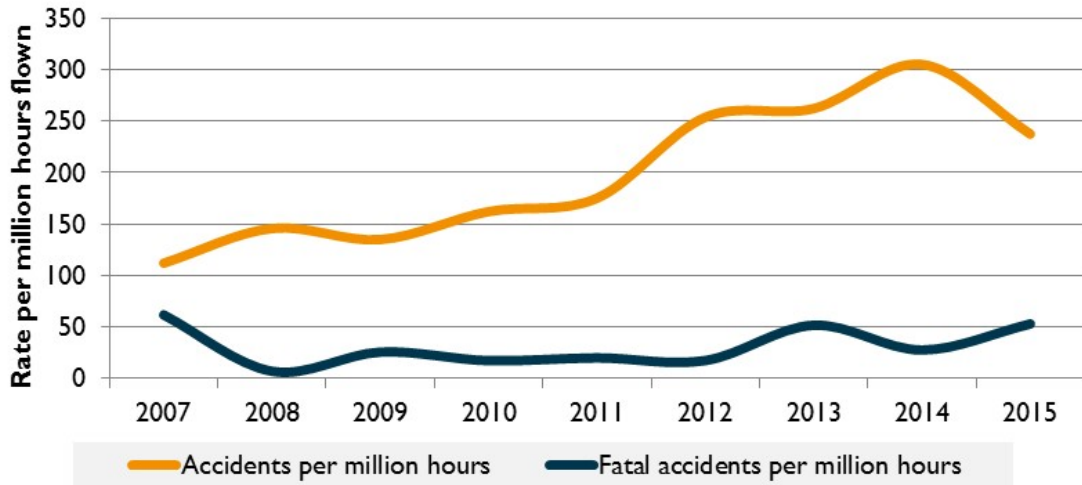
¹⁹ Data was only available from 2007 to 2015.

Figure 19: Recreational aviation occurrences and injuries 2007 to 2016



Though showing a decrease from 2014 to 2015, Figure 20 shows that the accident rate in recreational aviation has increased significantly since 2007. While this increase is likely due to better reporting of accidents to the ATSB, the recreational aviation accident rate in 2015 (237.3 accidents per million hours flown) was higher than any other type of flying in Australia. Recreational aeroplanes, those aircraft registered with Recreational Aviation Australia (RAAus) made up the largest proportion of recreational flying hours, and were also involved in around 72 per cent of all recreational aviation accidents, and 49 per cent of the fatal accidents in the 2007 to 2016 period. Although the recreational aeroplane accident rate over this period was higher than all other types of flying, gyrocopters had a higher than average fatal accident rate between 2007 and 2015.

Figure 20: Recreational aviation accident and fatal accident rate (per million hours flown) 2007 to 2015



The fatal and serious injury accidents involving recreational aircraft in 2016 are described in the following sections. For many of these occurrences, limited detail was provided to the ATSB regarding the circumstances of the accident or serious incident. Increasing the level and quality of safety reporting in general aviation and recreational flying is a major challenge for the ATSB.

In 2016, there were 94 recreational aircraft involved in accidents or serious incidents reported to the ATSB that did not result in fatal or serious injuries. Most of these occurrences involved fixed-wing recreational aeroplanes, with four involving weight shift aircraft and nine gyrocopters. The common occurrence types were:

- collision with terrain
- loss of control
- engine failure or malfunction
- hard landing
- runway excursion.

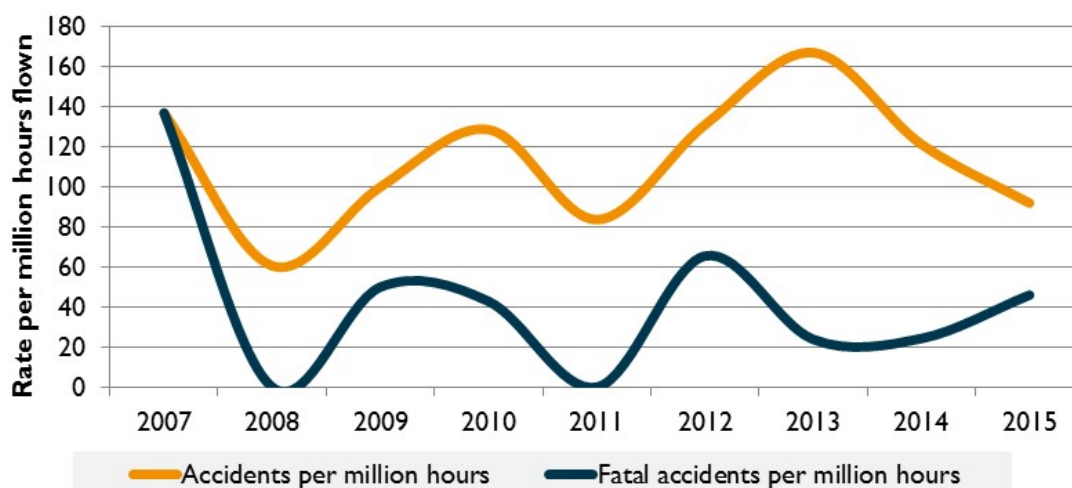
Gyrocopters

Over the last 10 years, 11 incidents, 10 serious incidents and 48 accidents involving gyrocopters were reported to the ATSB. While incident-reporting rates were very low over the study period, from 2007 there was a notable increase in the reporting of accidents involving gyrocopters registered with the Australian Sport Rotorcraft Association (ASRA). Figure 21 shows the rate of accidents and fatal accidents involving gyrocopters over the 2007 to 2015 period, for which flying hours were available. There was almost a 50 per cent increase in flying activity over this period. On average, gyrocopters had an accident rate (116 accidents per million hours flown) that was similar to private/business and sports aviation, including gliding. However, gyrocopter operations had the highest fatal accident rate of all types of flying in most years (43 per million hours flown), double that of VH-registered private/business and sport operations and significantly greater than recreational weight shift and aeroplane operations.

Table 23: Occurrences involving recreational gyrocopter operations 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|-------|------|------|-------|------|-------|-------|-------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 1 | 1 | 0 | 1 | 0 | 0 | 3 | 1 | 1 | 3 |
| Serious incidents | 0 | 2 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 4 |
| Serious injury accidents | 0 | 0 | 0 | 2 | 3 | 1 | 2 | 1 | 0 | 1 |
| Fatal accidents | 4 | 0 | 2 | 2 | 0 | 3 | 1 | 1 | 2 | 0 |
| Total accidents | 4 | 2 | 4 | 6 | 4 | 6 | 7 | 5 | 4 | 6 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 3 | 0 | 0 | 2 | 3 | 2 | 2 | 1 | 1 | 1 |
| Fatalities | 4 | 0 | 2 | 2 | 0 | 4 | 2 | 1 | 2 | 0 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million hours | 136.8 | 60.5 | 99.9 | 128.5 | 83.6 | 130.9 | 166.9 | 121.3 | 91.9 | N/A |
| Fatal accidents per million hours | 136.8 | 0.0 | 50.0 | 42.8 | 0.0 | 65.4 | 23.8 | 24.3 | 45.9 | N/A |

Figure 21: Accident rate for recreational gyrocopter operations (per million hours flown) 2007 to 2015



There were six accidents, but no fatal accidents, reported to the ATSB in 2016 involving gyrocopters. Some of the notable accidents are described below:

- The pilot of a gyrocopter sustained serious injuries when it collided with terrain following a rejected take-off at Bindoon aerodrome landing area, Western Australia. The gyrocopter sustained substantial damage in the accident (ATSB occurrence 201600233).
- While manoeuvring near Hughenden aerodrome, Queensland, a Xenon 2 RST's left door detached and struck the propeller, causing the engine to run rough. The pilot shut down the engine and conducted a forced landing. The gyrocopter sustained substantial damage. It was subsequently determined that the door was not latched correctly. No injuries were reported (ATSB occurrence 201600467).
- During climb near Wondai aerodrome landing area, Queensland, the engine of a gyrocopter (unknown model) failed and the pilot conducted a forced landing. The inspection revealed a gearbox bearing failure. No injuries were reported (ATSB occurrence 201600749).

More information on gyrocopter operations in Australia is available from ASRA at www.asra.org.au.

Recreational aeroplanes

Recreational aeroplanes include all non-weight shift controlled aircraft registered with RAAus. Reporting of safety occurrences involving recreational aeroplanes has increased significantly in recent years, as shown in Table 24.

Figure 22 shows the rate of accidents and fatal accidents involving recreational aeroplanes over the 2007 to 2015 period. Despite the increase in flying activity, the accident rate has increased steadily over the study period, although 2015 was significantly lower than the previous two years. In 2015, the recreational aeroplane accident rate in Australia (about 332.8 per million hours flown) was significantly higher than for any other type of flying, including higher risk general aviation operations such as aerial agriculture (218.6 accidents per million hours flown) and (VH-registered) private/business and sport aviation, including gliding (155.0 accidents per million hours flown). The number of accidents in 2016 was consistent with the 10-year average.

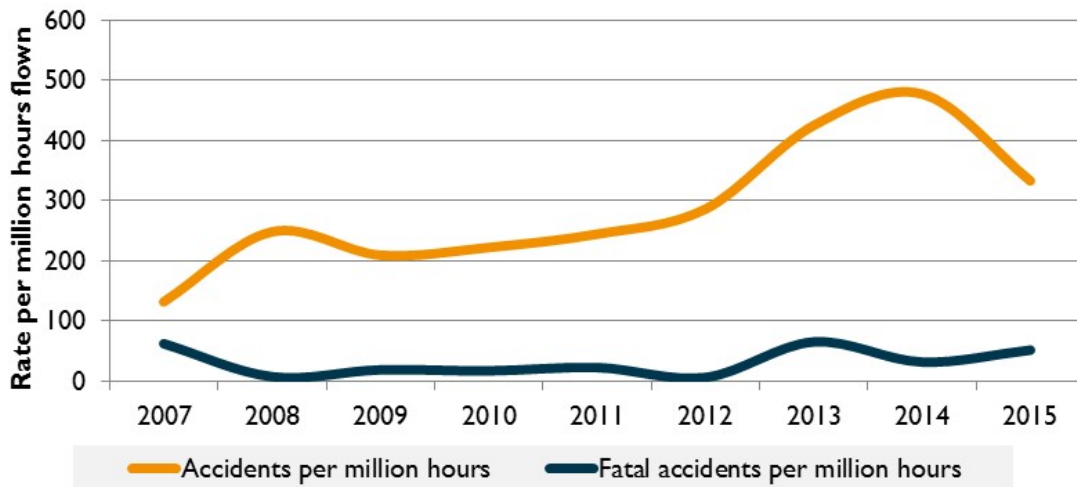
The fatal accident rate involving recreational aeroplanes in 2015 (51.2 fatal accidents per million hours flown) was significantly higher than for comparable private/business and sport aviation, including gliding operations (14.3 fatal accidents per million hours flown).

Table 24: Occurrences involving recreational aeroplane operations 2007 to 2016²⁰

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 43 | 62 | 43 | 68 | 85 | 90 | 98 | 132 | 87 | 117 |
| Serious incidents | 11 | 16 | 13 | 17 | 7 | 35 | 27 | 39 | 35 | 44 |
| Serious injury accidents | 2 | 2 | 4 | 3 | 4 | 4 | 4 | 1 | 4 | 3 |
| Fatal accidents | 8 | 1 | 3 | 3 | 4 | 1 | 9 | 5 | 8 | 4 |
| Total accidents | 17 | 36 | 34 | 40 | 44 | 50 | 59 | 76 | 52 | 43 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 3 | 2 | 4 | 6 | 5 | 4 | 5 | 1 | 4 | 3 |
| Fatalities | 12 | 2 | 3 | 4 | 6 | 2 | 10 | 7 | 8 | 5 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million hours | 131.5 | 248.1 | 209.1 | 222.0 | 244.3 | 285.8 | 425.0 | 477.3 | 332.8 | N/A |
| Fatal accidents per million hours | 61.9 | 6.9 | 18.5 | 16.7 | 22.2 | 5.7 | 64.8 | 31.4 | 51.2 | N/A |

²⁰ Includes RAAus registered motorised gliders.

Figure 22: Accident rate for recreational aeroplane operations (per million hours flown) 2007 to 2015²⁰



There were 43 recreational aircraft involved in accidents and 44 serious incidents reported to the ATSB in 2016. Four of these accidents were fatal and three resulted in serious injuries. The fatal accidents are described below:

- The pilot of a Jabiru J170-C was fatally injured when the aeroplane collided with terrain during a solo training flight at Yarram aerodrome, Victoria. The aircraft was destroyed in the accident ([ATSB investigation AO-2016-112](#)).
- The pilot of a Jabiru ST3 was fatally injured when the aeroplane collided with terrain near Katoomba, New South Wales. The aircraft was destroyed in the accident (ATSB occurrence 201600267).
- The pilot of an ICP SAVANNAH was fatally injured when the aeroplane collided with terrain near Yeoval, New South Wales. The aircraft was destroyed by impact forces and post-impact fire (ATSB occurrence 201600325).
- The passenger and pilot of a Brumby Aircraft Australia LSAR600 were fatally injured when the aeroplane collided with terrain 26 km north of Penfield authorised landing area, Victoria. The aircraft was destroyed by impact forces and post-impact fire (ATSB occurrence 201600485).

More information on recreational aeroplane operations in Australia is available from RAAus at www.raa.asn.au.

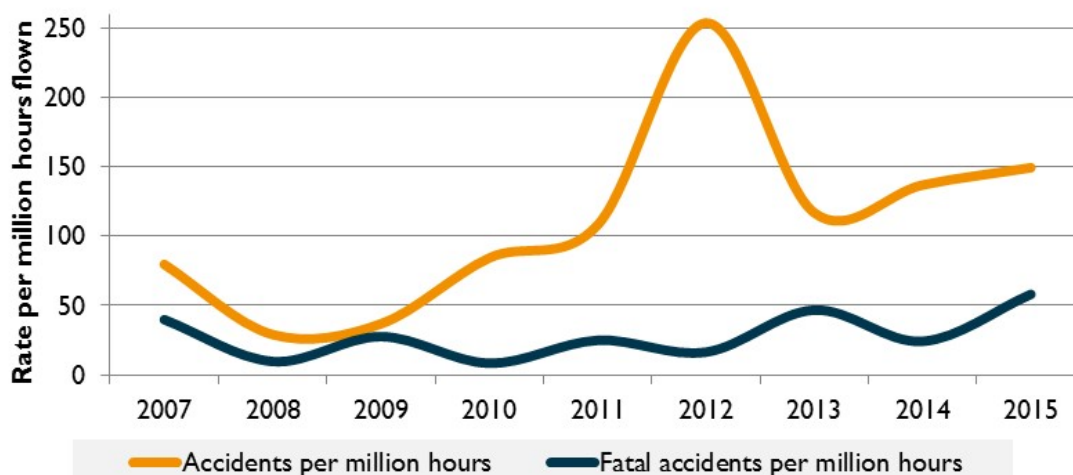
Weight shift

Weight shift aircraft refer to hang gliders, paragliders, powered parachutes, and weight-shift trikes and microlights. Over the last 10 years, 61 incidents, 20 serious incidents and 129 accidents have been reported to the ATSB involving weight shift aircraft (Table 25). Most of these aircraft were registered with the Hang Gliding Federation of Australia (HGFA), with some registered with RAAus. Figure 23 shows the rate of accidents and fatal accidents involving weight shift aircraft over the 2007 to 2015 period (for which flying hours were available). Weight shift activity, as reported by the HGFA and RAAus, increased by around 20 per cent over this period. On average, weight shift aircraft had the lowest accident rates of all types of recreational flying.

Table 25: Occurrences involving recreational weight shift operations 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|------|-------|-------|-------|-------|-------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 4 | 3 | 2 | 3 | 3 | 23 | 13 | 6 | 3 | 1 |
| Serious incidents | 1 | 1 | 0 | 0 | 1 | 7 | 2 | 3 | 3 | 2 |
| Serious injury accidents | 2 | 1 | 0 | 4 | 5 | 20 | 4 | 6 | 8 | 6 |
| Fatal accidents | 4 | 1 | 3 | 1 | 3 | 2 | 6 | 3 | 7 | 2 |
| Total accidents | 8 | 3 | 4 | 10 | 13 | 31 | 15 | 17 | 18 | 10 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 2 | 2 | 0 | 4 | 7 | 20 | 4 | 7 | 8 | 7 |
| Fatalities | 5 | 1 | 4 | 1 | 3 | 3 | 7 | 3 | 8 | 4 |
| Rate of aircraft involved | | | | | | | | | | |
| Accidents per million hours | 79.7 | 29.1 | 36.8 | 84.3 | 108.0 | 253.8 | 116.9 | 136.9 | 149.4 | N/A |
| Fatal accidents per million hours | 39.8 | 9.7 | 27.6 | 8.4 | 24.9 | 16.4 | 46.8 | 24.2 | 58.1 | N/A |

Figure 23: Accident rate for recreational weight shift operations (per million hours flown) 2007 to 2015



There were 10 accidents and two serious incidents reported in 2016 involving weight shift aircraft. Two of these accidents resulted in fatalities, and six resulted in a serious injury. The fatal accidents are described below:

- The passenger and pilot of an AirBorne Australia XT912 were fatally injured when the motorised glider collided with terrain near Yarrowonga aerodrome, Victoria. The aircraft was destroyed in the accident (ATSB occurrence 201600333).
- The crew of an AirBorne Australia Edge XT-912 were fatally injured when the motorised glider collided with terrain at Hedlow, Queensland. The aircraft was destroyed in the accident. The ATSB provide technical assistance to the Queensland Coroner during their investigation ([ATSB investigation AE-2016-168](#)).

More information on weight shift aircraft in Australia is available from the HGFA at www.hgfa.asn.au and RAAus at www.raa.asn.au.

Remotely piloted aircraft systems

Remotely piloted aircraft systems (RPAS) refers to unmanned fixed-wing, rotary-wing, and lighter-than-air craft that are controlled by a ground-based operator or remote pilot. These aircraft may be VH- registered or not registered by the Civil Aviation Safety Authority. RPAS are also known as unmanned aerial vehicles (UAVs) or drones. The term RPAS emphasises that there is a human ‘in the loop’ controlling and overseeing the aircraft. In contrast to model aircraft flown for sport and recreation, RPAS used for commercial, government or research purposes operate under CASA’s regulations.

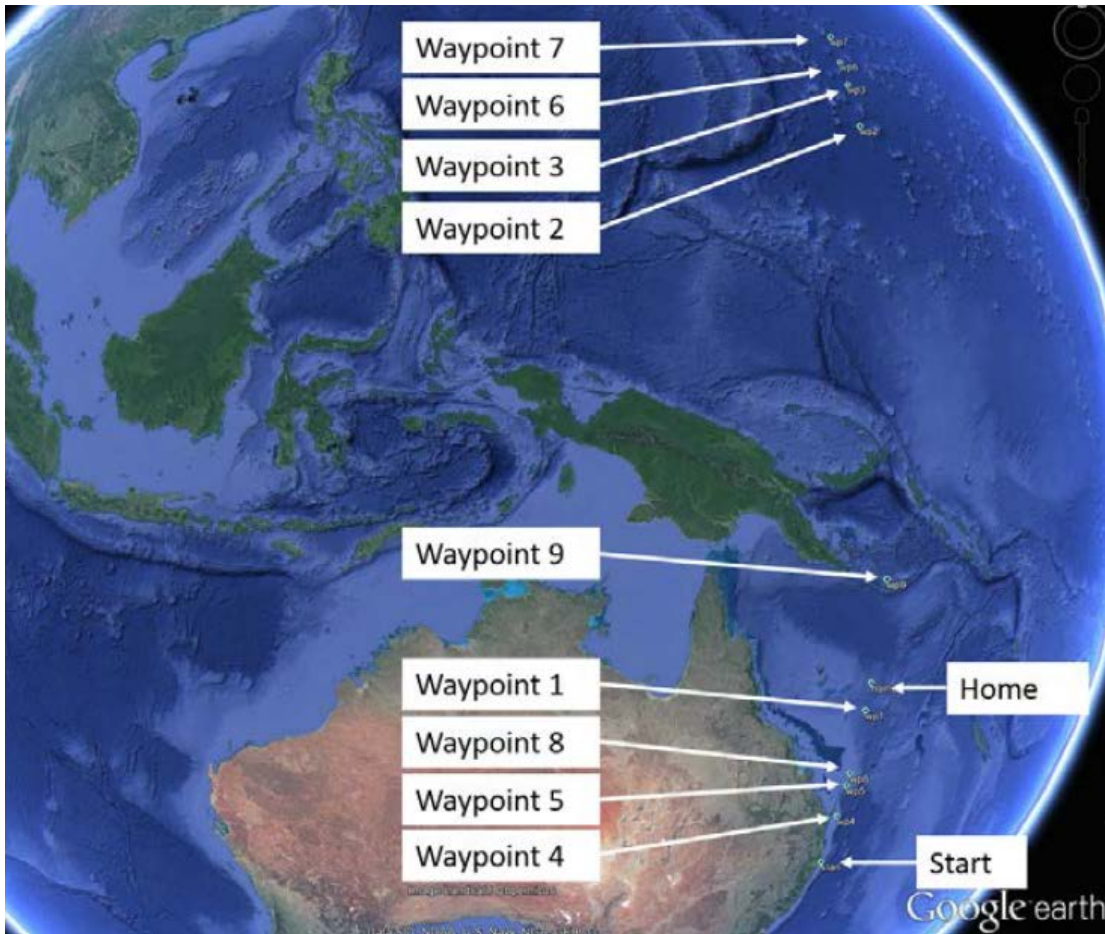
In 2016 there were 41 occurrences involving the operation of RPAs reported to the ATSB. This does not include incidents where pilots of conventional aircraft have reported encountering an unidentified RPA/model aircraft (Table 26). This is a significant increase compared to any other year in the previous nine years and reflects the increasing prevalence of RPAS.

Table 26: Occurrences involving remotely piloted aircraft systems 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------------------------------------|------|------|------|------|------|------|------|------|------|------|
| Number of aircraft involved | | | | | | | | | | |
| Incidents | 0 | 1 | 0 | 0 | 3 | 2 | 8 | 6 | 20 | 41 |
| Serious incidents | 0 | 1 | 0 | 0 | 3 | 1 | 2 | 3 | 4 | 5 |
| Serious injury accidents | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 4 | 5 |
| Fatal accidents | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total accidents | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 12 | 31 |
| Number of people involved | | | | | | | | | | |
| Serious injuries | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fatalities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

There were 31 accidents and five serious incidents reported to the ATSB involving RPAS in 2016. Most of the RPAS accidents involved collision with terrain and around 40 per cent were the result of a loss of control. Some of these accidents are described below:

- A Pulse Aerospace Vapor 55 was lost when the RPA flew to a ‘home’ location that was inadvertently selected in the Coral Sea around 1200 km north of the start position at Lighthouse Beach Ballina, New South Wales. The RPA entered into the ‘home’ flight mode following a loss of the data. In the ‘home’ flight mode, the RPA did not respond to the control inputs made by the pilot, and the pilot subsequently lost sight of the RPA. The RPA was not found despite an extensive search. No injuries were reported ([ATSB investigation AO-2016-128](#)).



Actual location of 'home' position and waypoints from the ground control station's telemetry data. Source: Google earth, modified by the ATSB

- A Lockheed Martin Stalker XE was destroyed when the RPA collided with terrain at Mount Disappointment, Victoria. During flight, the RPA aircraft did not transition from vertical to forward flight. As the aircraft climbed above the ground antenna, it flew into a null in the antenna pattern where communication between the ground control station and the aircraft was interrupted. The aircraft hovered, and after a few minutes, the operator commanded 'abort' from the ground control station. After observing continued lost link indications, the operator enabled the alternate radio datalink, restoring communication with the aircraft. However, the previously selected 'abort' command was unavailable for re-issue after the initial selection. Eventually the aircraft's power failed, and it descended vertically, colliding with the ground. No injuries were reported ([ATSB investigation AO-2016-139](#)).
- A Lockheed Martin Stalker XE was destroyed when the RPA collided with terrain at Avoca Race Track, Victoria. During flight, the RPA's negative main power cable separated from its pin in the connector leading to a total loss of electrical power and the aircraft was unable to maintain normal flight or conduct safe glide landing. As a result, the aircraft manufacturer advised the ATSB the aircraft battery circuitry was being modified to prevent similar failures from occurring. No injuries were reported ([ATSB investigation AO-2016-141](#)).

Occurrences by aircraft type

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

Of the 15,360 aircraft on the Australian civil aircraft (VH-) register,²¹ fixed-wing aircraft (aeroplanes) accounted for 83 per cent of all aircraft (11,510 powered fixed-wing aeroplanes, 278 motorised gliders and 998 unpowered gliders). Rotary-wing aircraft, helicopters, accounted for 14 per cent or 2,175 aircraft. The remaining three per cent were balloons, 397 aircraft, and one airship. At the time of writing, the number of VH-registered RPAS is unknown. Australian-registered recreational aircraft are additional to these figures. There were 5,302 aircraft registered with Recreational Aviation Australia (RAAus) in late 2016 (4,364 aeroplanes and motorised gliders and 938 weight shift aircraft). Gyrocopters are registered with the Australian Sport Rotorcraft Association (ASRA). Weight-shift aircraft are registered with both the Hang Gliding Federation of Australia (HGFA) and the RAAus.

The year 2016 had the fewest fatal accidents in the study period, half the number of 2015.

In this section:

- aeroplanes refer to all manned, VH- registered powered fixed-wing aircraft, and to recreational powered aeroplanes registered by RAAus
- balloons refer to all manned, VH- registered hot air balloons and lighter-than-air craft, including dirigibles
- helicopters refer to all manned, VH- registered rotary-wing aircraft
- gliders refer to all manned, VH- registered non-powered fixed-wing aircraft, and manned, VH- registered and non-VH- registered powered gliders
- gyrocopters refer to rotary-wing aircraft registered with ASRA, marked with a G- registration
- remotely piloted aircraft refers to unmanned fixed-wing, rotary-wing, and lighter-than-air craft that are controlled by a ground-based operator. These aircraft may be VH- registered or not registered by the Civil Aviation Safety Authority.
- weight shift refers to manned aircraft which are controlled by human movement. They include hang gliders, paragliders, powered parachutes, weight-shift trikes and microlights. These aircraft may be registered with HGFA, marked with a T1- or T2- registration, or with RAAus marked with a 32- registration.

As flying activity data is only available for some of these types of aircraft, accident rates are only provided for aeroplanes, helicopters, and recreational aircraft types including recreational aeroplanes, gyrocopters, and weight-shift aircraft.

Differences in accidents between operation groups and aircraft type

There are considerably more accidents in Australia involving aeroplanes than other aircraft; around 70 per cent of all accidents over the study period (Table 27). The reporting of recreational aircraft accidents to the ATSB has improved significantly in the last 10 years. Recreational aeroplanes are involved in more than half as many reported accidents as general aviation aeroplanes. In 2016, all fatal accidents involved general aviation or recreational aeroplanes. There

²¹ CASA registered aircraft numbers are until the end of 2016. These data were obtained from the CASA website: www.casa.gov.au/standard-page/data-files

were no fatal accidents involving an aeroplane conducting commercial air transport operations (Table 28).

Helicopters were involved in around 30 per cent of all general aviation accidents and fatal accidents in the 10-year period, even though they accounted for only 14 per cent of the Australian VH-registered fleet and flew far less hours than aeroplanes.

Recreational aircraft contributed to an even larger proportion of the total number of fatal accidents. Between 2007 and 2016, 30 per cent of all accidents and 37 per cent of all fatal accidents in Australian aviation involved recreational aircraft, even though they contribute to just nine per cent of the recorded hours flown by aircraft in Australia between 2007 and 2015 (Table 28). In the last four years of the study period, recreational aircraft were involved in around 51 per cent of all fatal accidents.

Since 2013, the number of accidents involving remotely piloted aircraft has significantly increased, from zero in 2012 to around 14 per cent of all accidents by 2016. This was greater than helicopters and is an increase from only five per cent in 2015.

Table 27: Number of accidents involving Australian-registered aircraft, by aircraft type 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|
| Aeroplanes | | | | | | | | | | |
| Air transport | 16 | 23 | 11 | 20 | 16 | 9 | 9 | 22 | 6 | 11 |
| General aviation | 84 | 84 | 78 | 84 | 73 | 60 | 58 | 106 | 88 | 84 |
| Recreational | 17 | 36 | 34 | 40 | 44 | 50 | 59 | 76 | 52 | 43 |
| Balloons | | | | | | | | | | |
| Air transport | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 |
| General aviation | 2 | 3 | 3 | 2 | 3 | 1 | 0 | 2 | 0 | 1 |
| Helicopters | | | | | | | | | | |
| Air transport | 5 | 5 | 2 | 3 | 5 | 4 | 5 | 3 | 1 | 2 |
| General aviation | 25 | 36 | 33 | 36 | 25 | 27 | 24 | 28 | 35 | 25 |
| Gliders | | | | | | | | | | |
| General aviation | 5 | 3 | 1 | 2 | 8 | 11 | 8 | 8 | 6 | 8 |
| Recreational | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gyrocopters | | | | | | | | | | |
| Recreational | 2 | 4 | 2 | 4 | 6 | 4 | 6 | 7 | 5 | 4 |
| Remotely Piloted Aircraft | | | | | | | | | | |
| General aviation | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 12 | 31 |
| Weight Shift | | | | | | | | | | |
| Recreational aircraft | 8 | 3 | 4 | 10 | 13 | 31 | 15 | 17 | 18 | 10 |

Table 28: Number of fatal accidents involving Australian-registered aircraft, by aircraft type 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|
| Aeroplanes | | | | | | | | | | |
| Air transport | 1 | 2 | 0 | 1 | 2 | 1 | 1 | 0 | 1 | 0 |
| General aviation | 9 | 18 | 7 | 8 | 6 | 14 | 12 | 9 | 5 | 5 |
| Recreational | 8 | 1 | 3 | 3 | 4 | 1 | 9 | 5 | 8 | 4 |
| Balloons | | | | | | | | | | |
| Air transport | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| General aviation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Helicopters | | | | | | | | | | |
| Air transport | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| General aviation | 2 | 2 | 8 | 4 | 9 | 4 | 2 | 2 | 4 | 2 |
| Gliders | | | | | | | | | | |
| General aviation | 1 | 2 | 1 | 0 | 1 | 2 | 1 | 0 | 1 | 0 |
| Recreational | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gyrocopters | | | | | | | | | | |
| Recreational | 4 | 0 | 2 | 2 | 0 | 3 | 1 | 1 | 2 | 0 |
| Remotely Piloted Aircraft | | | | | | | | | | |
| General aviation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Weight Shift | | | | | | | | | | |
| Recreational aircraft | 4 | 1 | 3 | 1 | 3 | 2 | 6 | 3 | 7 | 2 |

Differences in accidents between specific operation types and aircraft types

Considering flying activity, private ballooning had by far the highest accident rate. The accident rate involving helicopters is higher than for aeroplanes conducting the same operation type (Table 29). The accident rate for recreational aeroplanes was higher than for aeroplanes in all operation types

The fatal accident rate over the 2007 to 2015 period was highest for gyrocopters, followed by aeroplanes used for recreational flying. It was lowest for aeroplanes conducting flying training, and for aeroplanes and helicopters in charter operations.

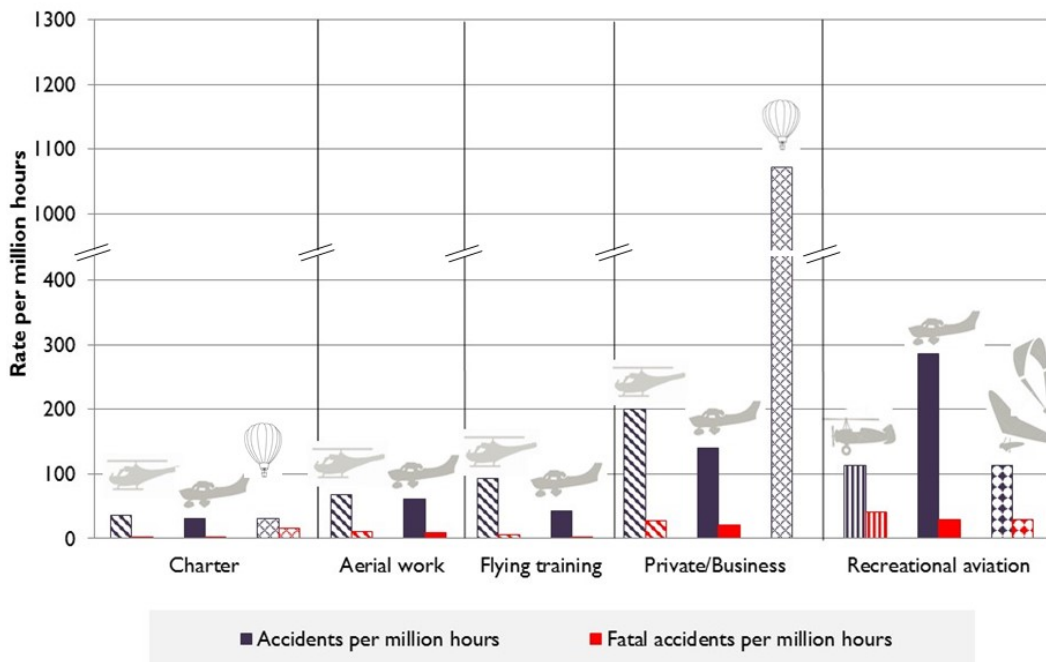
When comparing the accident rate of aircraft types²² by operation type, there is significant difference between air transport (charter), general aviation, and recreational aviation (Table 29 and Figure 24). These differences are discussed below.

²² Activity data was only available for aeroplanes, helicopters, balloons, gyrocopters, recreational aeroplanes, and weight-shift aircraft.

Table 29: Rate of accidents and fatal accidents by operation and aircraft type, 2007-2015

| Operation | Aircraft type | Accidents per million hours | Fatal accidents per million hours |
|-----------------------|---------------|-----------------------------|-----------------------------------|
| Charter | Helicopters | 36.1 | 2.4 |
| | Aeroplanes | 31.0 | 2.4 |
| | Balloons | 31.0 | 15.5 |
| Aerial work | Helicopters | 68.1 | 10.9 |
| | Aeroplanes | 61.7 | 9.0 |
| Flying training | Helicopters | 92.3 | 5.8 |
| | Aeroplanes | 43.1 | 1.8 |
| Private/business | Helicopters | 201.0 | 26.8 |
| | Aeroplanes | 140.9 | 20.2 |
| | Balloons | 1,071.7 | 0.0 |
| Recreational aviation | Gyrocopters | 113.7 | 40.6 |
| | Aeroplanes | 286.0 | 29.4 |
| | Weight Shift | 113.7 | 28.7 |

Figure 24: Rate of accidents and fatal accidents by operation and aircraft type



Over the 2007 to 2015 period, all air transport operations involving helicopters were charter operations, so the only air transport comparison for aircraft types provided here is for charter.

Charter

Helicopters involved in charter air transport operations had slightly higher accident rates (about 36 versus 31 accidents per million hours flown over the 2007 to 2015 period) than charter aeroplanes.

The rate of fatal accidents over this period involving helicopters was the same for aeroplanes (2.4 per million hours flown). There were fewer fatalities in charter helicopter accidents (six) than in

charter aeroplane accidents (nine). There were four charter balloon accidents over this period, including one fatal accident in 2013.

In 2015, charter hours flown by aeroplanes (about 243,200) were more than double helicopter charter hours (about 105,200). There were about 7,200 charter hours flown by balloons.

Aerial work

Aeroplanes involved in all types of aerial work had a slightly lower accident rate than for helicopters conducting aerial work (about 62 versus 68 per million hours flown over the 2007 to 2015 period). There are, however, significant differences in the types of aerial work that are performed by aeroplanes as opposed to helicopters.

The fatal accident rate in aerial work for helicopters over this period (about 11 per million hours flown) was slightly higher than the aeroplane fatal accident rate (about nine per million hours flown). The number of fatalities involving helicopters and aeroplanes were similar (27 versus 28).

The amount of aerial work conducted by helicopters is greater than for aeroplanes. In 2015, about 272,300 hours were flown by helicopters conducting aerial work, compared to 189,700 for aeroplanes. In aerial agriculture, more than twice as many hours were flown by aeroplanes in 2015 (56,800) than by helicopters (21,000).

Flying training

The helicopter accident rate from 2007 to 2015 was about 92 per million hours flown, which was more than double that for aeroplanes conducting flying training (about 43 accidents per million hours flown). Most flying training is done in aeroplanes. In 2015, about 279,200 hours of aeroplane flying training were recorded by the BITRE compared to about 26,400 for helicopters. A large decrease in aeroplane flying training in Australia has occurred in recent years, with 39 per cent fewer hours flown in 2015 compared to a peak of 454,500 hours flown in 2009, the highest of any year since 1990.

The fatal accident rate over the 2007 to 2015 period for helicopter flying training (about 5.8 per million hours flown) was notably higher than that for aeroplanes (about 1.8 fatal accident per million hours flown), although there were fewer fatalities in total involving helicopters.

Private/business

Helicopters performing private or business flying had an accident rate over the 2007 to 2015 period that was about 40 per cent higher than that for aeroplanes (about 201 accidents per million hours for helicopters, compared to 141 per million hours flown for aeroplanes). Balloons being used for private flying had the highest accident rate over this period (1,072 per million hours flown), due to 17 accidents and a relatively small amount of flying activity. There were 1,400 hours flown in balloons used for other than charter in 2015, compared to 29,900 for helicopters and 270,000 for aeroplanes.

Helicopters also had a higher fatal accident rate (27 versus 20 fatal accidents per million hours flown). Due to the higher use of aeroplanes for private/business flying over this period compared to helicopters, there were significantly more fatalities in those fatal accidents involving aeroplanes than in helicopter accidents. There were no private fatal balloon accidents over this period.

Recreational aviation

The fatal accident rate for gyrocopters over this period (41 per million hours flown) was significantly higher than that of other recreational aircraft (29 per million hours flown for recreational aeroplanes, and 29 per million hours flown for weight shift aircraft). The fatal accident rate for gyrocopters was significantly higher than for all other aircraft and operation type combinations in air transport and general aviation.

The fatal accident rate for recreational aeroplanes was higher than for private/business aeroplanes (29 versus 20 fatal accidents per million hours flown), as was the overall accident rate (about 286 versus 141 accidents per million hours flown).

Recreational aeroplanes (286 per millions hours flown) had an accident rate of more than double that of weight shift aircraft and gyrocopters (both 114 per million hours flown).

Occurrence types: what happened

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

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

There are broad occurrence type categories used by the ATSB to classify occurrences. These are:

- airspace-related
- infrastructure-related
- environment-related
- operational-related
- technical-related.

Consequential events that happen as the result of an occurrence, for example; forced and precautionary landings, emergency descents, rejected take-offs, evacuations and fuel dumps to reduce landing weight, are also recorded.

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

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

Commercial air transport

Accidents and serious incidents

In 2016, the most common accidents and serious incidents in air transport operations (Table 30) were related to:

- terrain collisions
- aircraft control
- crew and cabin safety

- aircraft separation
- ground operations.

Table 30: Accidents and serious incidents in air transport operations, by occurrence type 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| Airspace | | | | | | | | | | | |
| Aircraft separation | 17 | 10 | 7 | 14 | 7 | 18 | 16 | 7 | 9 | 10 | 115 |
| Operational non-compliance | 5 | 6 | 3 | 2 | 2 | 1 | 3 | 0 | 3 | 2 | 27 |
| ANSP ²³ operational error | 2 | 1 | 0 | 0 | 2 | 1 | 2 | 1 | 0 | 0 | 9 |
| Airspace infringement | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Breakdown of co-ordination | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Encounter with RPA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Other | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Environment | | | | | | | | | | | |
| Weather | 4 | 5 | 4 | 6 | 0 | 6 | 6 | 5 | 3 | 5 | 44 |
| Wildlife | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 2 | 0 | 7 |
| Interference with aircraft from ground | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 3 |
| Infrastructure | | | | | | | | | | | |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Operational | | | | | | | | | | | |
| Aircraft control | 15 | 20 | 11 | 14 | 6 | 13 | 11 | 18 | 9 | 12 | 129 |
| Terrain collisions | 8 | 13 | 6 | 8 | 11 | 7 | 6 | 9 | 4 | 13 | 85 |
| Crew and cabin safety | 11 | 18 | 9 | 5 | 6 | 6 | 4 | 10 | 3 | 11 | 83 |
| Runway events | 8 | 8 | 1 | 5 | 7 | 6 | 10 | 12 | 2 | 5 | 64 |
| Ground operations | 1 | 1 | 1 | 1 | 4 | 3 | 4 | 6 | 2 | 10 | 33 |
| Communications | 2 | 4 | 2 | 3 | 3 | 5 | 2 | 5 | 2 | 2 | 30 |
| Fuel related | 4 | 6 | 3 | 1 | 2 | 2 | 7 | 2 | 1 | 0 | 28 |
| Fumes, smoke, fire | 1 | 7 | 3 | 2 | 1 | 1 | 2 | 3 | 2 | 6 | 28 |
| Flight preparation / navigation | 4 | 0 | 2 | 4 | 0 | 2 | 4 | 1 | 3 | 2 | 22 |
| Miscellaneous | 0 | 6 | 3 | 5 | 0 | 1 | 1 | 1 | 0 | 0 | 17 |
| Ground proximity alerts / warnings | 2 | 0 | 1 | 0 | 0 | 2 | 1 | 1 | 1 | 0 | 8 |
| Aircraft loading | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 3 |
| Technical | | | | | | | | | | | |
| Power plant / propulsion | 9 | 18 | 6 | 11 | 12 | 8 | 10 | 8 | 4 | 9 | 95 |
| Systems | 6 | 10 | 6 | 3 | 4 | 2 | 3 | 5 | 6 | 5 | 50 |
| Airframe | 4 | 2 | 4 | 5 | 5 | 5 | 4 | 10 | 2 | 3 | 44 |
| Consequential events | 18 | 30 | 18 | 24 | 16 | 12 | 22 | 15 | 16 | 18 | 189 |

Terrain collisions

There were six accidents and seven serious incidents of terrain collisions involving air transport aircraft, mostly charter, reported to the ATSB in 2016. Two resulted in minor injuries. This number

²³ Air navigation service providers

of terrain collision accidents in 2016 was the second highest reported for air transport in the study period.

Aircraft control

There were six accidents, including one fatal and one serious injury, and six serious incidents relating to aircraft control issues in air transport aircraft reported to the ATSB in 2016. The majority of the aircraft control accidents and serious incidents occurred during the approach or landing phase of flight. The fatal accident and serious incidents involved an aircraft conducting charter operations.

Crew and cabin safety

There was one accident and 10 serious incidents relating to cabin and crew safety, reported in 2016, involving an air transport aircraft, mostly in high capacity aircraft. One of the accidents resulted in serious injuries.

Aircraft separation

There were 10 serious incidents in 2016 involving air transport aircraft with separation or aircraft proximity issues. Most involved aircraft conducting charter operations and over half occurred in the approach to landing phases of flight.

By their nature, these types of serious incidents indicate a reduced safety margin between two aircraft, and an increased risk of a collision.

Ground operations

There were three air transport ground operations accidents and seven serious incidents in 2016. Over half involved aircraft conducting charter operations.

Incidents

The most common incident types in 2016 involving air transport operations (Table 31) were:

- wildlife strikes
- aircraft system problems
- weather-related issues.

Table 31: Incidents in air transport operations, by occurrence type 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------------|
| Airspace | | | | | | | | | | | |
| Aircraft separation | 127 | 188 | 164 | 161 | 190 | 222 | 244 | 261 | 190 | 244 | 1,991 |
| Operational Non-compliance | 104 | 115 | 78 | 100 | 95 | 114 | 119 | 126 | 77 | 108 | 1,036 |
| ANSP Operational error | 190 | 173 | 129 | 75 | 50 | 59 | 99 | 119 | 20 | 52 | 966 |
| Airspace infringement | 26 | 25 | 16 | 10 | 13 | 20 | 16 | 16 | 8 | 8 | 158 |
| Breakdown of co-ordination | 26 | 26 | 20 | 16 | 4 | 13 | 16 | 20 | 6 | 9 | 156 |
| Encounter with RPA | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 14 | 56 | 80 |
| Other | 3 | 6 | 4 | 1 | 1 | 5 | 7 | 2 | 6 | 1 | 36 |
| Environment | | | | | | | | | | | |
| Wildlife | 986 | 1,093 | 1,207 | 1,372 | 1,453 | 1,370 | 1,438 | 1,425 | 1,418 | 1,581 | 13,343 |
| Weather | 147 | 177 | 141 | 209 | 254 | 303 | 464 | 554 | 472 | 386 | 3,107 |
| Interference with aircraft from ground | 6 | 1 | 3 | 5 | 6 | 8 | 9 | 12 | 17 | 58 | 125 |
| Infrastructure | | | | | | | | | | | |
| Runway lighting | 16 | 18 | 26 | 22 | 13 | 22 | 14 | 15 | 12 | 17 | 175 |
| Other | 17 | 11 | 8 | 6 | 4 | 7 | 11 | 5 | 5 | 5 | 79 |
| Nav aids | 2 | 3 | 4 | 7 | 5 | 2 | 2 | 8 | 19 | 3 | 55 |
| ATM ²⁴ | 4 | 5 | 1 | 5 | 0 | 1 | 1 | 4 | 3 | 3 | 27 |
| Radar / Surveillance | 0 | 2 | 2 | 6 | 3 | 8 | 2 | 0 | 1 | 1 | 25 |
| Operational | | | | | | | | | | | |
| Miscellaneous | 242 | 330 | 302 | 273 | 282 | 396 | 273 | 277 | 206 | 43 | 2,624 |
| Fumes, Smoke, Fire | 125 | 146 | 139 | 266 | 292 | 305 | 289 | 294 | 262 | 228 | 2,346 |
| Aircraft control | 82 | 98 | 83 | 96 | 136 | 212 | 221 | 222 | 189 | 151 | 1,490 |
| Aircraft loading | 115 | 91 | 65 | 124 | 221 | 222 | 202 | 191 | 83 | 98 | 1,412 |
| Ground proximity alerts / warnings | 83 | 37 | 22 | 20 | 38 | 69 | 172 | 220 | 247 | 189 | 1,097 |
| Crew and cabin safety | 96 | 73 | 69 | 86 | 121 | 92 | 151 | 140 | 94 | 95 | 1,017 |
| Communications | 91 | 142 | 97 | 72 | 75 | 86 | 97 | 91 | 68 | 82 | 901 |
| Ground operations | 67 | 68 | 50 | 49 | 79 | 72 | 60 | 58 | 40 | 51 | 594 |
| Runway events | 41 | 57 | 47 | 52 | 66 | 69 | 63 | 68 | 55 | 70 | 588 |
| Flight preparation / Navigation | 84 | 59 | 31 | 41 | 54 | 54 | 50 | 42 | 38 | 45 | 498 |
| Fuel related | 55 | 52 | 35 | 30 | 36 | 32 | 35 | 30 | 33 | 14 | 352 |
| Terrain Collisions | 14 | 15 | 10 | 9 | 8 | 5 | 13 | 5 | 5 | 5 | 89 |
| Technical | | | | | | | | | | | |
| Systems | 328 | 369 | 311 | 430 | 487 | 515 | 494 | 500 | 508 | 511 | 4,453 |
| Airframe | 188 | 246 | 219 | 251 | 309 | 271 | 268 | 228 | 216 | 182 | 2,378 |
| Power plant / propulsion | 209 | 215 | 212 | 176 | 218 | 247 | 199 | 180 | 155 | 188 | 1,999 |
| Consequential events | 619 | 719 | 704 | 652 | 743 | 872 | 834 | 814 | 785 | 743 | 7,485 |

Wildlife strikes

The majority of wildlife strikes involving air transport aircraft were birdstrikes, with a small number of animal strikes reported. The number of wildlife strikes has increased by around 55 per cent over

²⁴ Air traffic management

the last decade, driven by a large increase in aircraft movements, departures and landings in high capacity RPT operations over the same period.

The ATSB biennially publishes a report detailing wildlife strike statistics, the most recent report, *Australian aviation wildlife strike statistics*, was published in February 2017 (ATSB report AR-2016-063).

Aircraft system problems

Around 43 per cent of aircraft system issues were avionics or flight instrument problems. The majority of these incidents were minor in nature, and affected a wide range of aircraft systems and aircraft types.

About 15 per cent of all aircraft system issues involved issues with flight controls, 14 per cent were air and pressurisation system issues and another 14 per cent were hydraulic issues.

Very few incidents, around three per cent of all systems issues, were related to anti-ice protection or fuel system problems.

Weather

The ATSB received 386 reports of weather-related incidents that affected safe air transport operations in 2016. Around 86 per cent of all weather-related incidents reported involved windshear or turbulence. This figure has increased almost five-fold since 2009 from around 80 reported weather-related incidents per year to 386 in 2016. The increase in windshear or turbulence events has significantly outpaced the increase in air transport activity over the decade. An increase of this magnitude has not been observed in other aviation operation types.

General aviation

Accidents and serious incidents

In 2016, the most common accidents and serious incidents involving general aviation aircraft (Table 32) were:

- terrain collisions
- aircraft control
- aircraft separation
- power plant/propulsion issues.

Table 32: Accidents and serious incidents in GA operations, by occurrence type 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|---------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| Airspace | | | | | | | | | | | |
| Aircraft separation | 22 | 36 | 28 | 34 | 42 | 58 | 66 | 43 | 44 | 54 | 427 |
| Operational Non-compliance | 5 | 12 | 8 | 3 | 7 | 10 | 7 | 5 | 5 | 3 | 65 |
| Airspace infringement | 1 | 2 | 3 | 1 | 1 | 0 | 2 | 1 | 0 | 1 | 12 |
| ANSP Operational error | 0 | 4 | 3 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 12 |
| Encounter with RPA | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Environment | | | | | | | | | | | |
| Weather | 13 | 2 | 10 | 8 | 3 | 7 | 5 | 9 | 9 | 12 | 78 |
| Wildlife | 2 | 2 | 3 | 3 | 5 | 1 | 3 | 3 | 4 | 10 | 36 |
| Infrastructure | | | | | | | | | | | |
| Other | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 3 |
| Runway lighting | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Operational | | | | | | | | | | | |
| Terrain Collisions | 99 | 116 | 82 | 138 | 104 | 96 | 89 | 100 | 95 | 127 | 1,046 |
| Aircraft control | 44 | 50 | 44 | 38 | 48 | 44 | 58 | 66 | 53 | 75 | 520 |
| Runway events | 22 | 20 | 22 | 21 | 18 | 19 | 21 | 26 | 21 | 35 | 225 |
| Fuel related | 6 | 9 | 8 | 14 | 16 | 16 | 7 | 9 | 20 | 10 | 115 |
| Communications | 1 | 10 | 4 | 6 | 11 | 14 | 17 | 12 | 8 | 19 | 102 |
| Ground operations | 5 | 1 | 5 | 2 | 4 | 3 | 3 | 12 | 11 | 6 | 52 |
| Flight preparation / Navigation | 4 | 4 | 5 | 0 | 4 | 6 | 5 | 4 | 7 | 5 | 44 |
| Fumes, Smoke, Fire | 4 | 5 | 6 | 4 | 2 | 3 | 2 | 3 | 4 | 5 | 38 |
| Crew and cabin safety | 3 | 4 | 3 | 2 | 5 | 1 | 2 | 4 | 3 | 4 | 31 |
| Miscellaneous | 0 | 2 | 1 | 4 | 2 | 3 | 4 | 3 | 6 | 3 | 28 |
| Aircraft loading | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 |
| Technical | | | | | | | | | | | |
| Power plant / propulsion | 64 | 39 | 50 | 41 | 36 | 40 | 32 | 32 | 34 | 44 | 412 |
| Airframe | 3 | 5 | 8 | 10 | 7 | 6 | 16 | 15 | 10 | 17 | 97 |
| Systems | 3 | 4 | 5 | 9 | 9 | 2 | 3 | 6 | 8 | 11 | 60 |
| Consequential events | 62 | 49 | 59 | 68 | 55 | 65 | 58 | 60 | 65 | 74 | 615 |

Terrain collisions

In 2016, there were 80 accidents, six fatal and 13 resulting in serious injuries and 47 serious incidents. This was the second largest number in the study period.

Over half of the collisions in 2016 that involved a general aviation aircraft were collisions with terrain. Most other terrain collisions reported to the ATSB were ground strikes during take-off, or landing or wire strikes.

Aircraft control

There were 58 aircraft control accidents, one fatal and four resulting in serious injuries, and 17 serious incidents reported to the ATSB involving general aviation aircraft in 2016. This was the highest number in the 10-year period.

The most common control issues were loss of control, 55 per cent, and hard landings at 25 per cent.

Aircraft separation

In 2016, 54 general aviation aircraft were involved in separation serious incidents; 17 were investigated. Of the 54, eighty-seven per cent were near collisions, with 15 investigated, and four aircraft were involved in two collisions, one of which was investigated.

Power plant and propulsion

In 2016, there were 19 accidents, one resulting in serious injury, and 25 serious incidents involving to engine-related issues reported to the ATSB involving general aviation aircraft. Half of these occurrences involved aircraft conducting private/business operations. This was consistent with the 10-year average.

The majority of these engine-related accidents and serious incidents were due to an engine failure or malfunction; nine were investigated by the ATSB. Around 40 per cent of the engine failures occurred shortly after take-off and during climb.

Incidents

The most common types of incidents involving general aviation aircraft in 2016 (Table 33) were:

- wildlife strikes
- aircraft separation
- runway events.

Table 33: Incidents in GA operations, by occurrence type 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------------|
| Airspace | | | | | | | | | | | |
| Aircraft separation | 133 | 177 | 178 | 146 | 192 | 176 | 186 | 172 | 179 | 205 | 1,744 |
| Operational non-compliance | 123 | 263 | 213 | 193 | 183 | 161 | 125 | 91 | 81 | 106 | 1,539 |
| Airspace infringement | 69 | 58 | 49 | 39 | 40 | 41 | 37 | 23 | 15 | 15 | 386 |
| ANSP operational error | 58 | 59 | 44 | 27 | 19 | 30 | 52 | 37 | 17 | 36 | 379 |
| Breakdown of co-ordination | 9 | 7 | 4 | 7 | 2 | 11 | 14 | 6 | 2 | 5 | 67 |
| Encounter with RPA | 1 | 3 | 0 | 1 | 0 | 3 | 0 | 3 | 12 | 26 | 49 |
| Other | 1 | 1 | 1 | 1 | 1 | 2 | 5 | 1 | 2 | 1 | 16 |
| Environment | | | | | | | | | | | |
| Wildlife | 353 | 323 | 361 | 376 | 322 | 286 | 287 | 269 | 285 | 293 | 3,155 |
| Weather | 26 | 15 | 8 | 18 | 17 | 17 | 15 | 15 | 10 | 13 | 154 |
| Interference with aircraft from ground | 1 | 3 | 0 | 2 | 1 | 5 | 2 | 3 | 10 | 25 | 52 |
| Infrastructure | | | | | | | | | | | |
| Other | 3 | 2 | 2 | 2 | 4 | 5 | 2 | 1 | 1 | 2 | 24 |
| Runway lighting | 0 | 2 | 0 | 2 | 0 | 2 | 2 | 1 | 1 | 0 | 10 |
| ATM | 0 | 2 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 7 |
| Radar/surveillance | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 1 | 6 |
| Nav aids | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 3 |
| Operational | | | | | | | | | | | |
| Runway events | 229 | 296 | 450 | 300 | 260 | 239 | 243 | 142 | 172 | 171 | 2,502 |
| Communications | 122 | 199 | 147 | 135 | 119 | 119 | 127 | 113 | 89 | 108 | 1,278 |
| Flight preparation / navigation | 118 | 73 | 74 | 65 | 51 | 46 | 61 | 40 | 35 | 53 | 616 |
| Aircraft control | 67 | 52 | 54 | 40 | 51 | 57 | 52 | 41 | 47 | 48 | 509 |
| Terrain collisions | 43 | 43 | 51 | 31 | 34 | 35 | 41 | 11 | 16 | 25 | 330 |
| Fumes, smoke, fire | 38 | 33 | 28 | 36 | 35 | 31 | 29 | 30 | 17 | 19 | 296 |
| Ground operations | 28 | 24 | 30 | 32 | 20 | 26 | 27 | 35 | 20 | 29 | 271 |
| Miscellaneous | 18 | 31 | 27 | 32 | 37 | 31 | 26 | 33 | 15 | 17 | 267 |
| Fuel related | 17 | 19 | 13 | 21 | 19 | 14 | 12 | 25 | 21 | 15 | 176 |
| Crew and cabin safety | 8 | 2 | 4 | 5 | 5 | 3 | 4 | 4 | 2 | 6 | 43 |
| Aircraft loading | 4 | 4 | 1 | 3 | 1 | 2 | 1 | 2 | 1 | 1 | 20 |
| Ground proximity alerts / warnings | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 3 | 7 |
| Technical | | | | | | | | | | | |
| Systems | 127 | 111 | 122 | 158 | 155 | 148 | 126 | 162 | 158 | 168 | 1,435 |
| Power plant / propulsion | 159 | 148 | 136 | 111 | 133 | 142 | 114 | 121 | 130 | 121 | 1,315 |
| Airframe | 112 | 115 | 130 | 124 | 141 | 139 | 121 | 127 | 132 | 127 | 1,268 |
| Consequential events | 278 | 295 | 312 | 277 | 294 | 311 | 280 | 278 | 310 | 294 | 2,929 |

Wildlife

Reporting of wildlife strikes involving general aviation aircraft has reduced by around 30 per cent since its peak in 2010. However, wildlife strikes were still the most commonly reported general aviation safety incident, making up around 15 per cent.

Aircraft separation

Aircraft separation incidents made up around 11 per cent of all general aviation incidents reported to the ATSB in 2016. For around 50 per cent of general aviation aircraft involved aircraft separation incidents the operation type was unknown.

Separation issue (58 per cent) was the most commonly reported aircraft separation incident. Loss of separation (23 per cent) was the second most commonly reported incident.

Runway events

The number of runway events reported to the ATSB in 2016 involving general aviation aircraft was the second lowest over the 10-year period and was significantly below the 10-year average.

Runway incursions made up around 71 per cent of the reported incidents. Runway excursions (18 per cent) accounted for the second largest share of runway events reported to the ATSB in 2016.

Recreational aviation**Accidents and serious incidents**

Accident and serious incident reporting in the recreational aviation community has increased in recent years, as shown by the difference in the number of occurrences reported to the ATSB in 2007 compared to 2016 (Table 34). Significant growth in recreational flying has driven this increase, as has greater awareness among pilots and recreational aviation administration organisations (RAAOs) of the need to report accidents and serious incidents to the ATSB.

The most common types of accidents and serious incidents in recreational aviation are similar to those in general aviation. The most common in 2016 were:

- terrain collisions
- power plant/propulsion
- aircraft control
- runway events.

Table 34: Accidents and serious incidents in recreational aviation, by occurrence type 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|---------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| Airspace | | | | | | | | | | | |
| Aircraft separation | 3 | 6 | 2 | 3 | 1 | 5 | 4 | 9 | 7 | 3 | 43 |
| Airspace infringement | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 |
| Operational Non-compliance | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Environment | | | | | | | | | | | |
| Weather | 0 | 1 | 1 | 3 | 0 | 6 | 5 | 4 | 6 | 11 | 37 |
| Wildlife | 0 | 1 | 0 | 1 | 0 | 0 | 3 | 1 | 0 | 2 | 8 |
| Infrastructure | | | | | | | | | | | |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Operational | | | | | | | | | | | |
| Terrain Collisions | 25 | 28 | 35 | 34 | 48 | 60 | 64 | 65 | 61 | 57 | 477 |
| Aircraft control | 10 | 12 | 10 | 20 | 17 | 44 | 38 | 49 | 24 | 37 | 261 |
| Runway events | 2 | 6 | 6 | 4 | 10 | 11 | 15 | 15 | 18 | 14 | 101 |
| Fuel related | 1 | 4 | 1 | 0 | 3 | 6 | 8 | 13 | 9 | 5 | 50 |
| Ground operations | 2 | 0 | 1 | 1 | 0 | 2 | 0 | 7 | 4 | 3 | 20 |
| Communications | 1 | 3 | 2 | 0 | 1 | 1 | 1 | 1 | 2 | 1 | 13 |
| Flight preparation / Navigation | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 2 | 4 | 2 | 11 |
| Fumes, Smoke, Fire | 1 | 1 | 1 | 3 | 0 | 0 | 1 | 1 | 1 | 1 | 10 |
| Crew and cabin safety | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 3 |
| Aircraft loading | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 2 |
| Miscellaneous | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Technical | | | | | | | | | | | |
| Power plant / propulsion | 14 | 17 | 18 | 22 | 17 | 40 | 35 | 32 | 35 | 38 | 268 |
| Airframe | 0 | 3 | 2 | 3 | 1 | 10 | 4 | 7 | 7 | 9 | 46 |
| Systems | 0 | 2 | 2 | 0 | 0 | 4 | 4 | 3 | 3 | 6 | 24 |
| Consequential events | 11 | 24 | 17 | 25 | 18 | 38 | 35 | 54 | 33 | 45 | 300 |

Terrain collisions

There were 45 terrain collision accidents and 12 serious incidents involving recreational aircraft reported to the ATSB in 2016. Seven involved fatal injuries, 15 per cent of accidents, and 11 involved serious injuries to the aircraft occupants.

Seventy-two per cent of terrain collision accidents involved collisions with terrain, with 26 per cent ground strikes and seven per cent wire strikes.

Power plant/propulsion

There were 11 power plant/propulsion-related accidents and 27 serious incidents involving recreational aircraft reported to the ATSB in 2016. The majority involved aeroplanes. There were two serious injury accidents but no fatalities.

Ninety-seven per cent of the reported accidents and serious incidents involved engine failure or malfunctions, with most, 78 per cent, requiring a forced landing. As almost all powered recreational aircraft are single-engine, a forced landing is generally the only remaining option for the pilot.

Aircraft control

There were 26 aircraft control accidents, four resulting in serious injuries, and 11 serious incidents reported in recreational aviation in 2016. This made up around 16 per cent of all recreational reported accidents or serious incidents. Most involved aeroplanes.

Over 62 per cent were losses of control and 32 per cent were hard landings.

Runway events

There were eight accidents and six serious incident runway events reported to the ATSB in 2016 involving recreational aircraft, all were aeroplanes. There were no fatal or serious injury accidents. The majority, 93 per cent, of reported runway events were runway excursion.

Incidents

The most commonly reported types of incidents to the ATSB in 2016 (Table 35) that involved recreational aviation operations were:

- runway events
- aircraft separation
- power plant/propulsion.

Table 35: Incidents in recreational aviation, by occurrence type 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|--|----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|
| Airspace | | | | | | | | | | | |
| Aircraft separation | 3 | 3 | 9 | 4 | 5 | 6 | 5 | 18 | 12 | 19 | 84 |
| Operational Non-compliance | 2 | 1 | 2 | 2 | 4 | 3 | 4 | 3 | 4 | 7 | 32 |
| Airspace infringement | 2 | 1 | 5 | 2 | 1 | 1 | 2 | 5 | 0 | 2 | 21 |
| ANSP Operational error | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 |
| Encounter with RPA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 |
| Environment | | | | | | | | | | | |
| Wildlife | 2 | 2 | 2 | 3 | 5 | 0 | 4 | 3 | 6 | 13 | 40 |
| Weather | 0 | 2 | 0 | 2 | 4 | 4 | 2 | 2 | 3 | 5 | 24 |
| Interference with aircraft from ground | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 |
| Infrastructure | | | | | | | | | | | |
| Other | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 |
| Operational | | | | | | | | | | | |
| Runway events | 7 | 10 | 8 | 11 | 12 | 20 | 23 | 21 | 17 | 26 | 155 |
| Aircraft control | 11 | 12 | 9 | 10 | 19 | 31 | 30 | 10 | 7 | 15 | 154 |
| Terrain Collisions | 14 | 16 | 6 | 15 | 18 | 19 | 25 | 5 | 8 | 12 | 138 |
| Communications | 0 | 6 | 5 | 5 | 4 | 3 | 8 | 10 | 10 | 13 | 64 |
| Ground operations | 3 | 3 | 1 | 0 | 2 | 5 | 2 | 5 | 3 | 8 | 32 |
| Fuel related | 2 | 3 | 0 | 1 | 2 | 4 | 2 | 5 | 4 | 3 | 26 |
| Flight preparation / Navigation | 1 | 2 | 1 | 1 | 3 | 4 | 3 | 4 | 4 | 2 | 25 |
| Fumes, Smoke, Fire | 1 | 3 | 1 | 2 | 2 | 3 | 4 | 4 | 2 | 1 | 23 |
| Miscellaneous | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 6 |
| Crew and cabin safety | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 3 |
| Aircraft loading | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Technical | | | | | | | | | | | |
| Power plant / propulsion | 11 | 14 | 4 | 24 | 18 | 18 | 24 | 51 | 18 | 16 | 198 |
| Airframe | 6 | 10 | 8 | 12 | 18 | 16 | 19 | 20 | 12 | 14 | 135 |
| Systems | 2 | 1 | 2 | 4 | 5 | 9 | 5 | 13 | 8 | 9 | 58 |
| Consequential events | 8 | 16 | 8 | 29 | 20 | 28 | 19 | 43 | 27 | 24 | 222 |

Runway events

In 2016, there were 26 runway events involving a recreational aircraft reported to the ATSB, approximately 13 per cent of all recreational reported incidents. The number of runway events in 2016 was the most in the study period. Half of the runway incidents were runway excursions and almost half were runway incursions.

Aircraft separation

In 2016, aircraft separation incidents made up around 10 per cent of all recreational incidents reported to the ATSB. Separation issues was the most commonly reported aircraft separation incident. Almost all involved recreational aeroplanes.

Power plant/propulsion

There were 16 power plant/propulsion-related incidents reported to the ATSB in 2016 involving recreational aircraft. Over 60 per cent of these incidents involved engine failure or malfunction.

Remotely piloted aircraft systems

Accidents and serious incidents

The number of accidents and serious incidents involving an RPAS increased significantly in 2016, as shown by the difference in the number of occurrences reported to the ATSB over the 10-year period (Table 36). This is a reflection of the increasing prevalence of this type of aircraft in Australia.

In March 2017, the ATSB published a report detailing analysis of RPAS occurrences in Australia over the years 2012 to 2016 ([ATSB report AR-2017-016](#)) and a second edition in August which contained updated statistics from 2012 until end of June 2016 ([ATSB report AR-2017-016a](#)).

The most common types of accidents and serious incidents involving an RPAS in 2016 were:

- terrain collisions
- aircraft control
- power plant/propulsion.

Table 36: Accidents and serious incidents involving an RPAS, by occurrence type 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|-----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Airspace | | | | | | | | | | | |
| Aircraft separation | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Encounter with RPA | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Environment | | | | | | | | | | | |
| Wildlife | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 4 | 6 |
| Weather | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Operational | | | | | | | | | | | |
| Terrain collisions | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 11 | 33 | 51 |
| Aircraft control | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 8 | 16 | 26 |
| Miscellaneous | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 |
| Technical | | | | | | | | | | | |
| Power plant / propulsion | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 2 | 7 | 13 |
| Systems | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 2 | 7 |
| Consequential events | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 1 | 5 |

Terrain collisions

In 2016, most (32) of the terrain collision accidents involving an RPAS were collisions with terrain, there was also one wire strike and a controlled flight into terrain.

Aircraft control

There were 15 aircraft control accidents and one serious incidents involving an RPAS in 2016; three were investigated by the ATSB. The majority, 81 per cent, were loss of control.

Power plant/propulsion

In 2016, there were six accidents and one serious incident involving an RPAS power plant/propulsion-related issues.

Incidents

There were six incidents involving an RPAS reported to the ATSB in 2016 (Table 37), one involved a systems malfunction that lead to aircraft control issues. Aircraft operation occurrences accounted for three of the six incidents.

Table 37: Incidents involving an RPAS, by occurrence type 2007 to 2016

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|----------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Airspace | | | | | | | | | | | |
| Aircraft separation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 |
| Encounter with RPA ²⁵ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 |
| Operational Non-compliance | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| Airspace infringement | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Environment | | | | | | | | | | | |
| Wildlife | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| Operational | | | | | | | | | | | |
| Aircraft control | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 5 |
| Communications | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| Terrain Collisions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| Technical | | | | | | | | | | | |
| Systems | 0 | 0 | 0 | 0 | 4 | 1 | 1 | 1 | 0 | 1 | 8 |
| Power plant / propulsion | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 3 |
| Consequential events | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 |

²⁵ Only includes near encounters with RPA where the RPA was identified. Does not include 136 occurrences involving unidentified RPAS (84 of which were from 2016).

Data sources and submissions

Sources of information

The sources of information during the investigation included:

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

Appendices

Appendix A – Explanatory notes

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

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

Analysis methodology

Inclusions

Specifically, occurrence data includes:

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

Exclusions

Fatalities do not include those resulting from:

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

Important points to consider

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

- An occurrence may involve one or more aircraft.
- Where occurrence data is presented by operation type or occurrence type (as in the Occurrences by operation type and Occurrence types: what happened sections of this report), tabulated figures refer to the number of aircraft involved in occurrences. Occurrences involving more than one aircraft are recorded once for each aircraft involved.
- *Occurrence types: what happened* sections of this report, tabulated figures refer to the number of aircraft involved in occurrences. Occurrences involving more than one aircraft are recorded once for each aircraft involved except where the aircraft are of the same operation type where they are recorded once.
- Aircraft involved in fatal accidents are counted based on what happens to the aircraft occupants. This means that each aircraft with an on-board 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 on-board 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 G²⁶ 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, all general aviation and all recreational aviation include occurrence data where the country of registration is not known, but the general type of operation is known. This means that the addition of sub-categories will be less than the total number at the higher level.

Operation types

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

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

- *High capacity regular public transport (RPT) and charter* - regular public transport operations²⁷ and charter operations 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). In this report, charter operations (for both occurrences and departures/hours flown) mostly refer to charter operations in low capacity aircraft.²⁸
- *Medical transport* - operations involving flights facilitating emergency medical assistance in and/or transport by carrying ill or injured persons as medical passengers, other persons directly involved with the medical passenger, and/or medical personnel.

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

- Aerial work. This includes flying for the purposes of agriculture (spraying and spreading), mustering, search and rescue, fire control, or survey and photography.
- Flying training.

²⁶ Class G airspace is all airspace not promulgated as Class A, C, D, or E.

²⁷ RPT operations are conducted in accordance with fixed schedules to and from fixed terminals over specific routes.

²⁸ In the ATSB online aviation occurrence database, closed charter operations are generally coded as 'low capacity' operation type with 'charter' as an operation sub-type. Other charter occurrences in low capacity aircraft is coded as an operation type of 'charter'.

- Private, business and sports aviation. Sports aviation includes gliding, parachute operations, ballooning, warbird operations, and aerobatics.

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

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

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

Remotely piloted aircraft systems (RPAS) refer to occurrences involving unmanned fixed-wing, rotary-wing or lighter-than-air craft that are controlled by a ground-based operator conducting commercial, government or research activities and not flown for sport or recreation.

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

Occurrence types and events

Not all notifications reported to the ATSB are classified as incidents, serious incidents or accidents. Those that are deemed to not be a transport safety matter are classified as ‘events’. Events are not included in this report.

Notifications of the following occurrence type events *when they occur without any other occurrence type event* are coded as events:

- consequential events (diversion/return, fuel dump/burn off, missed approach/go-around)
- operational non-compliance with air traffic control verbal or published instruction
- airspace infringement
- breakdown of co-ordination between air navigation service providers (ANSP).

Note that previous (pre-2014) editions of *Aviation occurrence statistics* did include operational non-compliance, airspace infringement and breakdown of co-ordination as incidents.

In addition, infrastructure related events (air traffic management, navigation aids, radar/surveillance, runway lighting) are coded as events when no aircraft was affected.

Appendix B – ATSB occurrence type taxonomy

| Occurrence Type Level 1 | Occurrence Type Level 2 | Occurrence Type Level 3 | |
|-----------------------------|---|--|-------------------------------------|
| Airspace | Aircraft separation | Airborne collision alert system warning | |
| | | Collision | |
| | | Loss of separation | |
| | | Loss of separation assurance | |
| | | Near collision | |
| | | Issues | |
| | | Airspace infringement | |
| | | ANSP operational error | Information / procedural error |
| | | | Failure to pass traffic |
| | | | Other |
| Encounter with RPA | Encounter with RPA | Collision with RPA | |
| | | Near encounter with RPA | |
| | | Sighting | |
| | | Breakdown of co-ordination | |
| | | Operational non-compliance | |
| | Other | | |
| Consequential events | Ditching | | |
| | | Diversion / return | |
| | | Emergency evacuation | |
| | | Emergency / precautionary descent | |
| | | Forced / precautionary landing | |
| | | Fuel dump / burn off | |
| | | Missed approach / go-around | |
| | | Rejected take-off | |
| | | Other | |
| | | | |
| Environment | Interference with aircraft from ground | | |
| | | Weather | Icing |
| | | | Lightning strike |
| | | | Turbulence / windshear / microburst |
| | | | Unforecast weather |
| | | | Other |
| | | Wildlife | Animal strike |
| | | | Birdstrike |
| | | | Other |
| | | | Other |
| Infrastructure | ATM | | |
| | | Nav aids | |
| | | Radar / surveillance | |
| | | Runway lighting | |
| | | Other | |
| Operational | Aircraft control | Airframe overspeed | |
| | | Control issues | |
| | | Hard landing | |

| Occurrence Type Level 1 | Occurrence Type Level 2 | Occurrence Type Level 3 |
|-------------------------|---|------------------------------------|
| | | Incorrect configuration |
| | | In-flight break-up |
| | | Loss of control |
| | | Stall warnings |
| | | Unstable approach |
| | | Wheels up landing |
| | | Other |
| | Aircraft loading | Dangerous goods |
| | | Loading related |
| | | Other |
| | Communications | Air-ground-air |
| | | Call sign confusion |
| | | Transponder related |
| | | Other |
| | Crew and cabin safety | Inter-crew communications |
| | | Cabin injuries |
| | | Cabin preparations |
| | | Depressurisation |
| | | Flight crew incapacitation |
| | | Passenger related |
| | | Unrestrained occupants / objects |
| | | Other |
| | Fire, fumes and smoke | Fire |
| | | Fumes |
| | | Smoke |
| | Flight preparation / navigation | Aircraft preparation |
| | | Flight below minimum altitude |
| | | Lost / unsure of position |
| | | VFR into IMC |
| | | Other |
| | Fuel related | Contamination |
| | | Exhaustion |
| | | Leaking or venting |
| | | Low fuel |
| | | Starvation |
| | | Other |
| | Ground operations | Foreign object damage / debris |
| | | Ground handling |
| | | Jet blast / prop / rotor wash |
| | | Taxiing collision / near collision |
| | | Other |
| | Ground proximity alerts / warnings | |
| | Miscellaneous | Missing aircraft |
| | | Security related |
| | | Warning devices |

| Occurrence Type Level 1 | Occurrence Type Level 2 | Occurrence Type Level 3 |
|-------------------------|-------------------------------|---|
| | | Other |
| | Runway events | Depart / approach / land wrong runway Runway excursion Runway incursion Runway undershoot |
| | Terrain collisions | Other Collision with terrain Controlled flight into terrain Ground strike Wire strike |
| Technical | Airframe | Doors / exits Furnishings and fittings Fuselage / wings / empennage Landing gear / indication Objects falling from aircraft Windows Other |
| | Power plant/propulsion | Abnormal engine indications Auxiliary power unit Engine failure or malfunction Propeller / rotor malfunction Transmission and gearboxes |
| | Systems | Other Air/pressurisation Anti-ice protection Avionics / flight instruments Datalink (RPA) Electrical Fire protection Flight controls Fuel Hydraulic Other |

Australian Transport Safety Bureau

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

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

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

Purpose of safety investigations

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

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

Developing safety action

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

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

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

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

Glossary

Occurrence - an accident, incident or serious incident.

Accident - an occurrence involving an aircraft where:

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

Incident - an occurrence, other than an accident, associated with the operation of an aircraft that affects or could affect the safety of operation (International Civil Aviation Organisation Annex 13).

Serious incident - an incident involving circumstances indicating that an accident nearly occurred (International Civil Aviation Organisation Annex 13).

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

Australian Transport Safety Bureau

Enquiries 1800 020 616

Notifications 1800 011 034

REPCON 1800 020 505

Web www.atsb.gov.au

Twitter @ATSBinfo

Email atsbinfo@atsb.gov.au

Facebook [atsbgovau](https://www.facebook.com/atsbgovau)

Research

ATSB Transport Safety Report

Aviation Research

Aviation Occurrence Statistics

AR-2017-104

Final – 15 January 2018