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Addendum

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Safety summary

The purpose of this report

Each year, thousands of safety occurrences involving Australian aircraft and foreign-registered aircraft operating in Australia are reported to the Australian Transport Safety Bureau (ATSB).

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

The study uses information over the 10-year period from 2010–2019 to provide an insight into current and possible future trends in aviation safety.

This statistical report presents interactive web versions of all tables and graphs to allow the user to display aviation occurrence data in the format of their choice.

What the ATSB found

2019

In 2019, 220 aircraft were involved in accidents in Australia, with a further 154 aircraft involved in serious incidents (an incident with a high probability of becoming an accident). There were 35 fatalities from 22 fatal accidents. The number of fatalities was consistent with the average of the previous nine years (32.3 fatalities per year), and the number of fatal accidents was also consistent with its average (23.1 fatal accidents per year).

There have been no fatalities in scheduled commercial air transport in Australia since 2005.

2010 to 2019 accidents and incidents

Between 2010 and 2019, over 90 per cent of accidents and fatal accidents, and around 80 per cent of serious incidents, involved aircraft operating within the general aviation and recreational aviation sectors. In contrast, due to the more stringent reporting requirements for air transport operations, three-quarters of reported incidents involved aircraft operating within commercial air transport.¹

Considering all years in the period, the number of general aviation (GA) fatalities and fatal accidents decreased. The number of fatalities and fatal accidents within commercial air transport and recreation aviation remained relatively constant.

Since 2016, remotely piloted aircraft (RPA) have surpassed helicopters to become the second most common aircraft type involved in an accident. Further, the number of manned aircraft experiencing near encounters with an RPA also increased significantly over the study period.

2014 to 2018 accident rates

For the first time, statistics in this report have been organised around the type of aircraft activity being conducted, rather than the operational regulation. Due to the availability of activity data (departures and hours flown data), it was only possible to calculate accident and fatal accident rates over the five-year period 2014–2018.

¹ Includes scheduled airline flying as well as non-scheduled passenger-carrying activities such as charter, medical transport, and joyflight/sightseeing flights, as well as freight

Over this period, test and ferry flights, recreational flights involving an aircraft registered with Recreational Aviation Australia (RAAus), followed by pleasure and personal transport, had the highest accident rates. Community services flights, followed closely by test and ferry flights, had the highest fatal accident rates. (However, as there was only one fatal accident involving an aircraft conducting community service flights between 2014 and 2018 there is a high level of statistical uncertainty associated with this rate). For aircraft types, recreational aeroplanes, followed by commercial balloons had the highest accident rates. Also, recreational aeroplanes had the highest fatal accident rate.

Commercial air transport

There were no fatalities within commercial air transport in 2019.

Over the full study period (2010–2019), more than half of all serious incidents and the majority of accidents and fatal accidents for commercial air transport operators involved aircraft conducting non-scheduled activities, predominantly passenger transport charters. There were no identified increases or decreases in the number of accidents or serious incidents, however, the number of reported incidents for aircraft conducting scheduled international flights and commercial freight increased over the 10 years.

Between 2014 and 2018, around three-quarters of the hours flown, and approximately one-half of all departures, within commercial air transport, were operated by scheduled domestic or international operations. Over this period, there was a decrease in the hours flown by scheduled domestic operators; conversely, there was a proportionate increase in the hours for scheduled international operators.

Concerning activities within commercial air transport, passenger transport charters had the highest accident and fatal accident rates.

For specific aircraft types, within commercial air transport, balloons had an accident rate more than 10 times higher than for aeroplanes or helicopters. However, there was only one fatal accident involving a commercial balloon in the 2010 and 2019 timeframe.

Most commercial accidents and serious incidents were operational in nature (typically aircraft control and terrain collisions). The majority of incidents were environmental (mainly birdstrikes).

General aviation

In 2019, there were 17 fatalities in GA.

Over the 10 years, around one-third of GA accidents and 44 per cent of fatal accidents involved aircraft conducting sport and pleasure flying. Aerial work accounted for a further 37 per cent of GA accidents and 32 per cent of fatal accidents. The number of GA accidents per year increased over the period, with aerial work identified as the primary contributor. Conversely, there was a decrease in the number of fatal accidents, resulting in a decrease of around one fatal accident or 1.4 fewer fatalities per year.

There was also an increase in the number of reported incidents for GA aircraft conducting instructional flying.

Between 2014 and 2018, around 40 per cent of GA hours flown were conducted within aerial work, with instructional flying accounting for a further 30 per cent. Sport and pleasure flying made up around 14 per cent.

The rate of GA accidents decreased over the five years 2014–2018. The main contributors to this decline were sport and pleasure flying, and own business travel. Additionally, there was also a decrease in the rate of fatal accidents for aircraft conducting sport and pleasure flying.

Between 2010 and 2019, there was an increase in the number of GA RPA accidents per year; this primarily resulted from a significant increase in the overall number of survey and photographic accidents.

Overall, there was a decrease in the accident rate for aeroplanes conducting GA flying. The main contributors to this decrease were identified as aeroplanes conducting sport and pleasure flying, and own business travel.

Over the 10 years, the majority of GA accidents, incidents and serious incidents were related to operational or technical issues. Additionally, the majority of fatal accidents were also attributable to operational issues.

Further, the number of GA operational-related accidents and serious incidents, per year, increased over the period. Instructional flying was the main contributor to this operational-related increase. Additionally, there was an increase in the number of accidents and serious incidents of a technical nature; largely attributable to aerial work operations (especially those conducted using an RPA).

Recreational aviation

In 2019, there were 18 fatalities involving an aircraft conducting recreational flying.

The accident rate for recreational flying decreased between 2014 and 2018, with Recreational Aviation Australia (RAAus) registered aircraft having the greatest contribution to this reduction.

Aeroplanes had the highest accident and fatal accident rates of any recreational aircraft type.

Similar to GA, over the full study period (10 years), the majority of recreational accidents and serious incidents were operational (mainly terrain collisions) or technical (primarily engine failure or malfunction) in nature.

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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 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 Regulation 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 routinely reportable matters (RRMs). For the full list of IRMs and RRM, visit the [ATSB's website](#).

Aviation occurrence statistics are updated and published annually by the ATSB, and can be subject to change pending the provision of new information. 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 a general explanation of the analysis approach, and definitions of aircraft types and activity types. Definitions of occurrence types are shown in *Appendix B – ATSB occurrence type taxonomy*. Definitions of occurrence categories appear in the *Glossary*.

Major change from past editions: From operation types to activity types

This edition of *Aviation occurrence statistics* uses *activity types* rather than *operation types* to display the count and rates of occurrences.

An activity type reflects the activity the aircraft was engaged in, while an operation type reflects the legal regulation that the aircraft was flown under. For example, aerial mustering may be done either as a commercial aerial work operation or as a private operation. In this example, both operation types are recorded as the single activity.

Activity types also reflect only the activity being done for that flight and do not reflect what the aircraft is usually used for. For example, all ferry flights are recorded under the same activity irrespective of whether the ferry flight was a positioning flight for a commercial air transport passenger flight or an aerial work flight.

Additionally, activity types apply to all aircraft types participating in that activity. For example, accidents for 'aerial work – policing' can involve aeroplanes, helicopters and remotely piloted aircraft.

The taxonomy of activity types used in this report is described in the *Exposure data* section, with a full taxonomy with definitions provided in *Appendix A – Explanatory notes*.

As departures and hours flown for activity types are only available between 2014 and 2018, this report presents rate data for five years only. Previous editions using operation types reported nine or 10 years. As more years of exposure data becomes available, future editions will report more years in rate trends until the 10-year period becomes available.

Background to change

In 2013, recommendations by the Tenth Session of the Statistics Division of the International Civil Aviation Organization (ICAO) were adopted by the ICAO Council and a new edition of the [Reference Manual on the ICAO Statistics Program](#) was published. Included within the manual was a new ICAO *Classification of Civil Aviation Activities*.

The Australian Bureau of Infrastructure, Transport and Regional Economics (BITRE) adopted ICAO's new classification in 2014 and began collecting statistics in their *General Aviation Activity Survey* (which the ATSB uses to calculate rate data presented in this report) to reflect this change.

In 2019 the ATSB adopted the new activity classification to better align with BITRE and ICAO. The ATSB conducted a multi-year project to reclassify over 320,000 occurrences and events within the ATSB occurrence database to include the new activity classification. As a result, the ATSB's occurrence data now closely aligns with BITRE's classification and therefore reduces most of the uncertainty associated with combining the databases. These changes mean the ATSB will be able to present more accurate, higher resolution rate data (the best measure for comparison between activities) for more activities than previously.

Data sources and submissions

Sources of information

The sources of information used included:

- the ATSB aviation occurrence database
- ATSB investigation reports
- aircraft type and activity departures and hours flown data from the Bureau of Infrastructure, Transport and Regional Economics (BITRE).

Exposure 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 activities they perform, aviation occurrence statistics are often presented as a rate per departures or hours flown.

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

Figure 1 displays exposure data (departures or hours flown) used to calculate rates in this report. The data is rounded to the nearest thousand departures (or thousand hours flown) to present the size or magnitude of the data in general terms. Specific data for non-Australian (foreign) registered aircraft is limited, but tabulated where available. This is presented in a web-based [interactive tool](#), the data can be filtered for different activities and displayed in chart or tabular format.

Aviation activity is classified into a three-tier hierarchical structure (activity group, activity type and activity subtype):

- Commercial air transport (activity group)
 - Scheduled (activity type). Includes activity subtypes: international and domestic regular public transport, and scheduled freight.
 - Non-scheduled (activity type). Includes activity subtypes: medical transport, passenger transport charters, joyflight/sightseeing charters, non-scheduled freight, and other non-scheduled commercial air transport.
- General aviation/Recreational (activity group)
 - Aerial work (activity type). Includes activity subtypes: agricultural mustering, agricultural spreading/spraying, other agricultural flying, photography, policing, firefighting, construction – sling loads, other construction, search and rescue, observation and patrol, power/pipeline surveying, other surveying, advertising, and other aerial work.
 - Own business travel (activity type).
 - Instructional flying (activity type). Includes activity subtypes: solo and dual flying training, and other instructional flying.
 - Sport and pleasure flying (activity type). Includes activity subtypes: pleasure and personal transport, glider towing, aerobatics, community service flights, parachute dropping, and other sport and pleasure flying.
 - Other general aviation flying (activity type). Includes activity subtypes: test flights, ferry flights and other flying.

Definitions of each activity is contained in *Appendix A - Activity types*.

Within this report, recreational flying (activities conducted by aircraft registered by a Recreational Aviation Administration Organisation - RAAO²) is split from general aviation as a separate activity group. The purpose to this division was to highlight the different associated level of risk between these activities. Generally, the activity type structure (which reflects the activity the aircraft was engaged in, not the legal regulation that the aircraft was flown under) combines general aviation and recreational activities. Additionally, since the exposure data associated with gliders was provided by the Gliding Federation of Australia (GFA), all glider activity was also

² Includes Recreational Aviation Australia (RAAus), Sports Aviation Federation of Australia (SAFA), Australia Sport Rotorcraft Association (ASRA), and Gliding Federation of Australia (GFA).

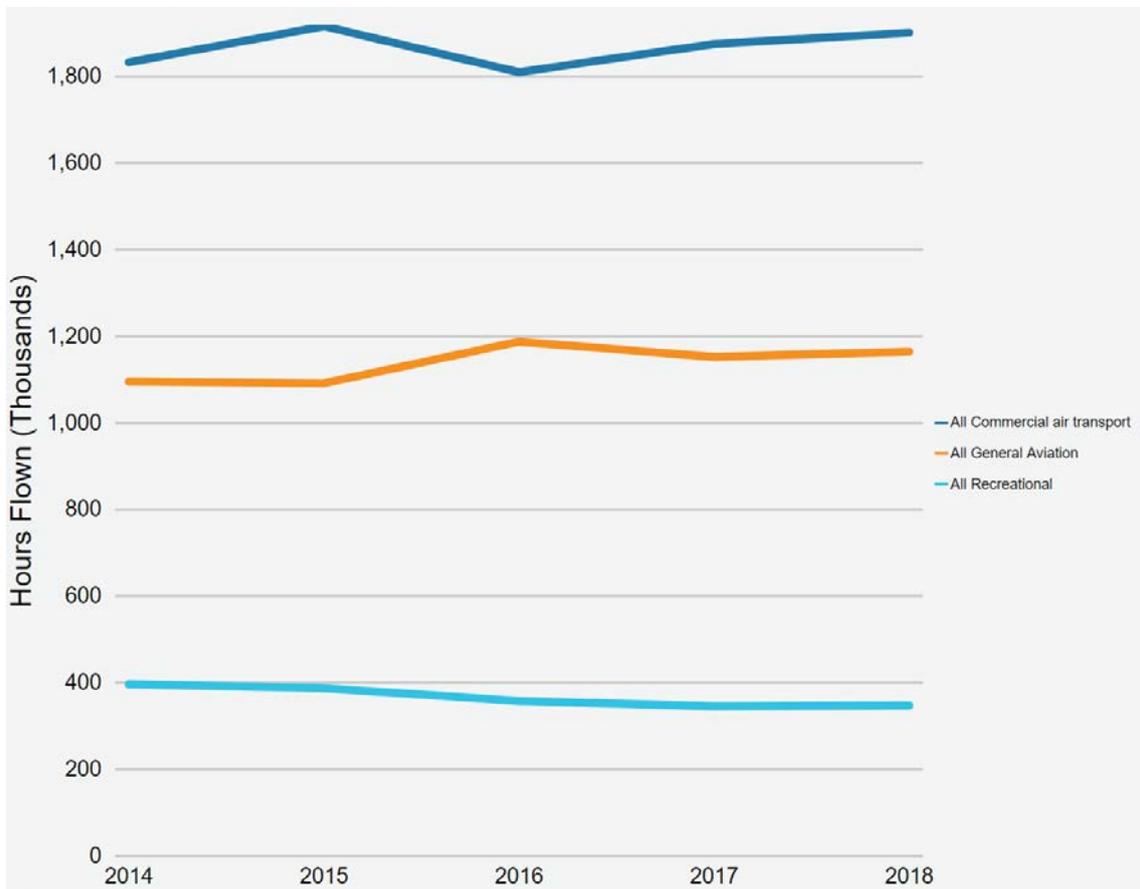
incorporated into recreational flying. However, it should be noted that a large proportion of these aircraft were also registered by the Civil Aviation Safety Authority (CASA).

In this study, there are two types of exposure data used, aircraft **departures** and **hours flown**.

Aircraft departures are widely used as a measure of exposure, that is, the opportunity for an unsafe event to occur within a certain amount of flying. This report uses departure data for calculating accident and fatal accident rates for all commercial air transport and general aviation (GA) activities. **Departures data was not available for recreational flying.** Rates calculated using departures are a more appropriate measure than hours flown as most accidents occur either during the approach and landing or departure phases of flight.

Flying hours are a more useful measure of exposure for activities with a higher risk of an accident outside of approach, landing and take-off phases of flight. Examples of these activities include agricultural and search and rescue aircraft performing low level flying as part of normal operations. **Hours flown data was available for recreational flying.**

Figure 1 : Exposure by activity 2014 to 2018



Data source: Bureau of Infrastructure, Transport and Regional Economics (BITRE)

For the majority of commercial air transport activities, departures and hours flown remained relatively constant over the five-year period.³ However, it is very likely (see *Appendix C – Estimative language*⁴) that there was a decreasing trend of hours flown for scheduled domestic

³ Within this report, the ATSB uses the non-parametric Mann-Kendall trend test to identify significant increases or decreases in the yearly number of occurrences or rates.

⁴ The ATSB uses verbal probability expressions (for example ‘very likely’) as a standardised method to communicate probability information. More information regarding the ATSB’s use of probability expressions can be found in the ATSB research report, [Analysis, Causality and Proof in Safety Investigations](#) (AR-2007-053).

operators. Conversely, it is also very likely that there was an increasing trend in the hours flown for scheduled international flights. Additionally, it was very likely that there was an increasing trend in the number of departures for aircraft conducting joyflight or sightseeing charters.

Around three quarters of commercial air transport flight hours in Australia between 2014 and 2018 were operated by Scheduled Domestic or International airline operations. However, these activities only make up around half of all total number of commercial air transport departures.

Considering aircraft conducting general aviation operations, it was very likely that there was a decreasing trend in both the departures and hours flown for aircraft flying survey or photographic activity, possibly due to the increased operations of remotely piloted aircraft (RPA) whose departures and hours were not available. Further, it was also very likely that there was an increasing trend in the hours flown for other agricultural operations. Concerning only the number of departures per year, it is very likely that the activity type of sport and pleasure flying had an increasing trend. All other activities within general aviation (GA) remained relatively constant.⁵

For recreational flying, it is very likely there was a decreasing trend in the total number of hours flown for RAAus aircraft and gliders.

Note, as activity for gliders is collected by the Gliding Federation of Australia (GFA) rather than BITRE, gliders have been grouped with recreational aviation in the graphs and tables in this report.

Note:

As a result of the activity classification work, there was not always sufficient information to distinguish between some activity subtypes which were previously one operation subtype. To produce more reliable statistics, some of these activities were merged in this report. For example, it was often not possible to reliably split the old operation subtype of survey/photography into the multiple activity subtypes: photography; pipeline/powerline surveying; and other surveying. In future editions of this report, merged activities will be able to be split into the appropriate activity subtypes as they will be classified at the time of notification (not as the result of classification work). More information regarding the merged activities is in *Appendix A – Explanatory notes*.

⁵ Due to the relatively short time period (five years) of exposure data in this study, there is a higher level of uncertainty when detecting trends in the data compared to previous editions of this report (which used 9 or 10-year periods). As time since 2014 (year when BITRE began collecting activity departures and hours flown data) increases, future editions of this report will have longer study periods and will therefore be better able to detect trends.

Occurrences by activity

Occurrence numbers and rates presented in this section relate to the activities detailed in *Appendix A – Explanatory notes*.

Aircraft involved in these occurrences include both Australian civil registered aircraft (both Civil Aviation Safety Authority (CASA) registered VH- aircraft, and aircraft registered by a Recreational Aviation Administration Organisation - RAAO) operating within or outside Australian territory,⁶ and foreign registered aircraft operating within Australian territory.

Figure 2 is a web-based [interactive tool](#) that displays the number of fatal accidents and fatalities for commercial air transport, general aviation (GA) and recreational⁷ flying for each of their activity types and subtypes. Fatal accidents in some aircraft activities are more likely to have a greater number of associated fatalities than other activities. For example, aircraft used for agricultural activities usually have a single pilot on board and, as a result, the number of fatal accidents was equivalent to the number of fatalities. In contrast, survey or photography aircraft generally have a pilot, in addition to a camera operator or navigator on board, resulting in twice as many fatalities than fatal accidents.

Overall, the majority of fatalities and fatal accidents were within GA or recreational flying. Over half of these were associated with aircraft conducting sport or pleasure flying and about one-fifth within aerial work. Most fatalities in commercial air transport were associated with passenger transport charters.

⁶ 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.

⁷ Recreation aviation in this report includes VH-registered gliding in addition to all activities conducted by aircraft registered with RAAOs.

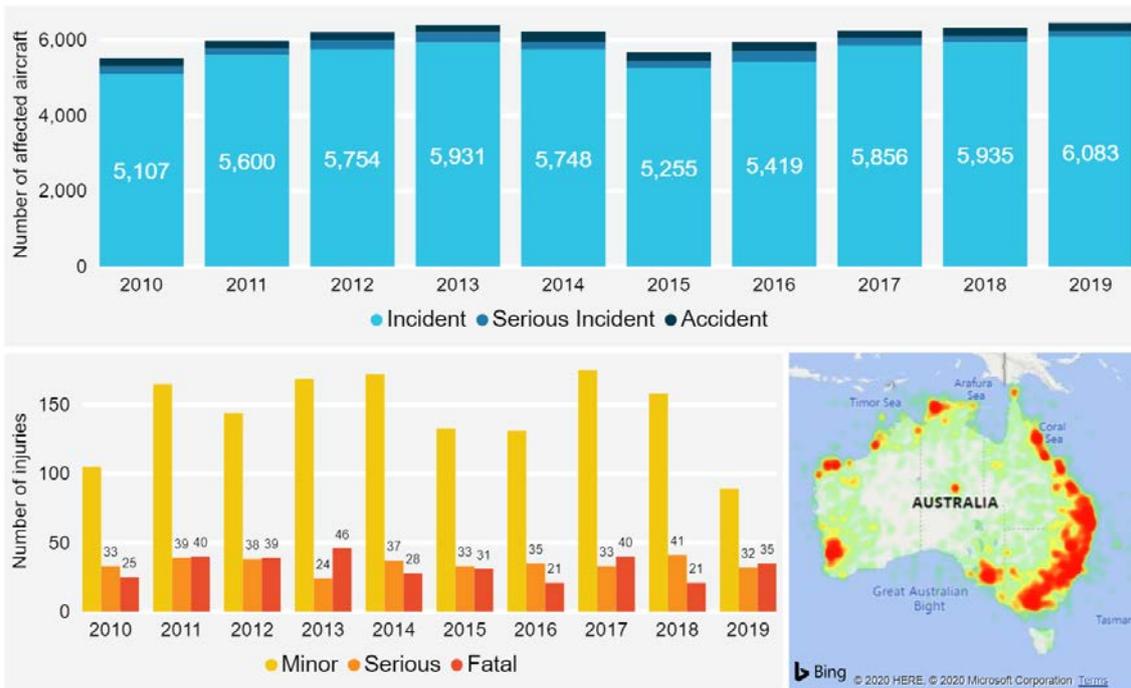
Figure 2: Aircraft involved in a fatal accident and fatalities by activity (for Australian-registered aircraft) 2010 to 2019

Activity Group	Activity Type	Activity Subtype	Aircraft involved	Fatalities	
Commercial air transport	Scheduled	International	0	0	
		Domestic	0	0	
		Unknown scheduled commercial air transport	0	0	
		Non-scheduled	Passenger transport charters	9	20
			Medical transport	0	0
			Joyflights / sightseeing charters	0	0
	Freight	Other non-scheduled commercial air transport	0	0	
		Unknown non-scheduled commercial air transport	0	0	
	General aviation	Unknown commercial air transport		3	4
				0	0
		Aerial work	Agricultural spreading/spraying	13	13
			Agricultural mustering	11	12
			Other agricultural	1	1
Unknown agricultural			0	0	
Construction			0	0	
Survey/Photographic			5	10	
Observation and patrol			0	0	
Search and rescue			2	2	
Policing			0	0	
Firefighting			2	2	
Advertising			0	0	
Other aerial work		3	4		
Unknown aerial work		0	0		
Instructional Flying			11	19	
			3	5	
Own Business Travel			0	0	
			0	0	
Sport & Pleasure Flying		Glider towing	1	5	
	Parachute dropping	2	2		
	Aerobatics	44	76		
	Pleasure and personal transport	2	6		
	Community service flights	2	3		
	Other sport and pleasure flying	1	1		
	Unknown sport and pleasure flying	11	12		
Other general aviation flying		1	1		
	Unknown general aviation flying	1	1		
Recreational			104	127	
Total			231	325	

Data source: ATSB occurrence database

Figure 3 is a web-based [interactive tool](#) that gives detailed information regarding the number of occurrences per activity (including locations, number of injuries, aircraft types and occurrence summaries) displayed as charts, tables and a map. Also included, for investigated occurrences, are links to ATSB investigation websites.

Figure 3: Occurrence data by activity 2010 to 2019



Data source: ATSB occurrence database.

In 2019, there were 35 fatalities from 22 fatal accidents. This is consistent with average of the previous nine years (32.3).

The have been no fatalities in scheduled commercial air transport in Australia since 2005.

There were no fatalities in all of commercial air transport in 2019 (scheduled and non-scheduled). Over the 10-year period, the majority of fatalities within commercial air transport were within the non-scheduled activity type, with most of these falling within the passengers transport charters activity subtype.

Over the study period, there were no identified increases or decreases in the trend of the number of accidents or serious incidents for the activity types and subtypes within the commercial air transport activity group. However, the trend in the number of reported incidents associated with aircraft conducting either scheduled international flights or commercial freight both increased over the 10 years.

The number of GA fatalities in 2019 (17) was consistent with the 10-year average. However, considering all years in the study period, it is very likely that the overall trend in the number of GA fatalities and fatal accidents was decreasing over the period. Conversely, it is very likely that the trend in the number of GA total accidents was increasing. This was driven by an overall increase in the number of accidents associated with an aircraft conducting aerial work. Additionally, it is virtually certain that there was an increasing trend in the number of reported incidents associated with instructional flying over the 10 years.

Around 75 per cent of incidents reported to the ATSB involved an aircraft conducting commercial air transport. However, over 90 per cent of all accidents, and almost 95 per cent of fatal accidents, involved a GA or recreational aircraft. This is indicative of the different reporting requirements between these activity groups and their associated level of risk.

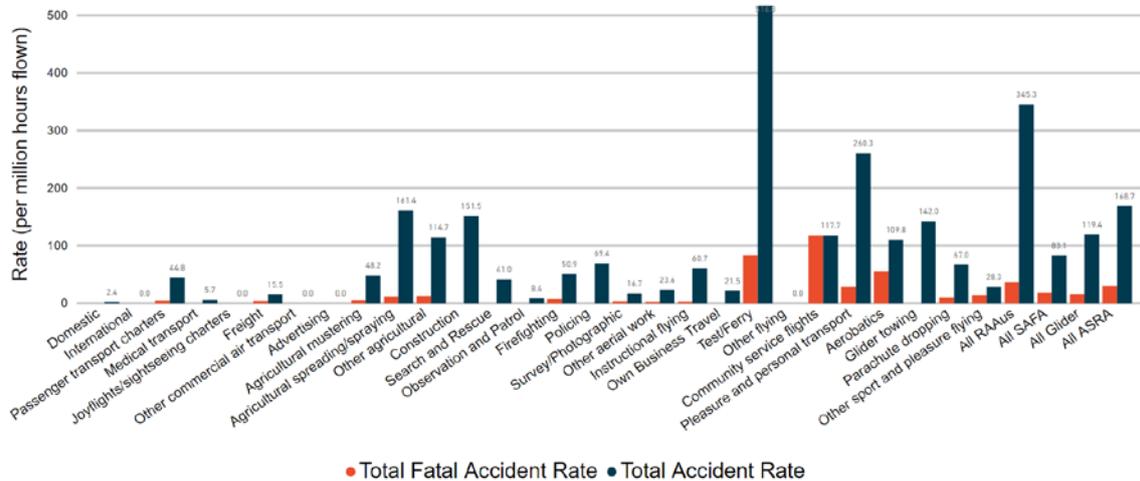
Additionally, the map in Figure 3 shows that the majority of occurrences happen along the eastern seaboard and around major population centres.

Figure 4 is a web-based [interactive tool](#) that presents the accident and fatal accident rates.

Note:

The rates presented in the Figure 4 are only calculated between 2014 and 2018, not the full year range of this study (2010–2019). This was due to the availability of exposure data (departures and hours flown) which was only available between these years. Further, departures data was not available for recreational flying, and there was no departures or hours flown data for RPAs. Rates specific to all aircraft types (excluding RPA) are included in Figure 5 in the *Occurrences by aircraft type* section of this report.

Figure 4: Accident and fatal accident rates by activity 2014 to 2018



Data sources: Bureau of Infrastructure, Transport and Regional Economics (BITRE) and ATSB occurrence database. Rates derived from departures not available for gliders, weight shift aircraft and gyrocopters. No rates available for remotely piloted aircraft.

Test and ferry followed by RAAus then pleasure and personal transport had the highest accident rates. Community service flights followed by test and ferry had the highest fatal accident rates. However, there was only one fatal accident involving a community service flight during the five-year period and therefore there is a high level of statistical uncertainty associated with this rate.

Over the five-year period, there were no identified increases or decreases in the accident or fatal accident rates for any of the activity type and subtypes within commercial air transport.

It is very likely that there was a decrease in the overall GA accident rate for hours flown over the five years. This resulted in a decreasing trend of around 14 fewer accidents per million hours flown per year. The main contributors to this decrease were the activity types sport and pleasure flying and own business travel. The activity subtypes search and rescue, and other agricultural flying also contributed to the decrease.

In addition, it is highly likely that there was a decrease in the fatal accident rate of the sport and pleasure flying activity type, with the pleasure and personal transport subtype identified as the main contributor to this decrease.

It is highly likely that there was a decreasing trend in the rate (per hours flown) of recreational accidents, with RAAus registered aircraft the main contributors.

Occurrences by aircraft type

This section explores trends in occurrences by the type of aircraft involved, and the type of activity conducted. It looks primarily at the rate of accidents within each activity, in relation to the number of departures and hours flown by the type of aircraft within that category. See *Appendix A - Aircraft types* for definitions.

There are over 15,600 aircraft on the Australian civil aircraft (VH-) register (registration with the Civil Aviation Safety Authority - CASA). Of these, fixed-wing aircraft (90% aeroplanes and 10% gliders) accounted for 82 per cent, rotary-wing aircraft (helicopters) for 15 per cent and the remaining 3 per cent were balloons (including one airship). At the time of writing, the number of remotely piloted aircraft (RPA) in Australia was unknown. Estimates of the number of RPAs used for recreational purposes range from 50,000 to hundreds of thousands. Commercial RPAs can be more accurately estimated based on the number of people who have either a remote pilot licence or a remote operator certificate. As of March 2020, there were over 1,700 remote operator certificate holders.⁸

Australian-registered recreational aircraft are additional to these figures. Recreational Aviation Australia (RAAus) administers the largest number of recreational aircraft in Australia. Of the over 3,300 aircraft registered with RAAus, the majority are aeroplanes (around 88%) with the remainder comprising of weight shift aircraft (trikes and powered parachutes). In addition, over 3,500 weight shift aircraft are registered with the Sports Aviation Federation of Australia (SAFA), and over 300 gyrocopters with the Australian Sport Rotorcraft Association (ASRA). Although gliders are VH-registered, the activity for the over 1,300 gliders is collected by the Gliding Federation of Australia (GFA) rather than BITRE. As such, gliders have been grouped with other recreational aviation aircraft in the graphs and tables in this report.

Figure 5 presents the available data in a web-based [interactive tool](#) that displays the number of accidents, fatal accidents and injuries by aircraft type per activity.

Figure 5: Number of accidents and injuries involving Australian-registered aircraft by aircraft type and activity 2010 to 2019

Aircraft Type	Activity Group	Activity Type	Activity SubType	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total		
Aeroplane	Commercial air transport	Scheduled	Domestic	1	1	1	1	3	3	1	3	2	0	16		
			International	1	1	0	0	0	0	0	0	0	0	0	2	
			Unknown	0	0	0	0	0	0	0	0	0	0	0	0	
		Non-scheduled	Freight	13	9	6	7	16	3	9	10	4	6	6	83	
			General aviation	3	1	2	0	1	0	0	1	1	1	0	9	
	Recreational	Commercial air transport	86	78	61	58	105	85	84	55	62	46	720			
		Recreational	44	46	50	59	74	50	43	38	37	38	479			
	Balloon	General aviation	Commercial air transport	2	2	0	1	2	0	3	2	5	2	19		
			General aviation	0	1	1	0	1	0	0	0	1	1	5		
	Glider	Recreational	3	12	12	6	11	6	9	10	3	8	80			
Gyrocopter	Recreational	6	4	6	7	5	4	6	7	10	5	60				
Helicopter	Commercial air transport	General aviation	Aerial work	Agricultural mustering	2	5	3	5	3	1	2	3	4	1	29	
				Agricultural spreading/spraying	15	5	8	1	4	11	6	6	9	10	75	
	Construction	3		0	3	3	4	3	3	3	4	2	28			
	Firefighting	0		1	0	0	1	0	1	0	0	0	3			
	Observation and patrol	0		0	0	0	0	0	0	1	0	0	1			
	Other aerial work	3		2	1	0	1	2	0	0	1	4	14			
	Other agricultural	1		1	0	0	2	1	2	1	2	1	11			
	Policing	3		0	0	1	0	3	1	0	0	0	8			
	Search and rescue	0		1	0	1	1	1	0	0	0	1	5			
	Survey/Photographic	0		2	1	4	1	0	0	1	0	0	9			
	Unknown	1		0	0	0	0	0	2	1	0	1	5			
	Instructional Flying	Own Business Travel		Sport & Pleasure Flying	Instructional Flying	3	4	4	5	4	4	2	2	2	3	33
					Own Business Travel	0	0	0	0	0	0	1	0	1	0	2
					Sport & Pleasure Flying	6	6	9	6	5	6	3	7	5	11	64
					Other general aviation flying	2	2	2	1	2	3	4	6	1	1	24
					Unknown general aviation flying	0	1	0	0	1	0	0	0	0	1	0
	Remotely Piloted Aircraft	General aviation		0	0	0	2	1	11	28	28	62	53	185		
Weight Shift	Recreational	10	13	31	15	18	17	12	9	9	18	152				

Data source: ATSB occurrence database.

Since 2016 there have been more accidents involving RPA than helicopters, resulting in RPA as the aircraft type (following aeroplanes) with the second most accidents per year.

⁸ www.casa.gov.au/rpa-operator-certificate-holders

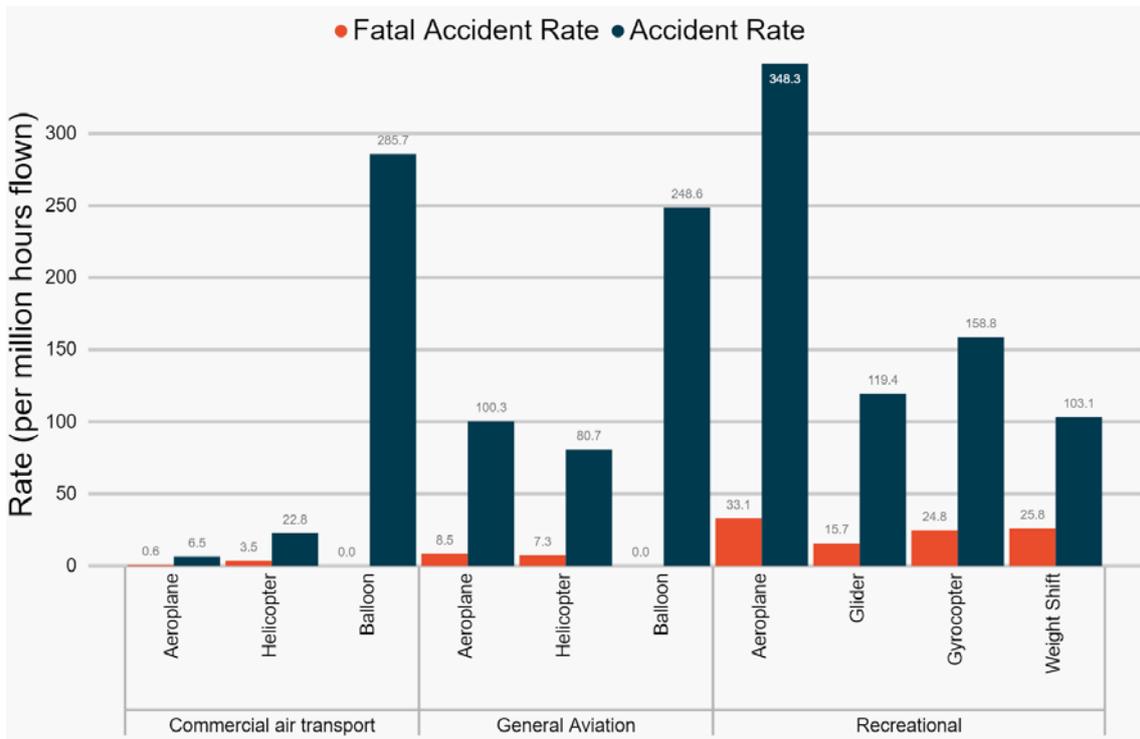
Over the 10-year period, it is very likely that there was an increasing trend for the number of accidents per year for RPA conducting survey or photographic work and instructional flying.

Figure 6 displays rate data (per million departures or million hours flown) for each activity and available aircraft types. This is presented in a web-based [interactive tool](#).

Note:

The number of hours flown each year is available for all activities and the following aircraft types: aeroplanes, helicopters, gliders, gyrocopters and weight-shift aircraft. The number of departures is available for all commercial and general aviation activities and for only aeroplanes, balloons and helicopters. There was no departure or hours flown data available for RPA. Consequently, accident and fatal accident rates are not available for all aircraft types.

Figure 6: Rate of accidents and fatal accidents by aircraft type and activity



Data sources: Bureau of Infrastructure, Transport and Regional Economics (BITRE) and ATSB occurrence database. Rates exclude remotely piloted aircraft for both hours flown and departures. Gliders, weight shift aircraft and gyrocopters are also excluded from departures as the departures data was not available.

Between 2014 and 2018, recreational aeroplanes had the highest accident rate (per hours flown) followed by balloons conducting commercial air transport. In addition, recreational aeroplanes had the highest fatal accident rate (per hours flown) followed by weight shift aircraft and gyrocopters.

There was probably an increase in the accident rate (per year) for gyrocopters. There were no other identified increases in accident rates for any activity/aircraft type combination over the five years. It is very likely that there was a decrease in the accident rate (per departures and hours flown) for aeroplanes conducting sport and pleasure flying, own business travel and GA overall. No increase or decrease in the fatal accident rate were identified for any activity/aircraft type combination.

Occurrence types: what happened

Occurrences are often the result of a complex set of circumstances, involving a chain, or sequence of events. The ATSB categorises each reported occurrence (accident, serious incident or incident) into one or more occurrence types to identify what happened, and how the sequence of events developed to lead to an occurrence. 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, incident or serious 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.

The ATSB uses a three-level hierarchical structure to classify occurrence types. There are broad occurrence type categories (level 1). 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 level 1 occurrence types are broken down further into different level 2 occurrence types, which are further broken down into [level 3 occurrence types](#), which are detailed in *Appendix B – ATSB occurrence type taxonomy* of this report and in the ATSB's [SIIMS Occurrence Type Coding Manual](#). The ATSB records one or more occurrence types for all aircraft involved in each occurrence. Accidents and serious incidents generally have more occurrence types coded than incidents, as they are more likely to be investigated, and their severity usually means that there is a greater amount of information to draw upon for analysis and coding. For occurrences involving multiple aircraft, aircraft conducting the same activity are recorded once, whereas aircraft conducting different activities, the occurrence will be recorded against the corresponding activities.

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 more likely to lead to an accident. 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.

Figure 7 presents a selection of the data available in a web-based [interactive tool](#) that displays the number of occurrences (accidents, serious incidents and incidents) for each year over the study period. The data can be filtered for different activities, aircraft types and injury levels.

Figure 7: Occurrences by occurrence type and activity 2010 to 2019

Level 1 Occurrence Types	Level 2 Occurrence Types	Level 3 Occurrence Types	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	
Airspace	Aircraft separation		285	339	372	418	411	352	432	407	365	425	3,806	
	Airspace infringement		45	46	50	47	34	20	22	46	40	27	377	
	ANSP Operational error		92	69	84	140	144	36	76	79	120	57	897	
	Breakdown of co-ordination		21	6	21	28	25	8	11	16	14	4	154	
	Encounter with RPA		1	0	3	1	11	28	87	150	153	194	628	
	Operational Non-compliance		279	268	260	239	205	154	200	321	276	178	2,380	
	Other		2	2	6	12	3	7	2	4	4	6	48	
	Consequential events		1,008	1,078	1,212	1,133	1,183	1,122	1,097	990	966	1,163	10,952	
Environment	Interference with aircraft from ground		7	7	13	12	16	27	83	78	7	4	254	
	Other		6	0	1	2	3	2	0	1	0	1	16	
	Weather		241	278	341	499	591	504	440	383	329	484	4,090	
	Wildlife	Animal strike	48	33	32	41	34	49	50	33	45	36	401	
		Birdstrike	1,698	1,738	1,617	1,676	1,653	1,656	1,840	1,954	1,726	1,761	17,319	
	Other	3	6	5	12	8	3	11	6	7	13	74		
Infrastructure	ATM		5	0	1	4	4	4	3	7	13	10	51	
	Nav aids		7	6	1	2	8	20	3	3	10	5	65	
	Other		7	8	11	12	8	6	10	6	10	5	83	
	Radar / Surveillance		7	4	8	2	1	1	2	1	3	4	33	
	Runway lighting		23	13	25	16	16	14	17	11	15	15	165	
	Aircraft control		217	278	401	410	410	334	359	391	358	414	3,572	
	Aircraft loading		129	224	228	204	201	87	102	66	69	37	1,347	
Operational	Communications		197	183	193	228	191	155	185	222	190	165	1,909	
	Crew and cabin safety		96	137	104	162	161	103	117	147	123	49	1,199	
	Flight preparation / Navigation		110	111	113	126	93	93	105	101	97	74	1,023	
	Fuel related		67	78	74	71	83	88	47	56	41	48	653	
	Fumes, Smoke, Fire		312	332	342	327	335	286	262	303	430	388	3,317	
	Ground operations		84	109	110	94	122	81	104	93	96	74	967	
	Ground proximity alerts / warnings		20	39	71	173	222	251	193	284	346	400	1,999	
	Miscellaneous		314	321	430	305	317	232	64	147	146	260	2,536	
	Runway events		382	360	345	362	265	269	298	328	364	344	3,317	
	Terrain Collisions		235	223	219	241	199	199	274	242	273	272	2,377	
	Technical	Airframe		406	482	449	432	408	379	351	404	361	423	4,095
		Powerplant / propulsion		385	432	496	420	424	380	421	378	369	385	4,090
Systems			604	662	679	635	688	696	713	630	646	692	6,645	

Data source: ATSB occurrence database.

Overall, the most common higher-level (level 1) occurrence type associated with an accident or serious incident reported to the ATSB are operational. The most frequent level 2 occurrence types associated with these accidents and serious incidents are terrain collisions and aircraft control issues (generally loss of control or hard landings). Further, these are also the most common occurrence types associated with fatal accidents for most aircraft types.

Aeroplanes, which account for the majority of incidents, are most commonly associated with environmental events, most frequently birdstrikes. However, most other aircraft types are more frequently associated with operational (mainly warning devices, runway incursions, air-ground-air communication issues, and collision with terrain) or technical (abnormal engine indications, avionics/flight instruments, and engine failure or malfunction) incidents.

For aircraft conducting commercial air transport, the most common level 1 occurrence type associated with an accident, fatal accident or serious incident are operational (especially aircraft control and terrain collisions) followed by technical events. The majority of these aircraft were conducting non-scheduled activities (typically passenger transport charters). Generally, accident and serious incident trends associated with aircraft conducting commercial air transport remained steady over the study period. However, it was very likely that the trend in the number of fire and ground strike serious incidents or accidents increased. Alternatively, it is very likely that the trends for fuel starvation, abnormal engine indications and wirestrikes all decreased.

The majority of commercial air transport incidents were environmental. It is highly likely that the number of environmental incidents increased, especially birdstrikes. The other major increases were the trends for airborne collisions alert system warnings, ground proximity alerts/warnings, encounter with RPA and missed approach/go-arounds. The major decreases were observed for warning devices and dangerous good loading incidents.

For general aviation (GA), the majority of accidents and serious incidents also related to operational (terrain collisions and aircraft control) or technical issues (mainly engine failure or malfunction). The majority of fatal accidents in GA were operational. Overall, the number of GA

operational accidents and serious incidents per year almost certainly increased over the 10-year period. Instructional flying had the greatest contribution to this increase. Additionally, there was also an increase in the number of technical accidents and serious incidents; this was largely due to an increase in those associated with aerial work (especially RPA conducting aerial work).

The majority of GA incidents were operational (frequently runway incursions) or technical (generally landing gear/indication, engine failure or malfunction, and avionics/flight instruments) in nature. This is related to the incident reporting requirements in these sectors. It is highly likely that there was an increase in the trend of the number of aircraft separation incidents along with near encounter with RPA, avionics/flight instruments, birdstrikes and air-ground-air communication issues. Decreasing trends were observed for flight preparation/navigation incidents, especially lost/unsure of position.

Like GA, the majority of recreational accidents or serious incidents were operational (mainly collision with terrain) or technical (primarily engine failure or malfunction) in nature. Similarly, the majority of recreational incidents were operational or technical.

For recreational aircraft, it is highly likely that there was an increase in the trend of the number of accidents or serious incidents that involved an airframe issues. It is also very likely that the trend for incidents involving an aircraft separation issues increased.

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 activity 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 minor injuries, 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 the number of occurrences (accidents, serious incidents and incidents) is presented, occurrences involving more than one aircraft with the same matching categorisation (activity, aircraft type and occurrence type) are recorded once. However, if this categorisation is different, the occurrence will be counted separately within the appropriate categorisation resulting in the occurrence being counted twice. Further, when the categorisations are 'rolled up' and the categories merged the occurrence will only be counted once. For example, a mid-air collision accident between an agricultural mustering helicopter and a survey/photography aeroplane would be counted under agricultural mustering accidents and again under survey/photography (when filtering on these activity subtypes), and separately under aerial work helicopters and aerial aeroplanes (when filtering on the aircraft type). However, the accident would only be included once under aerial work when not filtering on aircraft type or activity type.
- Injuries and fatalities are recorded against only the activity 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 activity can be reasonably ascertained. For example, aircraft operating in Class G⁹ airspace without a transponder or flight plan can be reasonably expected to belong to GA, even though the activity subtype is not known.

⁹ Class G airspace is all airspace not promulgated as Class A, C, D, or E.

- 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 to 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.

Activity types

This report provides data pertaining to a number of activity types.

Commercial air transport (*Activity Group*) 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:

- Scheduled (*Activity Type*)
 - International (*Activity Subtype*) - Scheduled operations of international airlines operating into/out of Australia (includes international flights by domestic airline, not just foreign airlines, excludes flights to Australian territorial islands).
 - Domestic (*Activity Subtype*) - Scheduled operations of domestic airlines operating within Australia (excludes foreign airlines conducting a domestic flight).
 - Scheduled freight only¹⁰ (*Activity Subtype*) - Scheduled operations carrying freight only.
 - Unknown scheduled commercial air transport (*Activity Subtype*) - Scheduled commercial operations where the activity subtype is unknown (unknown if the operator was conducting international, domestic or carrying freight only operations).
- Non-scheduled (*Activity Type*)
 - Passenger transport charters (*Activity Subtype*) - Flying involving the carriage of passengers by the aircraft operator or their employees for hire or reward (excludes scheduled airlines operations, includes marine pilot transfers).
 - Medical transport (*Activity Subtype*) – Operations as an aerial ambulance for the transport of ill or injured persons (excludes community service flights).
 - Non-scheduled freight only¹⁰ (*Activity Subtype*) – Flying involving the carriage of cargo by the aircraft operator or their employee for hire or reward (excludes scheduled airline freight operations).
 - Joyflight/sightseeing charters (*Activity Subtype*) – Flying involving the carriage of passengers for joyflights or sightseeing purposes (includes warbird flights).
 - Other non-scheduled commercial air transport (*Activity Subtype*) – Other non-scheduled commercial air transport operations not classified elsewhere.
 - Unknown non-scheduled commercial air transport (*Activity Subtype*) – Non-scheduled commercial air transport operations where the activity subtype is unknown (unknown if the operator was conducting a passenger transport charter, medical transport, non-scheduled freight only, joyflight/sightseeing or other non-scheduled operations).
- Other commercial air transport (*Activity Type*) – Other commercial air transport operation not classified elsewhere.

¹⁰ Scheduled and non-scheduled freight are merged within this report as Freight.

- Unknown commercial air transport (*Activity Type*) – Commercial air transport operation where the activity type is unknown (unknown if the operator was conducting scheduled, non-scheduled or other commercial air transport).
- **General aviation/Recreational**¹¹ is considered to be all flying activities that do not involve scheduled and non-scheduled passenger and freight operations. It may involve any Australian civil (VH-) aircraft, Australian recreational registered aircraft, or aircraft registered outside of Australia. General Aviation includes:
 - Aerial work (*Activity Type*)
 - Agricultural spreading/spraying (*Activity Subtype*) – Flying involving the spreading/spraying of chemicals, seeds, and fertilisers (includes flights from the spreading/spraying area).
 - Agricultural mustering (*Activity Subtype*) – Aerial stock mustering involving the direct use of aircraft for the movement of livestock.
 - Other agricultural (*Activity Subtype*) – Other agricultural activity not classified elsewhere (includes aerial culling and baiting, bore and property inspections).
 - Unknown agricultural (*Activity Subtype*) – Agricultural activity where the activity subtype is unknown.
 - Construction – sling loads¹² (*Activity Subtype*) – Flying using sling loads for construction purposes.
 - Other Construction¹² (*Activity Subtype*) – Flying for construction purposes (excludes sling loads).
 - Photography¹³ (*Activity Subtype*) – All aerial photographic work (includes media filming operations).
 - Pipeline / powerline surveying¹³ (*Activity Subtype*) – Aerial inspection patrols along pipelines or powerlines (includes insulator washing).
 - Other surveying¹³ (*Activity Subtype*) – Flying involving the use of aircraft for surveying not classified elsewhere (including geophysical surveys).
 - Observation and patrol (*Activity Subtype*) – Flying involving the use of aircraft for aerial observations and patrol (includes coastal surveillance, customs/border force patrols, traffic monitoring).
 - Search and rescue (*Activity Subtype*) – Any search missions (includes evacuations or rescue work).
 - Policing (*Activity Subtype*) – Flying involving the use of aircraft in police operations (includes traffic control, ground support, high-speed car pursuits, observation, air patrol).
 - Firefighting (*Activity Subtype*) – Flying involving the use of aircraft to combat fires (e.g. fire spotting, water bombing) (includes flight to and from the fire area).
 - Advertising (*Activity Subtype*) – Flying for of advertising purposes (includes skywriting and banner towing advertising).
 - Other aerial work (*Activity Subtype*) – Aerial work flying not classified elsewhere (includes stock or fish spotting, cloud seeding, Military target towing by non-military aircraft, aerial refuelling, military support, medical clinics, radar/nav-aid calibration flights).
 - Unknown aerial work (*Activity Subtype*) – Aerial work flying where the activity subtype is unknown.
- Own business travel (*Activity Type*) – Business flying not through hire or reward arrangement.

¹¹ Within this report, recreational flying (activities conducted by aircraft registered by a Recreational Aviation Administration Organisation - RAAO) is split from general aviation as a separate activity group. Generally, the activity type structure (which reflects the activity the aircraft was engaged in, not the legal regulation that the aircraft was flown under) combines GA and recreational activities.

¹² Construction – sling loads and Other Construction are merged within this report as Construction.

¹³ Photography, Other Surveying and Pipeline/Powerline Surveying are merged within this report as Survey/Photographic.

- Instructional flying¹⁴ (*Activity Type*) – Includes all training flights.
 - Instructional flying – solo¹⁴ (*Activity Subtype*) – Solo flying training for the issue or renewal of a licence or rating (includes solo navigation exercises conducted as part of a course of applied flying training).
 - Instructional flying – dual¹⁴ (*Activity Subtype*) – Flying training (with an instructor) for the issue or renewal of a license or rating (includes aircraft type endorsement or conversion training).
 - Instructional flying – other¹⁴ (*Activity Subtype*) – Instruction flying not classified elsewhere (includes search and rescue training, winching training, aircrew training, flight to maintain currency, load master training).
 - Instructional flying – unknown¹⁴ (*Activity Subtype*) – Instruction flying where the activity subtype is unknown.
- Sport and pleasure flying (*Activity Type*)
 - Pleasure and personal transport (*Activity Subtype*) – Flying for private pleasure, or personal transport not associated with a business or profession (includes paragliding).
 - Glider towing (*Activity Subtype*) – Flying involving an aircraft towing a glider.
 - Parachute dropping (*Activity Subtype*) – Flying involving the dropping of parachutists.
 - Aerobatics (*Activity Subtype*) – Flying with manoeuvres intentionally performed by an aircraft involving abrupt changes in altitude, abnormal altitude, or abnormal variation in speed (includes aerobatic displays, excludes competitions).
 - Community service flight (*Activity Subtype*) – Flights that are provided on a voluntary basis for public benefit (includes non-emergency flights provided as part of an organised voluntary or charitable activity, excludes flights a pilot provides to a friend or family member and repositioning flights).
 - Other sport and pleasure flying (*Activity Subtype*) – Other sport and pleasure flying not classified elsewhere (includes air show, air racing or competition flying, excludes aerobatic displays).
 - Unknown sport and pleasure flying (*Activity Subtype*) – Sport and pleasure flying where the activity subtype is unknown.
- Other general aviation flying (*Activity Type*)
 - Test flights¹⁵ (*Activity Subtype*) – Flying associated with the testing of an aircraft.
 - Ferry flight¹⁵ (*Activity Subtype*) – Flying associated with an aircraft delivery or movement to a location for maintenance, hire or other planned use (includes commercial airline aircraft).
 - Other flights (*Activity Subtype*) – Other general aviation flying not classified elsewhere (includes demonstration flights of an aircraft with a potential buyer).
 - Unknown other flights (*Activity Subtype*) – Other general aviation flight where the activity subtype is unknown.
- Unknown general aviation flying (*Activity Type*) – General aviation flight where the activity subtype is unknown.
- **Military**¹⁶ (*Activity Group*) – All flights where a military aircraft is involved.
- **Unknown activity group** (*Activity Group*) – Flying where the activity group is unknown.

¹⁴ All subtypes of Instructional flying are merged within this report as Instructional flying.

¹⁵ Test flights and Ferry flights are merged within this report as Test/Ferry.

¹⁶ Not included within this report

Aircraft types

- Aeroplanes refer to all manned, CASA (VH-) registered powered fixed-wing aircraft, and recreational powered aeroplanes registered by RAAus.
- Balloons refer to all manned, CASA (VH-) registered hot air balloons and lighter-than-air craft, including dirigibles.
- Helicopters refer to all manned, CASA (VH-) registered rotary-wing aircraft
- Gliders refer to all manned, CASA (VH-) registered non-powered fixed-wing aircraft, and manned, 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.
- Weight shift refers to manned aircraft controlled by human movement. They include hang gliders, paragliders, powered parachutes, and weight-shift trikes. These aircraft may be registered with the Sport Aviation Federation of Australia (SAFA), marked with a T1- or T2- registration, or with RAAus marked with a 32- registration.

Occurrence types and events

Not all notifications reported to the ATSB are classified as incidents, serious incidents or accidents. Those deemed not to 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).

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						
	Airspace infringement	ANSP operational error	Issues					
			Information / procedural error					
			Failure to pass traffic					
	Encounter with RPA	Breakdown of co-ordination	Other					
			Collision with RPA					
Consequential events	Operational non-compliance	Near encounter with RPA						
		Sighting						
		Other	Other	Ditching				
				Diversion / return				
		Emergency evacuation						
		Emergency / precautionary descent						
		Forced / precautionary landing						
		Fuel dump / burn off						
		Missed approach / go-around						
		Rejected take-off						
Environment	Interference with aircraft from ground	Other						
		Weather		Wildlife	Icing			
			Lightning strike					
			Turbulence / windshear / microburst					
			Unforecast weather					
			Other					
		Other	Other	Animal strike				
				Birdstrike				
				Other				
				Infrastructure	ATM	Other		
Nav aids	Other							
		Radar / surveillance	Other					
							Runway lighting	Other
Operational	Aircraft control	Other						
			Other	Other				
					Other	Other		
							Other	Other
Operational	Aircraft control	Other						
			Other	Other				
					Other	Other		
							Other	Other
Operational	Aircraft control	Other						
			Other	Other				
					Other	Other		
							Other	Other
Operational	Aircraft control	Other						
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Operational	Aircraft control	Other						
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							Other	Other
Operational	Aircraft control	Other						
			Other	Other				
					Other	Other		
							Other	Other
Operational	Aircraft control	Other						
			Other	Other				
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Operational	Aircraft control	Other						
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Operational	Aircraft control	Other						
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Operational	Aircraft control	Other						
			Other	Other				
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							Other	Other
Operational	Aircraft control	Other						
			Other	Other				
					Other	Other		
							Other	Other
Operational	Aircraft control	Other						
			Other	Other				
					Other	Other		
							Other	Other

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

Appendix C – Estimative language

Throughout this report, estimative language is used. This defines a probability range of an occurrence or outcome given in a statement (Table 1).

Table 1: Estimative language expressions with associated probability of occurrence/outcome

Terminology	Likelihood of the occurrence/outcome	Equivalent terms
Virtually certain	> 99% probability	<i>Extremely likely, almost certain</i>
Highly likely	> 95% probability	<i>Highly probable</i>
Very likely	> 90% probability	<i>Very probably</i>
Likely	> 66% probability	<i>Probable</i>
About as likely as not	33 to 66% probability	<i>More or less likely</i>
Unlikely	< 33% probability	<i>Improbable</i>
Very unlikely	< 10% probability	
Exceptionally unlikely	< 1% probability	<i>Extremely unlikely</i>

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 or serious incident, 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

The 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 the ATSB's 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.